

JSW Group

MANAGEMENT STANDARD

SAFETY MANAGEMENT SYSTEM

JSW/GHS/GS-01

MANAGEMENT STANDARD SAFETY MANAGEMENT SYSTEM

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1. PURPOSE

The purpose of the JSW Group Safety Management System is to establish a unified framework of minimum requirements and essential elements designed to prevent and mitigate injuries, workplace, and process hazards. This system underscores JSW Group unwavering commitment to providing a safe and healthy work environment, striving for an injury- and illness-free workplace. Aligned with JSW's Health and Safety Policy, JSW objective is to consistently promote and achieve the goal of Zero Harm.

JSW Group and its affiliates prioritize safety as a fundamental condition of employment, extending this commitment to all employees, associates, and contractors. By implementing standardized management processes and systems, JSW aim to enhance safety performance continually. The Safety Management System mandates adherence to the Plan-Do-Check-Act cycle, ensuring continuous improvement through a systematic and disciplined approach. This structured methodology supports JSW strategic business objectives and goals, fostering strong health and safety leadership at all levels of management.

Ultimately, the JSW Group Safety Management System serves as the cornerstone for delivering on JSW commitment of Zero Harm, driving a culture of safety and operational excellence across the organization.

2. SCOPE

This Standard applies to all JSW companies and subsidiaries, managed businesses, sites, locations, corporate/regional offices, research and development facilities, new projects, and merged or acquired entities. It is relevant to all JSW company employees and contractors. Conformance to the requirements in this Standard applies to the entire lifecycle of a project, business, site, or location, including planning, assessment, exploration, evaluation, design, development, operation, and closure.

This Standard is aligned with the requirements of ISO 45001:2018 (Occupational Health and Safety Management System - Requirements) and follows the principles and approach to risk management outlined in ISO 31000:2019 (Risk Management – Principles and Guidelines).

JSW businesses shall ensure compliance with applicable local, state, and national regulations, acts, and other mandatory requirements.

In the Standard, the following verbal forms are used to indicate requirements, recommendations, permissions, or capabilities:

- “shall” indicates a requirement.
- “should” indicates a recommendation.
- “may” indicates a permission.
- “can” indicates a possibility or capability.

3. REVIEW

The procedure shall be reviewed at least every 5 years to determine its adequacy, effectiveness, and suitability about implications for the Group, such as:

- Learning from potential incidents
- New or changing global commitments.
- Changes to International standard and guidelines.
- Changes in applicable local, state, and national regulations, acts, and other mandatory requirements.

4. POLICY AND STRATEGIC OBJECTIVES

4.1.1 Health and Safety Policy

The company's policy and objectives offer clear statements of what it aims to achieve. "Policy" outlines overarching commitments, principles, limitations, and intentions regarding the company's operations. Objectives provide more detailed requirements and long-term targets that support this policy within the scope of the SMS, addressing specific types of risks, threats, or impacts.

JSW Health and Safety Policy and Objectives are established at the corporate level and are applicable across the entire JSW Group. However, individual assets, businesses, or other levels within the organization may develop subordinate policy, procedures, or work instructions as needed to manage specific operational activities and local contexts.

Number	Expectation
1	The Policy statement shall align to the Group Health and Safety Policy. (Annexure-1)
2	Stakeholder concerns, both internal and external, should be considered when finalizing the policy, and the policy should be made accessible to them.
3	Top management will serve as the custodian of the Health and Safety policy and will be responsible for ensuring its ongoing suitability through periodic reviews, conducted at least once every two years or more frequently if necessary.
4	Subsidiary policy may be crafted for pertinent subjects such as drugs and alcohol, product safety, etc. as pertaining to individual site requirements.
5	The contractor safety management policy and procedures should align with the safety policy.
6	Health and Safety Policy shall: • Be available as documented information. • Be communicated across JSW Group • Be available to all stakeholders, as appropriate. • Be relevant and appropriate.

4.1.2 Strategic Objectives

Strategic Health and Safety (H&S) business objectives should be formulated, documented, and put into practice in collaboration with relevant functional groups. These objectives should consider the health and safety policy, Group Safety, and Business Safety Strategic Improvement Plan, applicable regulatory requirements, and the findings of risk assessments. Management should identify critical operations and installations that necessitate a comprehensive demonstration that risks have been minimized to 'As Low as Reasonably Practicable' (ALARP). Top management should periodically monitor progress towards safety objectives.

Number	Expectation
1	Each JSW site should establish and uphold documented H&S strategic objectives. When setting these objectives, the site should consider the following factors: • Alignment with the JSW Health and Safety policy. • The overarching vision of "Zero Harm" along with JSW Group and Business objectives. • Asset integrity concerns. • Examination of new, existing, or updated legislation. • Findings from risk assessments. • Outcomes from audits, assurance processes, or assessments. • Records of accidents, incidents, and near misses. • Insights gained from lessons learned.
2	When devising strategies to accomplish strategic H&S business objectives, the Group and Business should establish: • What tasks need to be undertaken. • What resources will be necessary. • Who will be accountable for each task. • The projected completion timeline. • How the outcomes will be assessed, including monitoring indicators. • How the actions to achieve strategic business objectives will be incorporated into the organization's business operations.
3	The H&S objectives should adhere to the SMART criteria, meaning they should be Specific, Measurable, Achievable, Realistic, and Time-bound. The emphasis should be on identifying the "who" and "what" of program activities, as well as determining "how much" change or progress is expected from the objectives (such as numbers,

Number	Expectation
	percentages, actions, target audience, or status). This approach facilitates follow-up, prioritization, and subsequent resource allocation.
4	The leadership team should regularly review Strategic H&S Objectives to ensure that appropriate progress is being made and deviations are promptly addressed. These objectives should cascade down to departments, sections, and individuals within the organization.

4.1.3 Dissemination

The Health and Safety Policy along with the strategic Health and Safety objectives, should be distributed to all employees and contractors. Top management should periodically monitor the Health and Safety objectives.

Number	Expectation
1	The health and safety policy and any subsidiary policy should be communicated to all employees and contractors in a way that promotes comprehension, relevance, and their role in implementation.
2	The policy should be prominently displayed at company work sites and offices and made accessible to the public.
3	Strategic Health and Safety objectives should be communicated to all employees and contractors to encourage their participation and to achieve the vision of "Zero Harm".

5. GENERAL REQUIREMENTS

This section outlines the general requirements for a Safety Management System, including considerations for new projects, mergers, and acquisitions to mitigate safety-related liabilities. All JSW companies, projects, and managed operations shall comply with the mandatory requirements defined in this standard.

At a minimum, JSW companies shall:

- **Define Safety Goals:** Establish safety goals, processes, roles, responsibilities, and competencies to ensure conformance with the requirements and achieve the goal of zero harm.
- **Incorporate Safety in Decision-Making:** Consider safety-related impacts in all business decision-making processes.
- **Hazard and Risk Management:** Identify and minimize hazards and risks to people, the environment, assets, and organizational reputation.
- **Apply Hierarchy of Controls:** Implement the hierarchy of controls for the safety management system in design and implementation across all JSW companies and sites.
- **Communication and Consultation:** Establish communication and consultation programs.
- **Structured Engagement:** Engage both line and safety functions through a structured approach to facilitate the effective implementation of the management system under this standard. This may involve using various management standards referred to in this document.
- **Proactive Measurement and Feedback:** Implement proactive measurement and feedback mechanisms.
- **Safety Culture:** Create, build, and nurture a positive safety culture with the goal of zero harm.
- **Compliance Assurance:** Implement a compliance assurance program.
- **Emergency Preparedness:** Prepare, implement, and periodically monitor the continued effectiveness of an Emergency Preparedness and Response Plan.

All JSW businesses shall demonstrate their commitment to this standard, strive to achieve safety excellence, and continually improve their performance.

5.1 SAFETY MANAGEMENT SYSTEM AT JSW

All JSW businesses, companies, and operating sites shall design, implement, and maintain a Safety Management System that:

- **Supports Implementation:** Facilitates the implementation of the JSW Safety Management System and its health and safety policy.
- **Administrative Structure:** Defines the administrative structure, hierarchy of safety management system documentation, and requirements.
- **Strategic Direction:** Provides strategic direction for management efforts through consistent and auditable safety management system implementation.
- **Zero Harm Culture:** Fosters the development of a Zero Harm culture through employee and contractor participation and motivation.
- **Effective Leadership Commitment:** Enables leaders and managers to demonstrate effective commitment to safety.
- **Risk Integration:** Integrates risk evaluation and management into all business activities.
- **Risk-Based Documentation**: Provides management documentation based on the results of risk evaluation.
- **Incident Reporting and Analysis**: Establishes a framework for reporting, investigating, and analysing occupational and process safety incidents.
- **Conformance Assurance:** Ensures conformance through periodic internal and external assessments.
- **Performance Monitoring:** Provides a framework for generating, monitoring, measuring, and analysing safety performance indicators.

All JSW businesses shall demonstrate their commitment to this standard, strive to achieve safety excellence, and continually improve their performance.

5.2 ELEMENTS OF SAFETY MANAGEMENT SYSTEM

The following elements provide foundation for Safety Management System in JSW Group

5.2.1 Management System Model for Vision Zero Harm

The JSW management system model is designed to achieve Zero Harm and is structured around 3 elements and 36 sub-elements that outline the basic requirements and expectations. All JSW businesses and sites are required to develop and maintain a documented management system to ensure alignment with this model, meeting its requirements and expectations.

The Three Elements are:

Element -1: Effective Leadership

Element -2: Competent Workforce

Element-3: Robust systems

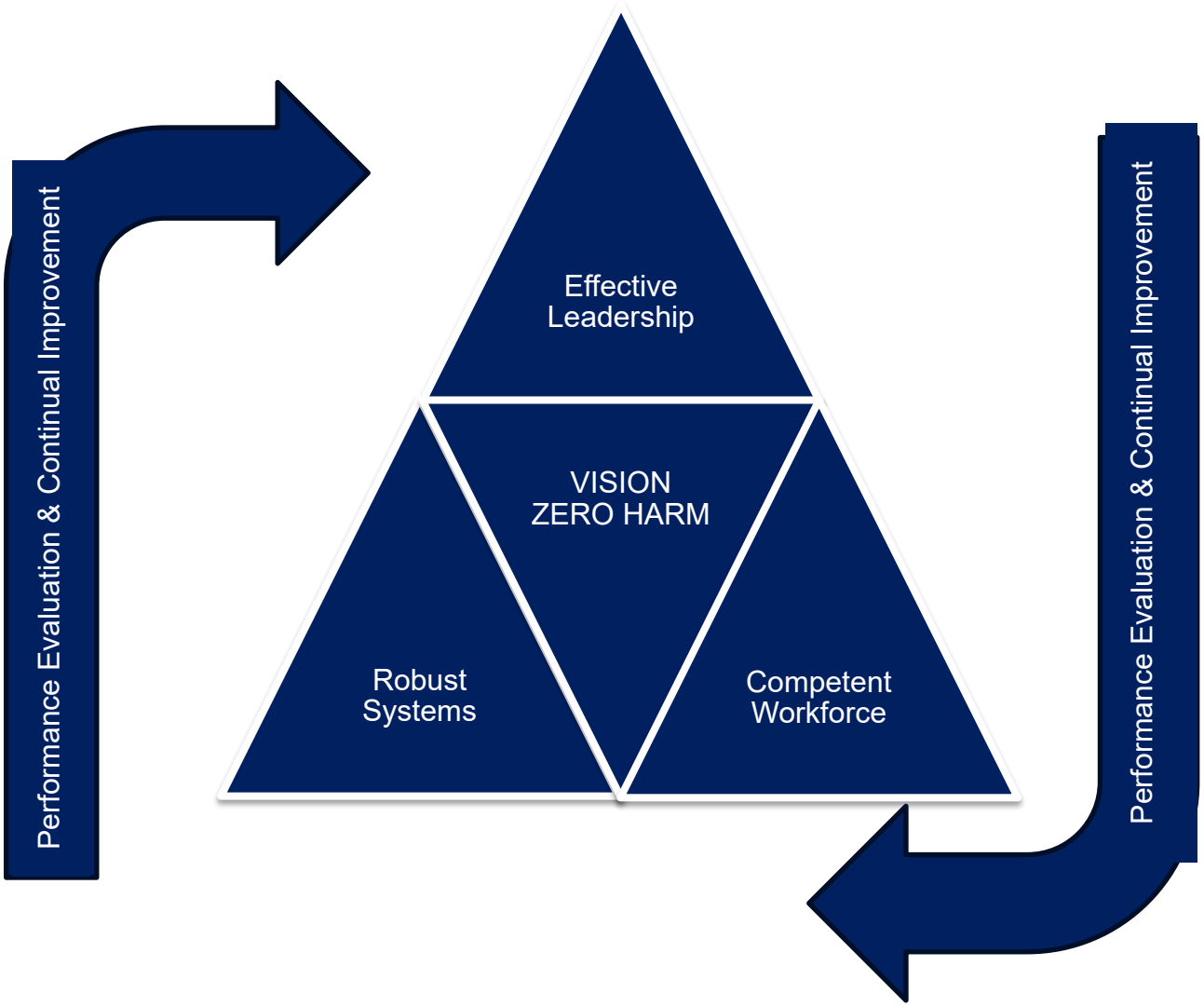


Figure-1: JSW Safety Management System Framework

5.2.2 Sub-Elements of the Management System

The sub-elements of the JSW Safety Management System model are based on above mentioned three elements.

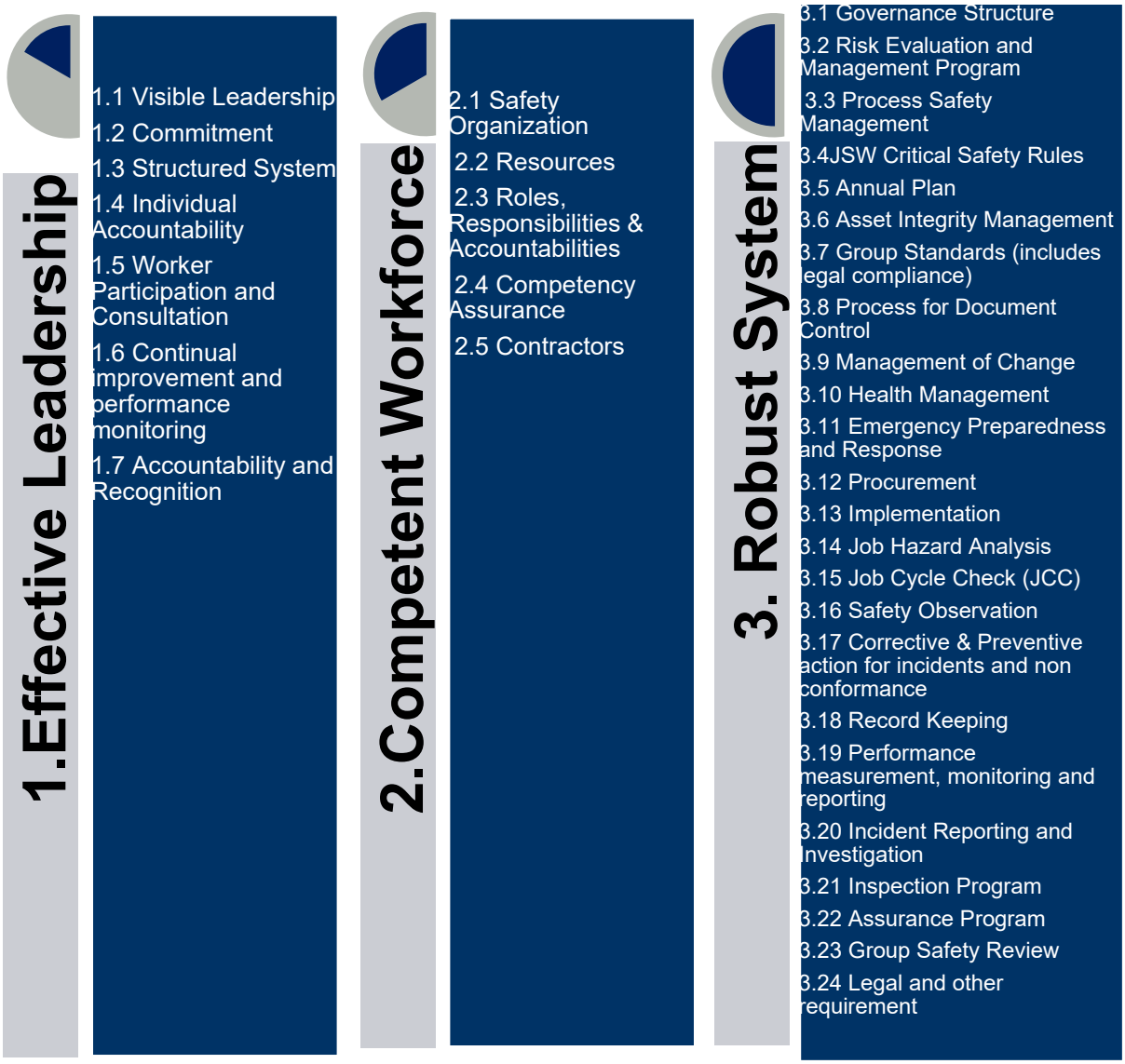


Figure-2: Elements and Sub-elements of Safety Management System

6. MANAGEMENT SYSTEM MODEL AND EXPECTATIONS

The individual elements are described in detail in the following sections.

6.1 ELEMENT-1: EFFECTIVE LEADERSHIP

Successful implementation and continuous improvement of a safety management system (SMS) hinges on committed and effective leaders who fully understand and embrace their specific Health and Safety roles and responsibilities, without ever compromising on compliance. Commitment and support should originate from the top, with executive leaders providing each level of the hierarchy the necessary direction, authority, and resources and active worker participation at all levels of the organization to establish and effectively implement the safety management system.

Accountabilities, roles, and responsibilities should be clearly defined and cascaded down to the front line, where activities take place with associated risk exposures. Managers at all levels should function as champions and role models, consistently demonstrating integrity, communicating openly, and leading by example. This fosters an environment where every individual feel empowered to intervene and provide feedback without fear of reprisal.

These leaders should be true safety advocates who understand the importance of their actions in fostering a strong and positive Health and Safety culture. They should nurture values such as the necessity to operate safely and responsibly. The organization's Health and Safety culture develops progressively over time and is heavily influenced by the visible actions of safety leaders. These actions set the tone for the commonly held attitudes, norms, accepted values, and reinforced beliefs.

Leadership and commitment are essential for meeting the expectations of Element 1, with executive leaders playing a crucial role by ensuring that:

i. Expectations and associated responsibilities are clearly communicated.
ii. Positive behaviours are recognized and rewarded.
iii. Swift intervention addresses behaviours that do not meet expectations.

JSW recognizes that leadership is vital for individuals with specific accountabilities within the SMS.

To be successful advocates, JSW leaders should be proactively involved in all critical areas of SMS implementation, including Risk Management, Implementation, and Continual Improvement.

JSW leaders should seek assurance that their SMS is adequately implemented by actively seeking insights into system effectiveness and using appropriate measures to understand performance. Regular reviews of audit outcomes, Key Performance Indicators (KPIs), and incident investigations are important tools to monitor Health and Safety performance. However, leaders should also cultivate a culture of constant vigilance or "mindfulness," relying on observations, employee engagement, consultation, and careful listening to maintain and continually improve the Health and Safety culture across JSW Group.

This approach will develop sensitivity and responsiveness to "weak signals" of emerging changes in areas such as operating discipline, workforce attitude, and stakeholder concern. This is particularly critical for process safety risks, where it is vital to ensure robust risk controls/barriers are maintained to prevent low-likelihood/high-consequence events.

JSW Leadership has set clear expectations for the leadership team to foster an effective safety culture throughout the organization through "Effective Leadership":

- **Walk the Talk:** Demonstrate commitment by ensuring that the highest standards of safety are consistently maintained, with no tolerance for substandard practices.
- **Integrate Safety:** Embed safety considerations into all decisions, activities, and actions.
- **Facilitate Risk Management:** Integrate safety in design and operations to proactively address vulnerabilities.
- **Lead the Change:** Actively participate in and encourage others involvement in health and safety initiatives.
- **Engage in Safety Conversations:** Regularly discuss safety to enhance understanding and awareness.

- **Report and Resolve Issues:** Identify and address safety and vulnerability issues, learning from both leading and lagging indicators.
- **Reward & Recognize:** Acknowledge and reward safe behaviors and effective leadership.
- **Support and Uphold Safety:** Intervene to reinforce positive behaviors and correct at-risk behaviors.
- **Mentor:** Guide and support new stakeholders in understanding and adhering to safety standards.
- **Address Infringement:** Respond to willful infringements of safety rules to reinforce accountability and responsiveness.

The Element of Effective Leadership is further sub divided into seven sub elements with expectations as described below:

6.1.1 Visible Leadership

Number	Expectation
1	Strong and visible leadership is essential to fostering a culture where all employees and contractors are dedicated to Health and Safety standard. Top and senior management should lead by example through: • Continuously emphasizing the importance of Health and Safety systems. • Communicating a strategic vision and setting goals for outstanding performance. • Rejecting procedural shortcuts and rule bending. • Ensuring that deviations from safety protocols are rare and brief. • Viewing all Health and Safety incidents—whether positive or negative—as opportunities for learning and improving transparency in reporting weaknesses, near misses, and incidents. • Considering the impact on external stakeholders and the wider community. • Engaging with employees and contractors through site visits and discussions. • Celebrating teamwork and individual contributions. • Wearing required Personal Protective Equipment (PPE).
2	Ensuring clarity in delegation, accountability, and authority, so that capable individuals have the autonomy and responsibility to make decisive actions when necessary.
3	Ensuring the availability and consultation of technical expertise, financial resources, and workforce. Simultaneously, investing in the development of personnel capabilities to enhance risk control measures
4	Communicating the Health and Safety policy, objectives, requirements, expectations, and the most significant risks to all internal and external stakeholders.
5	Regularly monitor and review performance, providing transparent communication about progress throughout the organization.
6	Demonstrate commitment by actively engaging in Health and Safety activities, such as training, industry workshops, inspections, and audits. Visibility in safety observations is crucial.
7	Evaluate Health and Safety impacts before finalizing decisions, ensuring alignment with the Health and Safety policy and risk management principles (ALARP).

6.1.2 Commitment

Number	Expectation
1	Assuming ultimate responsibility and accountability for ensuring safe and healthy workplaces and activities and preventing occupational injuries and illnesses.
2	Ensuring that the Health and Safety policy and objectives are established in alignment with the strategic direction of JSW.
3	Ensuring the incorporation of SMS requirements into JSW's business processes.
4	Ensuring the availability of resources necessary for establishing, implementing, maintaining, and enhancing the SMS. Supporting the establishment and operation of Sub-committees tasked with developing, implementing, and continually improving the SMS.
5	Conveying the significance of an effective SMS and the importance of adhering to its requirements.
6	Offering guidance and assistance to employees, relevant management, and contractors to ensure the successful implementation of SMS and demonstrating leadership within their areas of responsibility.
7	Ensuring that the JSW SMS achieves its intended outcomes and promoting continual improvement.
8	Fostering, spearheading, and advocating for a culture within the organization that aligns with the intended outcomes of the SMS, including fostering a no-blame culture to ensure and promote the reporting of incidents, hazards, risks, and opportunities.
9	Establishing and implementing a process for consultation and participation of employees and contractors.
10	Identifying high priority areas for improvement particularly in relation to legal compliance, Group requirement and expectations, stakeholder issues, and the status of follow up actions.
11	Publishing Key Performance Indicators (KPIs) and initiate appropriate actions to achieve them.

6.1.3 Structured System

Number	Expectation
1	Ensuring that the outcomes of regular management Health and Safety reviews are integrated into plans, objectives, and targets.
2	Developing and approving documented management systems, health and safety policy, strategic objectives, annual plans, standards/ procedures and their communication to employees and contractors
3	Providing an effective governance structure to ensure that employees and contractors are suitably informed on hazards and required compliance levels with internal and external performance standards
4	Conducting periodic self-assurance, management reviews and implementing corrective and preventive action in a time bound manner

6.1.4 Individual Accountability

Number	Expectation
1	Collaboratively developing and discussing with internal and external stakeholders the Health and Safety 'result' and 'activity' improvement targets and indicators by: • Ensuring that performance appraisals of staff and contractors include suitable Health and Safety 'result' and 'activity' improvement targets. • Actively participating in the review of Health and Safety 'result' and 'activity' indicators.
2	Establishing appropriate recognition and progressive consequence management procedures to promote safety accountability at individual levels.
3	Feedback on manager and worker behaviour is sought and responded to

6.1.5 Worker Participation and Consultation

Worker participation is a critical component of ISO 45001, and leaders shall establish systems for engaging workers in safety matters. This includes consulting with employees at all stages of the SMS, from hazard identification to decision-making processes and the evaluation of safety performance. Leaders should encourage a culture where workers feel empowered to voice safety concerns and contribute to safety-related improvements without fear of reprisal.

Number	Expectation
1	Implement formal mechanisms for employee consultation and participation in safety matters at all levels.
2	Foster a collaborative environment where workers are actively involved in risk assessments, safety observations, and incident investigations.
3	Establish a no-blame culture that encourages the reporting of near-misses, hazards, and risks.
4	Ensure that employees and contractors have clear avenues to provide feedback on safety performance.

Leadership shall not only create an open line of communication but also actively involve workers in safety decision-making and improvement. Regular feedback from workers shall be incorporated into the SMS for continuous improvement.

6.1.6 Continual Improvement and Performance Monitoring

Leadership shall champion the continual improvement of the SMS by ensuring it is consistently evaluated and refined. This includes using both leading and lagging indicators to measure safety performance, conducting regular management reviews, and analyzing incident data to identify areas for improvement. Leaders should ensure that performance data is used to proactively address safety risks and implement corrective actions when necessary.

Number	Expectation
1	Use performance indicators (both leading and lagging) to track and review the effectiveness of safety programs.
2	Implement regular management reviews to assess the SMS's performance and effectiveness, incorporating audit results, incident investigations, and feedback from all stakeholders.
3	Promote a culture of continual improvement based on data-driven decisions, with corrective and preventive actions taken promptly.

A strong focus on continuous improvement means that leadership shall prioritize data analysis, incident investigations, and feedback loops to identify root causes of safety issues. This should drive both systemic changes and individual actions aimed at improving safety outcomes.

6.1.7 Accountability and Recognition

To create a culture of accountability, leadership should establish clear expectations for safety behavior and ensure that individual performance is regularly evaluated against safety objectives. Safe behaviors should be recognized and rewarded, while unsafe behaviors should be addressed swiftly and consistently.

Number	Expectation
1	Establish clear accountability for safety at all levels, with specific roles and responsibilities related to health and safety outcomes.
2	Recognize and reward individuals who demonstrate outstanding safety leadership and safe behaviour.
3	Address and correct unsafe or non-compliant behaviours promptly, fostering a culture of accountability across the organization.

Effective safety management is about more than compliance—it is about building a safety culture that encourages proactive behaviour and supports those who go above and beyond in promoting safety.

6.2 Element 2 – Competent Workforce

The requirements for a safety organization, governance structure, resources, roles, responsibilities with accountabilities, and the necessary capabilities for accomplishing the Zero Harm goal are described in this management system element. Making sure the right men are hired for the right occupations, giving them thorough safety training, and ensuring they have the abilities needed to do their duties safely. This covers equipment-specific training, danger awareness training, basic safety instruction, and competence assessment.

6.2.1 Safety Organization

An effective safety organization structure appropriate to the nature and scale of risks shall be established and documented. The structure should clearly define the roles, responsibilities, and reporting channels for all functions involved in implementing and maintaining safety requirements.

Number	Expectation
1	Management shall establish or realign the existing organizational structure to ensure clear assignment of roles and responsibilities related to safety. The structure shall include designated functions to plan, implement, and monitor the requirements of this standard.

6.2.2 Resources

Management should allocate the resources required for establishing, implementing, maintaining, monitoring, and continuously improving the JSW safety management system. These resources encompass human resources, specialized skills, organizational infrastructure, technology, and financial support.

Number	Expectation
1	Adequate resources, including manpower, specialized skills, organizational infrastructure, technology, and financial support, should be available to establish, implement, maintain, monitor, and continually improve the JSW Safety Management System. These resources cover various aspects, such as meeting performance objectives, addressing safety deficiencies, conducting training, inspections, audits, and communication events, and ensuring compliance with legal and JSW requirements. Additionally, the management of change process should prevent safety risk associated with changes in resource levels and competencies, considering factors like equipment, personnel, procedures, and technology.

6.2.3 Roles, Responsibilities and Accountabilities

Clearly define, communicate, and ensure understanding of roles, responsibilities, competencies, and accountabilities at all organisational levels. Hold employees accountable for their performance and that of their direct reports, with the vision of achieving zero harm.

Number	Expectation
1	Roles, Responsibilities, and accountabilities should be clearly defined, documented, and effectively communicated to ensure compliance with the management system's requirement and expectations.
2	Responsibilities related to the technical integrity of facilities should be explicitly defined, including the authority to establish standards and perform technical validation and verification to ensure compliance with those standards.
3	Responsibilities for maintaining contact with appropriate government authorities shall be defined, established, and maintained.
4	Business heads shall be ultimately responsible for the safety performance of their business. Senior leadership shall reinforce line management accountability for safety. Performance criteria including progress towards achieving vision of zero harm shall form an integral part of performance appraisals for all JSW leaders, managers, and supervisors.
5	Line managers at all levels having supervision responsibilities shall be responsible for monitoring and enforcement of the standards and performance of the people reporting to them.
6	All JSW personnel shall be responsible to comply with the health and safety policy, JSW safety critical rules, safety standard, procedures & guideline to ensure their own safety and the safety of others, by carrying out their work in a safe and diligent manner.

6.2.4 Competency Assurance

Employees & contractors' capabilities shall be developed through a structured competency development process and training systems.

Number	Expectation
1	Safety training procedures and annual schedules should be meticulously developed and put into practice for employees and contractors across all hierarchical levels, following a thorough identification of training needs. These procedures should encompass structured training modules of appropriate durations, complemented by robust participant performance evaluation systems. At the very least, the training program should cover the following key areas: **Leadership Strategies:** Equipping employees and contractors with effective leadership methodologies to ensure safety protocols are effectively communicated and implemented throughout the organization. **Leadership and Communication Skills:** Fostering the development of communication skills among leaders to facilitate clear and concise dissemination of safety-related information. **Incident Investigation and Management:** Offering training programs that equip employees and contractors with the necessary skills to conduct thorough incident investigations and manage emergencies efficiently. **Observation Skill Development Training:** Cultivating employees' and contractors' ability to keenly observe their surroundings for potential safety risks and hazards. **Training on Safety Standards, Procedures, and Guidance Notes:** Ensuring employees and contractors are well-versed in safety standards, procedures, and guidance notes relevant to their roles and responsibilities. **Induction and Refresher Training:** Conducting induction sessions for new hires to familiarize them with safety protocols, along with periodic refresher training to reinforce safety practices among existing staff. **Management System Assessor Training:** Providing specialized training to designated personnel for effectively assessing and enhancing the organization's safety management systems.

Number	Expectation
	Regulatory Requirements and Compliance: Imparting knowledge on regulatory requirements and other pertinent standards, ensuring adherence to legal obligations and industry best practices.
2	Each JSW Business shall establish competency procedures to: • Ensure that employees, contractors, and other individuals under its authority, including contractors, possess the necessary competence through appropriate education, training, and/or experience. • Identify and assess competency requirements, including: • Task-specific competencies such as working at height, hot work, electrical work, completing permits to work, confined space entry, gas testing, excavation, handling gas cylinders, energy isolation (lockout and tagout), scaffolding, use of portable hand tools, operation of lifting equipment and cranes, working over water, contract management, firefighting, personnel handling hazardous chemicals, emergency response, and management assurance. • Conduct assessments to verify competencies. • Establish a process for documenting competencies, thereby ensuring their maintenance and enhancement. • Periodically review competency assessments, analyse results, and implement improvements as necessary to ensure ongoing effectiveness and compliance. By implementing these procedures, JSW Businesses can enhance safety and efficiency across all operations while maintaining compliance with regulatory requirements and industry best practices.

6.2.5 Contractors

A systematic approach to the management of contractors shall be adopted so that risks from the engagement of contractors are assessed & minimized to ALARP.

To manage the risks arising from engaging contractors, JSW businesses shall implement the relevant steps of the following contractor management process (Refer Standard on Contractor Safety Management JSW/GHS/GS-03).

Number	Expectation
1	Health and Safety pre-qualification, selection, and retention criteria should be established for all work carried out by contractors, subcontractors, and suppliers. Before extending an Invitation to Tender, a formal assessment of Health and Safety risks shall be conducted for each contract, ensuring that tenders are exclusively issued to contractors who meet the established Health and Safety criteria. This approach ensures that only qualified contractors with robust Health and Safety practices are engaged, promoting a culture of safety and compliance throughout the procurement process.
2	JSW Health and Safety requirements shall be shared with the contractors and suppliers for necessary agreement and implementation.
3	For every contract and prior to contract award, the contractor's Health and Safety competence shall be assessed against the Health and Safety risks. Tendering companies shall show adequate understanding of the risks, have a plan to manage the risks and demonstrate competence/capability to manage these risks
4	Contractor mobilization will be contingent upon the submission and approval of an acceptable Health and Safety Plan. This plan should be tailored to the level of Health and Safety risks involved and incorporate suitable interface arrangements to ensure alignment with the Company Safety Management System. For high-risk contracts, there should be a documented rationale outlining how the risks will be reduced to As Low as Reasonably Practicable (ALARP). This rigorous approach ensures that contractors prioritize safety measures in their operations and effectively manage risks throughout the lifecycle.

Number	Expectation
5	For all contracts, a Health and Safety inspection / audit programme shall be in place to monitor effective implementation of the SMS and the interfaces between contractor and Site.
6	Contracts shall specify the following: • An inspection / audit requirement. • Actions to be taken in case of non-compliance with standards, terms, and conditions. • Rewards or penalties relating to Health and Safety performance. • As a minimum, an annual SMS review for contracts running for two or more years; and • Competency and Quality Assurances that are equivalent or better than those of the JSW Site.
7	Site shall demonstrate that contractors' SMS are subject to continual improvement during work execution. They shall also ensure that all sub-contractors adhere to the expectation stated above. Site shall ensure that contractor employees are treated as their own employees for Health and Safety matters. Hence, all facilities, PPE and Health and Safety statistics shall be established in line with the system in place with the Site. Contractors also shall submit their SMS internal audits, statistics, Health and Safety Statement to the Site.
8	Selection of Contractors: Following Information shall be submitted to contractors: • Description of work required. • Potential fires, explosive, toxic, or unique hazards related to the proposed work. • Applicable job, Health and Safety Procedures and Safe Work Practices. • Identify the need for full time/part time representative responsible for on-site safety supervision of contractor employees. • Responsibilities of the contractor as specified in this Element. • Following Information shall be submitted by contractors: • Safety management program. • Previous experience and references within JSW Site / Affiliates or other facilities. • Contractor employees training and qualification documentation.
9	• All contractor employees have received proper safety orientation. The safety orientation shall address Site / Affiliates' Safety rules/regulations, incident reporting and emergency response requirements. • Entry of Contractor employees into the facility shall be restricted and controlled. Identification (ID) Cards shall be issued to the contractor employees only after they have received the safety orientation. • All equipment, cranes, vehicles etc. brought by the contractor shall be checked to ensure compliance with the applicable JSW Safety Standards and Site procedures. Only those equipment, tools, cranes, vehicles etc that meets the requirements and are approved by the Site shall be permitted. • A hazard assessment and risk evaluation should be performed in cooperation with the Contractor based on the degree of risk associated with the assigned work and the workplace. Contractors are informed on how to secure additional information. Contractor employees are monitored to assure execution of their assigned work in a Health and Safety responsible manner. The responsibility for supervision shall be assigned. • Periodically evaluate the performance of contractors through spot checks and field audits to ensure that the work practices and conditions meets the requirements of this Element. The results of the spot checks and field audits shall be documented and addressed. • Hold contractor management accountable for any violation to safety rules, Safe Work Practices, and applicable government laws/regulations by their employees. • Ensure Contractor Safety Management standard is being complied with

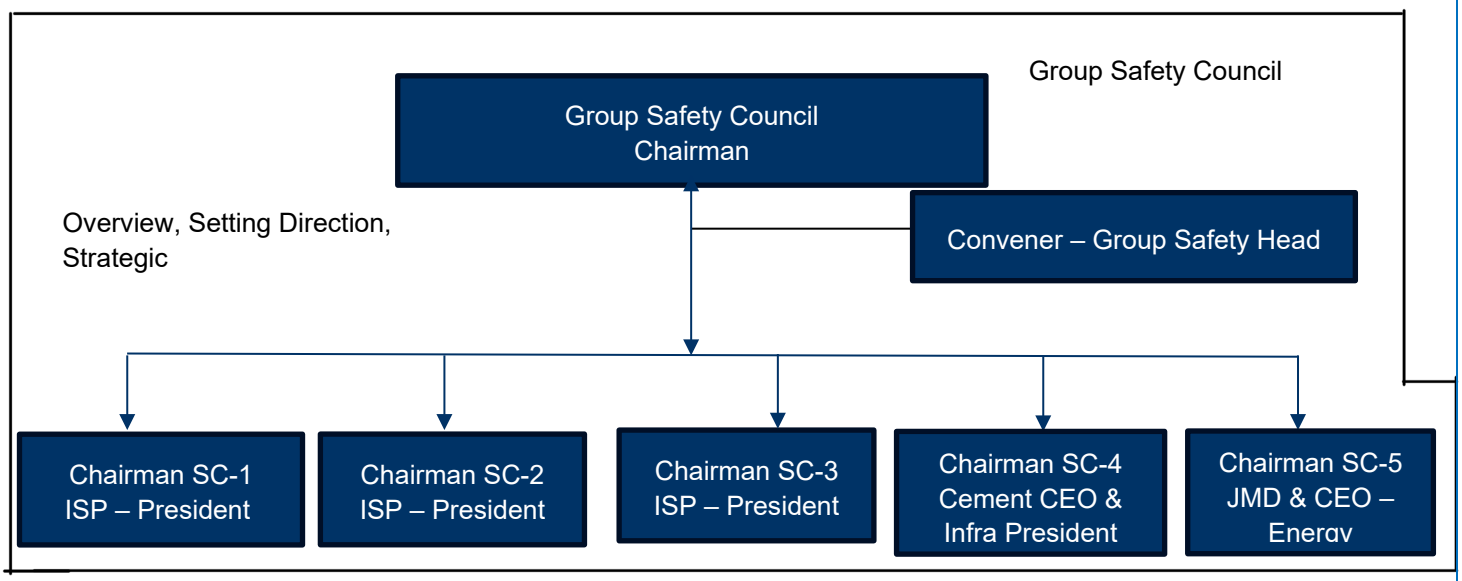
6.3 ELEMENT-3 – ROBUST SYSTEM

The operational complexity of JSW Business sectors mandates to have in place a robust system that is process based, with extensive supporting documentation and controls, to meet business objectives while fulfilling all legal obligations that identify and mitigate potential hazards and includes 24 sub-elements.

6.3.1 Governance Structure

Successful implementation of the management system requires a well-defined governance structure with clearly defined roles and responsibilities for personnel at both the business and site levels.

This ensures accountability, clarity in execution, and effective management of safety processes.



SC-1: Safety Observation & Audit,

SC-2: Rules and Procedures,

SC-3: Process Safety Management,

SC-4: Incident Investigation,

SC-5: Contractor Safety

6.3.1.1 Site Apex Committee

The Site Apex Committee oversees the overall safety management system at the site level, ensuring that all safety practices align with the organization's strategic goals and regulatory requirements, and includes Senior Site Management, Safety leaders, and representatives from key operational areas.

6.3.1.2 Divisional Implementation Committee

The Divisional Implementation Committee focuses on translating organizational safety policy into actionable plans at the divisional level, ensuring effective implementation and compliance, and includes divisional managers, safety officers, and key representatives from relevant departments.

6.3.2 Risk Evaluation and Management Program

This sub element addresses the requirements for a standardized approach to risk management as set out in Risk Management Group Standard (JSW/GHS/GS-17), which shall be applied consistently across the organization.

Hazard Identification and Risk Assessment (HIRA) encompass all activities aimed at identifying hazards and evaluating risks at facilities throughout their life cycle. The primary objective is to ensure that risks to employees, contractors, the public, the environment, and/or the organization's reputation are consistently

managed within the organization's risk tolerance. These activities are conducted through various Health and Safety studies and reviews.

The risk management process typically begins by considering both external and internal contexts:

External Context: This encompasses social, cultural, economic, regulatory, and environmental factors at local, regional, national, or international levels. It involves assessing how these factors influence the company's objectives and its relationships with stakeholders.

Internal Context: This involves evaluating how the company is structured and governed, its policy and objectives, its capabilities and resources, information, and decision-making systems, contractual and partnering relationships, and its organizational culture.

By comprehensively analyzing both external and internal contexts, organizations can effectively identify hazards, evaluate risks, and implement appropriate controls to mitigate these risks within acceptable levels. This holistic approach to risk management helps ensure the safety of personnel, the protection of the environment, and the preservation of the organization's reputation.

The risk management process, which is primarily focused on all Health and Safety -critical operations and installations shall include:

- An inventory of major hazards and vulnerabilities of the environment, health, and safety of personnel, the public and customers from all the activities, materials, products, and services.
- An assessment of all risks in terms of likelihood and potential consequences, followed by a prioritization of risks that are significant.
- Establish controls or barriers to mitigate significant risks to ALARP and recovery procedures in case of control failure.
- Environment, Health, and Safety Impact Assessment shall be conducted prior to all new activities, facility developments and/or significant modifications to existing ones. Soil and groundwater contamination and other forms of environmental degradation shall be assessed and, where required, control or remediation shall be in-hand. Health risk assessment shall address physical, chemical, biological, ergonomic, and psycho-social hazards associated with the work environment.
- Health and Safety Impact Assessment shall form an integral part of any proposal for acquisition, divestment, abandonment, or merger of business entities.
- The Inventories of hazards and risks shall be made available to the workforce, customers, and other stakeholders. Product stewardship shall be applied at all stages of product life cycle relevant to the Company’s activities.

The sequential steps in the risk management process are as follows:

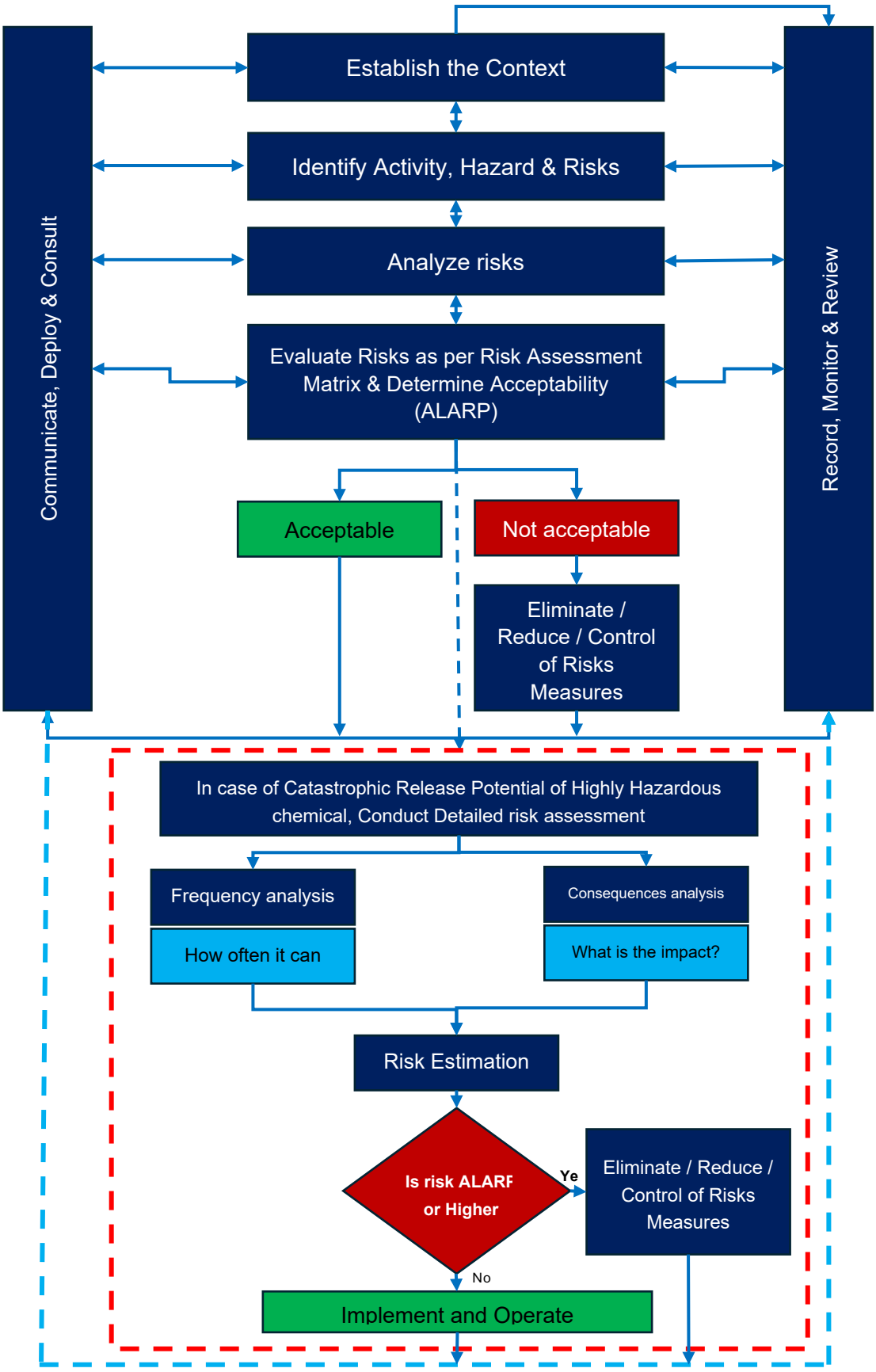


Figure-3: Risk Management Process

Number	Expectation

1	**Identification:**
	• Procedures shall be established for the systematic identification of Health, and safety hazards, effects, and aspects that may impact or arise from all the Company's activities and products. These identification procedures will:
	  ○ Utilize a structured review incorporating Company, JSW, industry, and international standards.
	  ○ Adhere to Quality Performance Standards.
	  ○ Incorporate a process for regularly updating hazard, effects, and aspect inventories/registers in response to operational changes, product use, or insights from activities such as job hazard analyses, inspections, or incident analyses.
	• The systematic identification of Health and Safety (including social) hazards, effects, and aspects will rely on the expertise of experienced personnel following established procedures. The scope of this identification process will:
	  ○ Encompass activities directly controlled by the Company or those it can influence.
	  ○ Cover the entire life cycle of projects, from inception to decommissioning and disposal, considering routine, non-routine, and emergency operating conditions.
	• A culture of risk awareness will be continuously nurtured and enhanced. Training programs will be implemented to:
	  ○ Equip personnel with the skills to recognize hazards and environmental aspects (including social factors).
	  ○ Foster risk awareness among employees and contractors.
	  ○ Enhance communication regarding risks among colleagues.
	  ○ Encourage the reporting of observed hazards.

2	**Evaluation and Assessment –**
	• Procedures shall be established for the systematic assessment of Health and Safety risks and opportunities, as well as the significance of identified hazards, effects, and aspects across all operations and assets. These assessment procedures will:
	  ○ Incorporate a process for reviewing and updating assessments at specified intervals or when circumstances change, integrated into the change control procedure.
	  ○ Define methodology and criteria for assessing Health and Safety risks, including social risks, ensuring a proactive rather than reactive approach. Documented information on the methodology and criteria will be maintained and retained.
	• The assessment of Health and Safety opportunities and other SMS opportunities will be ensured by establishing, implementing, and maintaining a process to assess:
	  ○ Health and Safety opportunities aimed at enhancing Health and Safety performance, considering planned changes to the organization, policy, processes, or activities.
	  ○ Opportunities to adapt work, work organization, and the work environment for employees' and contractors' benefit.
	  ○ Opportunities to eliminate hazards and reduce Health and Safety risks, as well as other opportunities for improving the SMS.
	• The assessment and significance evaluation methodology will consider:
	  ○ Legal and regulatory requirements.
	  ○ Company and Group policy and standards.
	  ○ Reputation, considering stakeholders' concerns, public perception, and employee and contractor feedback.
	  ○ Industry and international standards.
	  ○ Uncertainty in scientific knowledge and the lack of available information to determine risk or significance.
	  ○ Financial and cost-benefit considerations of risk reduction measures.
	• All identified hazards, effects, and aspects will be ranked in terms of risk and documented in the inventory or register. Specifically:
	  ○ Assessments will be conducted by qualified and competent personnel, with input solicited from individuals directly involved with the hazard or process.
	  ○ A qualitative assessment of risk using the concept of the Potential Risk Matrix will suffice for most situations. However, a quantitative risk assessment (QRA) may be necessary for more complex alternatives or regulatory compliance.

Number	Expectation
	• A process will be established to prioritize hazards, effects, and aspects according to risk. In determining controls, consideration will be given to achieving As Low as Reasonably Practicable (ALARP) levels of risk reduction, while also reflecting cost-benefit considerations.
3	Site are required to establish a systematic process for conducting Process Hazard Analysis (PHA). An Initial PHA shall be conducted before the facility's initial start-up. Facilities already in operation, without an Initial PHA, should develop a schedule to complete it within three years of this Element's approval. The PHA schedule should prioritize based on perceived risk levels, potential for injuries/fatalities within and outside the facility, incident history, and age and operating history. The considerations and rationale for prioritization should be documented. A PHA Plan (schedule) should be developed to conduct Revalidation PHA at least every **five** years. The Initial/Revalidation PHA study should consider hazards and operability issues associated with all modes of operation, including normal, start-up, shutdown, and emergency operations. It should also review changes through Management of Change (MOC) processes and evaluate prior incidents, engineering and administrative controls, consequences of their failure, safety critical equipment, facility siting, and human factors. The PHA study team should prioritize recommendations based on consequence severity and frequency, or as specified in the Site/Affiliates' Management System. Process Safety Information used for the PHA study should be accurate and up to date. If not available, it should be developed to support the PHA study adequately. Various methodologies like What-if Checklist, Failure Modes, and Effects Analysis (FMEA), Fault Tree Analysis (FTA), Hazard and Operability Study (HAZOP), Process Hazard Review (PHR), or equivalents may be used for Initial/Revalidation PHA. The selection of the methodology should consider process complexity and known hazards, with high-hazard and complex processes favouring more structured procedures like HAZOP. Senior Management should assign a team leader for the Initial/Revalidation PHA study, adequately trained in the chosen PHA methodology. If using HAZOP/PHR methodology, the team leader should have participated in at least two prior HAZOP/PHR studies. The PHA study team should include scribe/ secretary and personnel knowledgeable about the facility being studied. Key personnel like Process Engineers, Operations Specialists, Project Engineers, Safety, Health, Environment, Maintenance, Inspection, Instrumentation, Electrical, and Control Systems experts should be included. The PHA study team should review recommendations with concerned unit/department managers, resulting in acceptance of recommendations, acceptance in principle with alternative approaches, or acceptance of the current situation with documented rationale. The PHA study team leader should issue an executive summary PHA report within thirty days after resolving recommendations to all concerned parties.
4	• Procedures should be established to ensure appropriate recovery actions are promptly initiated in the event of a Health and Safety control failure. These procedures shall be documented within the Safety Management System (SMS), with designated competent individuals responsible for their maintenance and implementation. These individuals should fully understand their roles and responsibilities. • Managers and workers alike are empowered and required to exercise the "Stop and Intervene" principle when encountering unacceptable risks associated with an activity or when task execution deviates from prescribed procedures or plans. • Additionally, procedures for recovery from high-risk scenarios and emergency responses should be developed and regularly tested, reviewed, and updated. This ongoing process should be informed by actual incidents, analyses of emergency response drills, and industry best practices, ensuring the organization remains prepared to effectively mitigate and manage Health and Safety -related emergencies.



Figure-4: Hierarchy of Control

6.3.3 Process Safety Management

Process Safety Management (PSM) is a critical component of the overall Safety Management System, particularly for businesses involved in manufacturing, storage, and handling of hazardous chemicals. The applicability of PSM should be carefully determined by management based on the results of a primary risk assessment and any legal requirements stipulated in applicable country-specific legislation.

Number	Expectation
1	System shall be established for Compilation of Process Safety Information (PSI) or Process Technology (PT) for processes and installations subject to PSM.
2	Establishment of a governing structure with clear responsibilities and necessary competencies to conduct Process Hazard Analysis (PHA) using various tools.
3	Review and decision-making by management based on detailed risk assessments and recommendations from PHAs, with the possibility of utilizing a Management of Change (MOC) process for implementation.
4	Periodic review of the effectiveness of risk mitigation actions taken.
5	Promotion of review and revision of existing operating procedures considering PHA findings to enhance their suitability, along with providing necessary training to employees and contractor involved in these operations and processes.
6	Establishment and maintenance of a system ensuring the integrity of materials, structures, and installations through mechanical Integrity and Quality Assurance Programs.

6.3.4 JSW Critical Safety Rules

All JSW employees and business partners are responsible for adhering to the following mandatory Critical Safety Rules. These rules are essential for fostering a positive safety culture and achieving our goal of "Zero Harm":



Figure-5: JSW Critical Safety Rules

These rules are mandatory. Additionally, respective businesses may establish further rules tailored to the nature and scale of risks specific to their activities and services. Businesses shall implement appropriate recognition and consequence according to progressive consequence processes to ensure compliance.

By following these Critical Safety Rules, JSW can collectively contribute to a safer work environment and move closer to our goal of "Zero Harm."

6.3.5 Annual Plan

All JSW Group, Business Units (BUs), and sites are mandated to develop annual safety plans aligned with the strategic objectives and the overarching goal of achieving zero harm. These plans are crucial for maintaining ongoing risk control activities and steering efforts towards a safer work environment.

The annual safety plan outlines the key actions that each JSW site intends to undertake in the upcoming year. It serves as a guide for all employees and contractors, providing clarity on proposed actions, their significance, and individual roles and responsibilities in contributing to the goal of zero harm.

Each activity outlined in the plan should be linked to measurable Key Performance Indicators (KPIs), ensuring accountability, and facilitating the monitoring of progress. The Site Head, who chairs the site safety committee, acts as the custodian of the plan. It is their responsibility to ensure that the chosen actions are specific, clear, and pertinent to the operational needs of the site.

Furthermore, during the finalization of the plan, considerations should be given to technological options and resource requirements to effectively implement the proposed actions. This comprehensive approach ensures that safety initiatives are tailored to the unique needs of each site, fostering a culture of safety and continuous improvement across the organization.

Number	Expectation
1	Each JSW site shall prepare an annual plan in line with the intent as mentioned above.
2	The annual strategic safety improvement plan should undergo approval by leaders at the group, business unit, or site level, corresponding to their respective areas of responsibility, at the outset of the financial year. Once approved, it should be effectively communicated to all employees and contractors across the organization. This ensures that all stakeholders are aligned with the safety objectives and initiatives outlined in the plan, fostering a unified approach towards achieving safety excellence throughout the organization. Effective communication of the plan to employees and contractors underscores its importance and encourages their active participation and commitment to its implementation.
3	The development process of the annual safety plan shall encompass the following considerations: • **Health and Safety Policy:** Alignment with the organization's health and safety policy, ensuring consistency with its overarching safety objectives and principles. • **JSW OHS Dashboard and Safety KPIs:** Incorporation of relevant data from the JSW Occupational Health and Safety (OHS) Dashboard and adherence to JSW business safety Key Performance Indicators (KPIs) and expectations. • **Ongoing Activities:** Integration of ongoing initiatives aimed at achieving the goal of zero harm and zero leaks, ensuring continuity and reinforcement of existing safety practices. • **Strategic Business Objectives:** Alignment with the organization's strategic business objectives, ensuring that safety initiatives complement broader business goals. • **Legal Requirements:** Compliance with applicable legal requirements and regulations, ensuring adherence to statutory obligations and industry standards. • **Hazard Identification and Risk Assessment:** Incorporation of results from hazard identification and risk assessment processes, addressing identified risks and implementing appropriate control measures. • **Production or Service Processes:** Consideration of the organization's production or service processes, identifying safety implications and addressing potential hazards associated with these activities.

Number	Expectation
	• **Audit/Assurance Programs:** Integration of findings from audits and assurance programs, leveraging insights to drive continuous improvement in safety performance. • **Incident Investigations:** Incorporation of findings from incident investigations reports, learning from past incidents to prevent recurrence and improve safety practices. • **Technological Opportunities:** Exploration of opportunities presented by new or different technological options, leveraging innovative solutions to enhance safety performance. • **Continual Improvement:** Inclusion of continual improvement activities, fostering a culture of ongoing enhancement and optimization of safety processes. • **Resource Availability:** Assessment of resource availability required to achieve the organization's safety objectives, ensuring adequate allocation of resources to support safety initiatives effectively.
4	The documented annual safety plan should include, at a minimum, the following details: • **Objective/Focus Area:** Clear articulation of the objective or focus area to be addressed within the safety plan. • **Current State: Assessment** of the current state of safety performance or conditions relevant to the objective or focus area. • **Desirable State:** Definition of the desired state or target to be achieved in terms of safety performance or conditions. • **KPI** to Reflect Desirable State: Identification of Key Performance Indicators (KPIs) that will reflect achievement of the desirable state, providing measurable criteria for success. • **Designated Responsibility and Authority:** Specification of roles and responsibilities for individuals or teams tasked with achieving the objectives outlined in the plan. This should include clear delineation of authority and accountability. Additionally, specific timelines or deadlines should be established for goal attainment.

6.3.6 Asset Integrity Management

Business/Site shall adhere to JSW and applicable external standards, codes, and regulations throughout the design, construction, and commissioning phases. Safety equipment, crucial for preserving asset integrity, shall undergo rigorous asset integrity controls to ensure its effectiveness.

Number	Expectation
1	**Facilities Design and Construction** • Facility design, encompassing both greenfield and brownfield projects, as well as construction activities, shall strictly adhere to pertinent regulatory mandates, national and/or internationally recognized standards, and engineering specifications, where applicable. A transparent and auditable procedure should govern the review and approval of all design criteria, standards, tolerances, and any subsequent alterations, with oversight by competent personnel. Hazard study reports shall be preserved for the duration of the facility's operational lifespan. • All non-manufacturing installations, including warehousing facilities, ports, logistics sites, commercial and business buildings, as well as temporary and permanent storage areas, shall adhere to the relevant provisions of National Fire and Safety, Building Codes, country-specific regulations, and local requirements. These facilities are obligated to establish and maintain periodic inspection and audit programs to ensure ongoing compliance with safety standards.

Number	Expectation
2	**Project Management System** • A documented and formal project management system shall be established and upheld to integrate the management of process safety and safety-related risks throughout all phases of project execution, including planning, engineering (pre-execution), execution, and close-out. This system should align with standard on Process Safety Management (JSW/GHS/GS-18) • A comprehensive Construction Safety Plan shall be developed and put into action to guarantee safety throughout the construction phase.
3	**Operations Integrity** • Each JSW business/site shall institute and sustain procedures to establish clear ownership and management responsibility for the integrity of operational systems across various technical domains. This includes mechanical, electrical, instrumentation/control, civil/structural, process/chemical, marine, corrosion/erosion, fire & gas protection, machine guarding (referring to JSW/GHS/GS-10), Additionally, quality assurance for Process Safety Management should also be ensured. • As part of the management system, critical activities, equipment, and resources essential for safeguarding asset integrity shall be identified. This critical equipment should be maintained in accordance with the specifications provided by the Original Equipment Manufacturer (OEM). • The custodians responsible for process safety information shall be designated, and comprehensive information management systems should be established for all critical assets. Operations shall be conducted well within the operating design parameters and capabilities of the plant and equipment, as outlined in the manufacturer's specifications.
4	**Periodic Inspection and Testing** • Each JSW Business/site is required to develop and uphold procedures to ensure that the entire plant, equipment, pipelines, and protective systems undergo regular inspections, examinations, and testing assessments. These assessments should be documented and subject to auditing. Equipment should be operated within agreed-upon parameters, which are based on the original design specifications. Records of statutory requirements, inspections, maintenance, testing, and risk reviews should be diligently maintained.
5	**Pre-Startup/ Shut Down Safety Review** Each site is responsible for ensuring that the startup of new or modified equipment and new projects occurs only after completion of pre-startup safety reviews, with documented review reports signed by the review team and issued, ensuring all recommendations are fully implemented. These pre-startup safety reviews should be conducted by a multidisciplinary team knowledgeable about the operating, mechanical, technical, design, and safety requirements of the facility. Additionally, relevant pre-shutdown procedures should be established.
6	**Documentation** Each Business/site is tasked with developing and maintaining procedures to ensure the availability of documentation necessary to support operations, maintenance, inspection, start-up, and shut down. This documentation includes but is not limited to equipment manuals, design basis, process chemistry, hazard information, P&IDs, and all other relevant drawings, as well as hazard and risk assessment studies.

6.3.7 Group Standards

Adequate standards and operational control procedures should be established based on clearly defined risk assessment processes or internationally accepted practices.

Number	Expectation
1	Health and Safety standards and procedures shall be listed in the SMS. The appropriate standards and procedures shall be readily accessible to employees, suppliers and contractors and be written in a way that users will understand. The site management team will nominate the site managers responsible for ensuring that relevant Health and Safety procedures and requirements for their assets are communicated to suppliers and contractors.
2	A structured process for the development, including product stewardship, and review of Health and Safety standards, procedures, and work instructions should be established, with employee involvement. This process should ensure the attainment of Health and Safety objectives, integration of best practices, and compliance with legislative requirements.
3	Procedures / Mechanisms shall be established for controlling and monitoring access of personnel other than normally assigned operation staff, in operation area within a facility.
4	Company and other suitable Design and Engineering Practices or equivalent standards shall be consistently applied, and variances shall be subject to a control procedure.
5	There shall be evidence, in addition to the formal review cycle, of standards, procedures and work instructions being reviewed considering incidents, and that changes can and are initiated by operations personnel.

6.3.8 Process for Document Control

Site shall ensure that all documents, whether in paper or electronic format, are managed systematically throughout their lifecycle—from creation through disposal—within each JSW business according to site-specific certifications. The following documentation structure shall be included in each business management system. It comprises a 3-tiered structure, including Group, Business, and Site level documentation:

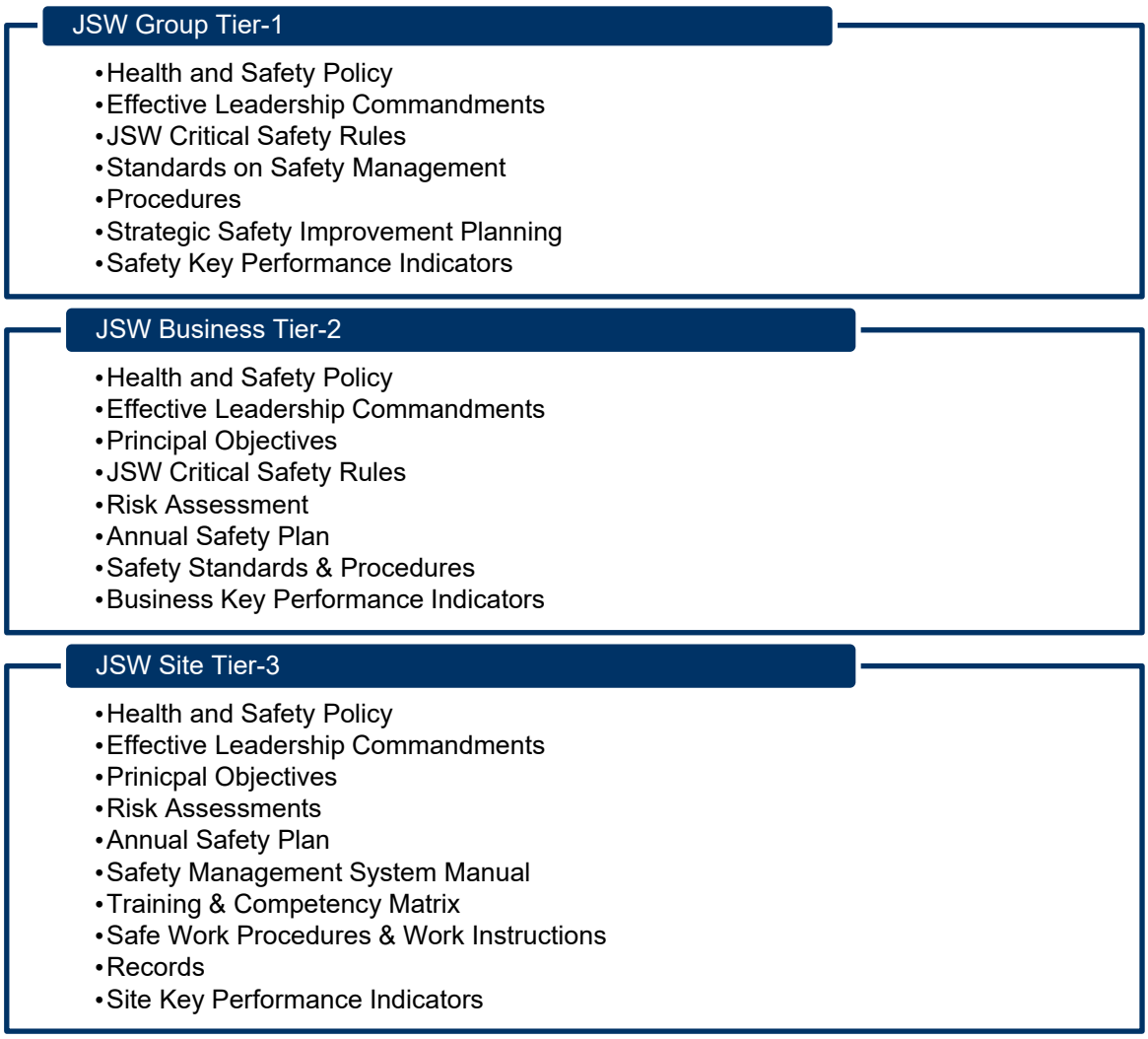


Figure-6: Management System Documentation Structure

Safety documentation shall be established and adequately controlled.

Number	Expectation
1	A procedure shall be established for the management and control of all documented information, whether in paper or electronic format, used to manage operational systems. This should encompass formal administration, custodianship to ensure technical correctness, and communication regarding correct usage. Examples of documents include: • Operational Management Systems Manual • Register of laws and regulations applicable to the company • Standards issued by JSW Group Safety or businesses and international standards. • Layouts, Piping, and Instrumentation diagrams (P&IDs), Process Flow Diagrams (PFDs), Process Hazard Analysis (PHA), etc. • Hazard and risk assessment registers • Strategic H&S objectives and plans • Operating standards • Procedures and standing work instructions • Supplier and contractor information • Product/material identification and composition data, both from the company and suppliers • Safety Data Sheets (SDS) • Emergency Response and Preparedness Plans

Number	Expectation
2	Each Business and site shall harmonize its existing management systems with the requirements outlined in this standard to support JSW, the business, and the site in achieving the goal of zero harm. The system should aid employees and contractors in comprehending site action plans designed to fulfil the health and safety policy, objectives, annual plans, and the overarching goal of zero harm.

6.3.9 Management of Change

All JSW Business and sites shall establish and maintain management of change system to evaluate and control changes that may affect or compromise design and operational integrity of the facility.

Number	Expectation
1	Each JSW Business and site shall develop written procedures to define change and to plan and control all changes. These procedures should include an assessment of the impact of the change to avoid adverse consequences. For detailed guidance, please refer to the Standard for Management of Change: JSW/GHS/GS-16.
2	The change control procedures will cover both permanent and temporary changes to: • People and organization structure • Plant, equipment, processes, and their controls. • Building, facilities, or other assets • Change in technology or subtle change in existing technology. • Business processes • Standards and procedures • Suppliers. • Reagents or process chemicals • Statutory license conditions • Legislation or regulatory which affects operations. • Layout or configuration of JSW owned or controlled railway lines, roads, site, buildings or building layout. • Lifting equipment including lifting beams • Frequency of scheduled checks or inspections of safety critical systems, alarms and interlocks to any plant or equipment • Group, Group Businesses, site or project Health & Safety standards and procedures which have the potential to alter the risk profile of the site; and • Maintenance or operating strategies which impact critical equipment or priority controls.
3	Change control procedures shall document the evaluation and approval process, along with the responsible authorities involved. At a minimum, these procedures should incorporate: • Hazard identification and evaluation of risks associated with the proposed change. • Development of a mitigation plan to reduce risks to As Low as Reasonably Practicable (ALARP). Each JSW Business and site is required to maintain a Change Control Register, documenting all records of managed changes.

6.3.10 Health Management

A robust Safety Management System (SMS) shall not only focus on safety but also prioritize the health and well-being of employees, contractors, and all stakeholders.

Number	Expectation
1	Ensure that the governance structure within the SMS includes provisions for health management, with clear roles, responsibilities, and accountabilities related to occupational health.
2	Implement systematic risk evaluation and management processes to identify, assess, and control health-related risks in the workplace.
3	Establish an Occupational Health Program that supports the health and wellness of employees, focusing on both physical and mental health aspects.
4	Implement a health surveillance system to monitor employees' health and well-being, especially in high-risk environments.
5	Recognize the importance of mental health and ensure a supportive environment for employees to address mental well-being.
6	Ensure that the workplace environment promotes physical health through proper ergonomics and the prevention of musculoskeletal disorders.
7	Include health-related risks in Job Hazard Analysis (JHA) and Job Cycle Checks (JCC), ensuring that all job tasks are assessed for both safety and health impacts.
8	Implement a structured rehabilitation and return-to-work program to support employees recovering from injuries or illnesses, ensuring a smooth transition back to full duties.
9	Involve employees in the identification of health risks and the development of health improvement programs.
10	Provide regular training to employees and contractors on health risks, prevention measures, and available support resources.
11	Ensure the integration of health considerations into all safety processes and decision-making.
12	Establish health performance metrics and report on health-related incidents, trends, and improvements.
13	Develop health-specific emergency preparedness plans to address health emergencies (e.g., medical emergencies, exposure to hazardous materials).
14	Maintain comprehensive records related to occupational health, including health assessments, medical surveillance, and health program participation.

6.3.11 Emergency Preparedness and Response

Procedures shall be established to identify foreseeable potential emergency situations, along with response strategies, mitigation measures, testing protocols, and internal and external communication plans.

Number	Expectation
1	Each JSW Business and site shall develop a detailed emergency preparedness and response plan to effectively manage potential emergency situations, guided by the risks identified through the risk evaluation process. This plan should include: • A defined organizational structure to manage emergencies. • Internal and external communication systems. • Training programs for all stakeholders. • Mock drill plans to assess the ongoing suitability of preparedness measures. Moreover, the plan should outline detailed procedures for implementation, clearly delineating the roles and responsibilities of individuals according to defined organization structure.

6.3.12 Procurement

The procurement process(es) should be utilized to identify, assess, and eliminate hazards, as well as to mitigate health and safety (H&S) risks associated with various aspects such as products, hazardous materials or substances, raw materials, equipment, or services before their introduction into the workplace.

These procurement processes should encompass requirements related to supplies, equipment, raw materials, and other goods and services purchased by JSW to conform to its H&S management system.

Number	Expectation
1	JSW management shall ensure that equipment, installations, and materials are safe for use by employees, including contractor workers, by verifying the following: • Adherence to the design validation process before project execution. • Delivery of equipment according to specifications and testing to ensure it functions as intended. • Commissioning of installations to verify they operate as designed. • Delivery of materials according to their specifications. • Communication and availability of any usage requirements, precautions, or other protective measures.
2	**Contractors or Vendors Outsourcing** When outsourcing, JSW Management shall maintain control over the outsourced functions and processes to ensure they achieve the intended outcomes of the JSW H&S management system. The responsibility for adhering to the requirements of this standard remains with the organization. The extent of control over outsourced functions or processes should be determined based on factors such as: • The external organization's ability to meet the organization's H&S management system requirements. • The technical competence of the organization to establish appropriate controls or assess the adequacy of controls on related hazards and risks. • The potential impact of the outsourced process or function on the organization's ability to achieve the intended outcomes of the JSW H&S management system. • The degree to which the outsourced process or function is shared. • The organization's capability to establish necessary control through its procurement process. • Opportunities for improvement.

6.3.13 Implementation

All critical activities with potential for harm to people and assets shall be executed according to the set management standards, procedures, and work instructions.

Number	Expectation

1	All employees and contractors shall conduct activities and tasks in accordance with the management and technical standards, procedures, and work instructions in place to control risks.
2	Each critical activity shall be assigned to an accountable party or person responsible for monitoring and regularly reporting the performance of their assigned activities using predefined performance criteria.
3	The staff performance appraisal system should integrate performance appraisal criteria to monitor personnel performance in: • Compliance with standards, procedures, and work instructions. • Achievement of planned targets.

6.3.14 Job Hazard/Safety Analysis

Appropriate Job Hazard/Safety Analysis programs shall be established to effectively identify hazards, plan, and implement measures to control risks associated with each step of the job. These analyses should also be utilized for providing training to individuals involved in the job on the day of their involvement.

Number	Expectation
1	Each JSW Business and site should establish requirements for identifying, assessing, and controlling personal risks associated with work activities by developing a Job Hazard Analysis (JHA) or Job Safety Analysis (JSA) program.
2	A Job Hazard Analysis (JHA) may be expanded to encompass all routine maintenance tasks and other relevant activities, and it should be integrated into a permit-to-work system. All actions performed for these tasks should adhere to the JHA. The JHA should be approved by designated competent individuals. For non-routine work, a Job Safety Analysis (JSA) or method statement should be developed and approved by a competent person. This analysis or statement should then be integrated into the permit-to-work system.

6.3.15 Job Cycle Check

A Job Cycle Check (JCC) is a systematic evaluation process designed to assess the adequacy and effectiveness of a written procedure and the capability of employees to perform a job safely and consistently. This evaluation involves actual observation, simulation, discussion, and/or testing.

The purpose of JCC is to ensure that the procedures outlined in Standard Operating Procedures (SOPs)/ or Standard Maintenance Procedures (SMPs) are effectively implemented, and to identify and address any gaps in safety, training, or procedure execution.

Number	Expectation
1	Each department within a site shall ensure JCC Implementation within their functions.
2	**Site APEX shall establish a document management system** to handle the approval process for any revised SOPs or SMPs resulting from JCC findings.
3	**Conducting JCC** The following steps shall be followed for conducting JCC: **Individual Can Perform JCC or Business Site can form a team to conduct JCC** **Scheduling:** Time and location for the pre-job evaluation and job execution.

Number	Expectation
	Preparation: A photocopy of the SOP or a checklist may be used for reference during the review. **Review:** Discuss job preparation and review the SOP/SMP. Key questions to consider include: • Required protective equipment and its condition. • Tools needed and their condition. • Unique safety checkpoints and procedure updates. • Interfering activities and positional risks. • Site specific risks. **On-the-Job Evaluation:** **Observation:** Observe job performance and compare it with SOP/ SMP. **Deviation:** Note any deviations from the procedure that appear safer and recommend updates to the SOP/SMP. **Assessment Categories:** Focus on reaction, position, PPE, tools and equipment, procedures, and housekeeping. **Final Evaluation and Reporting:** **Review:** The area owner or section In-charge will review their findings and agree on recommendations. **Documentation:** Complete and submit JCC evaluation and deviation forms.
4	**Review and Follow-Up** **Effectiveness Review:** **Implementation:** SRP Sub-committee will review to ensure corrective actions are implemented and their positive impact on safety performance. In case corrective actions are not being implemented due to any reasons then it should be presented to APEX meeting for their review & compliance.

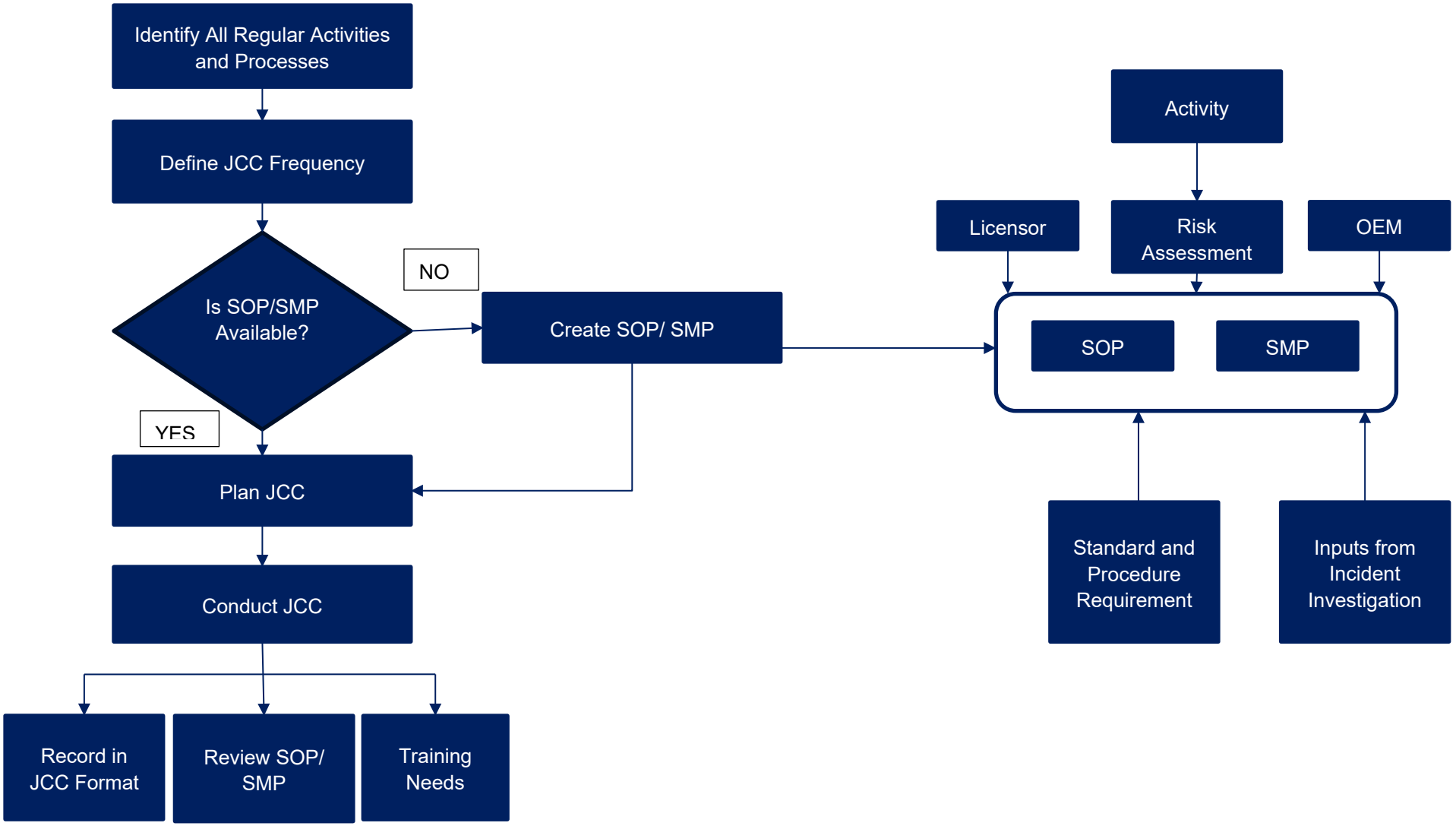


Figure-7: Flow Chart of Job Cycle Check

6.3.16 Safety Observation

6.3.16.1 Purpose and Scope

Enhancing safety isn't just about improving systems and procedures; it's also about fostering a positive safety culture through attitude and behaviour shifts. The JSW Group has introduced Safety Observation to elevate discussions and actions aimed at enhancing safety across our businesses.

Safety Observation entails structured, proactive, two-way safety conversations at workplaces. These conversations serve to acknowledge commendable safety practices, provide a platform to raise safety concerns, and collaborate on addressing safety issues. The initiative aims to:

- Recognize and reinforce positive safety behavior.
- Identify and rectify risky behavior.
- Encourage dialogue on safety concerns and issues.

By facilitating regular safety discussions, Safety observation enables the early identification and resolution of safety concerns, mitigating potential harm. It reinforces the collective responsibility JSW Group/ Business and Site share in injury prevention, emphasizing that everyone can make a meaningful impact.

In striving for a world-class safety culture characterized by voluntary adherence to safe practices, our objectives include:

- Reinforcing positive safety behavior.
- Addressing unsafe acts and conditions.
- Preventing incidents and injuries through the elimination of unsafe practices and conditions.
- Cultivating a safety culture one-on-one, fostering positive change incrementally.

All Safety observations are documented in the Safety Observation (SO) Module of JSW Company reporting platform, ensuring comprehensive reporting and tracking. This procedure applies universally across all JSW Group business sites and activities, both within India and internationally.

6.3.16.2 What is Safety Observation

A Safety Observation is a planned site visit where individuals are observed while working, followed by a discussion about the observed practices. It serves as an opportunity to:

- Recognize and acknowledge both safe and unsafe work practices.
- Raise any safety concerns.
- Collaborate to address unsafe situations.
- Follow up and resolve unsafe acts and conditions proactively to prevent injuries.
- Discuss health and hygiene topics alongside safe practices to ensure overall well-being.

Safety Observations are scheduled in advance and are not intended to catch individuals out; rather, they are opportunities for positive safety conversations. However, if an unsafe act or condition is witnessed, it's crucial to initiate a Safety Observation immediately. By following the steps of a Safety Observation, employees and contractors can be actively engaged and committed to safer practices in the future.

Benefits of Safety Observations include:

- Demonstrating leadership commitment to safety.
- Reinforcing positive safety behaviors.
- Increasing safety awareness.
- Motivating individuals to take responsibility for safety.
- Correcting unsafe behaviors in a positive, proactive manner.
- Preventing injuries and property damage.
- Identifying strengths and areas for improvement in the safety system.

Safety Observations and Feedback are NOT:

- An audit processes.
- Intended for penalization or writing up individuals.
- A process of catching people in the act.
- A negative procedure.

6.3.16.3 Participation

Safety Observations should be carried out and documented by personnel who have successfully completed the Safety Observation training. Initially, Safety Observations should be conducted by trained personnel in pairs until the Safety Observation and audit subcommittee is confident in the effectiveness of the process.

During Safety Observations conducted in pairs, one person should lead the conversation while the second person acts as an observer. Roles should be reversed at the next observation, and so forth. Following the conclusion of each Safety Observation round, both individuals should provide brief feedback, beginning with positive aspects and then offering suggestions for improving the quality of the observation.

If an individual has not been trained to conduct effective Safety Observations, they should refrain from leading them. This measure is in place to uphold the quality and integrity of the Safety Observation process.

6.3.16.4 Safety Observation

Safety Observations shall be conducted at scheduled frequencies in the field, with or without Trained Safety Observation Members solely focused on observing department/plant personnel in their workplace. Discussions on topics other than safety should be avoided during the Safety Observation round. The primary focus is on observing behaviour in the workplace, while also acknowledging and addressing conditions as necessary.

Each Safety Observation round should preferably last for 1 hour, with a minimum duration of 30 minutes. During this process, the Six-Step Safety Observation Process is to be utilized to reinforce positive acts and behaviours, discuss and correct unsafe acts and behaviours (emphasizing consequences), and address other safety-related issues.

Each Safety Observation round will typically involve multiple contacts, covering various observation Categories. Sufficient time should be allocated for effective observation and discussion (Six-Step process) during each contact. It's not mandatory to identify an unsafe act for every category during each individual Safety Observation.

The Safety Observation process acknowledges both positive safe acts/behaviours and unsafe behaviours/concerns. The entire discussion is intended to be a constructive, two-way conversation about safety, recognizing safe work, correcting unsafe work habits, and resolving any issues that arise.

6.3.16.5 The Six Step Observation Process

1. **Observe,** people working and decide an agenda for discussion based on six observation categories. Initiate the discussion, make sure interventions does not cause panic/distraction and result in an incident.

2. **Praise,** the individual for carrying out safe acts/behaviour

3. Start conversation for any unsafe act/condition observed

4. **Discuss**, consequences (Possible injury or property damage or environmental impact) of the unsafe act/behaviour.

5. **Get Agreement** (informal/verbal) to work safely.

6. **Encourage the contact** to discuss safer ways to do the job & arrive at a conclusion and **invite the contact** to discuss other safety issues in the workplace and **thank** the contact.

Document the observations and actions in online platform.

People often have the tendency to address problems they observe immediately, which can lead them to bypass the Six-Step process. However, research has shown that following these steps can yield powerful results in influencing behavioural change. It's crucial to maintain a positive tone and avoid confrontation, which is a primary aim and benefit of using the Six Steps. People respond better when they feel treated fairly, including recognition of safe practices. Correction is more readily accepted from someone perceived as fair and reasonable, who also acknowledges good practices.

During Step 1, it's essential to observe the situation first and decide on an approach that doesn't put oneself or the Contact at risk. Taking sufficient time to observe how people are working before making contact is important. In Step 4, obtaining agreement to work safely is key, but it's crucial to watch for responses driven by authority rather than genuine understanding. Ideally, people should choose to work safely because they see the value in doing so, not simply because of rules or authority figures. Therefore, aiming for genuine, high-quality agreements with Contacts is vital.

Safety Observation discussions may not always uncover "other issues" to consider in Step 5, and this doesn't signify failure. The important aspect is to ask, as responses may come later, even the next day. As Contacts

become accustomed to being asked about safety issues, they'll likely be better prepared for future Safety Observation discussions.

Here are some tips for conducting effective Safety Observations:

- Focus on observing people's activities rather than objects or equipment.
- Ensure that the individual being observed feels comfortable and at ease from the beginning of the process. Building rapport may take time and should not be rushed.
- Ask open-ended questions rather than delivering lectures. The goal is to encourage Contacts to personally recognize the importance of improving their safety performance. Discussions should be skillfully guided but not manipulative.
- Safety Observations should be seen as a powerful activity supporting the overall safety effort. They require management presence in the workplace, actively engaging with Contacts on safety-related matters. Such conversations can also serve as an effective means for boosting morale in the workplace.

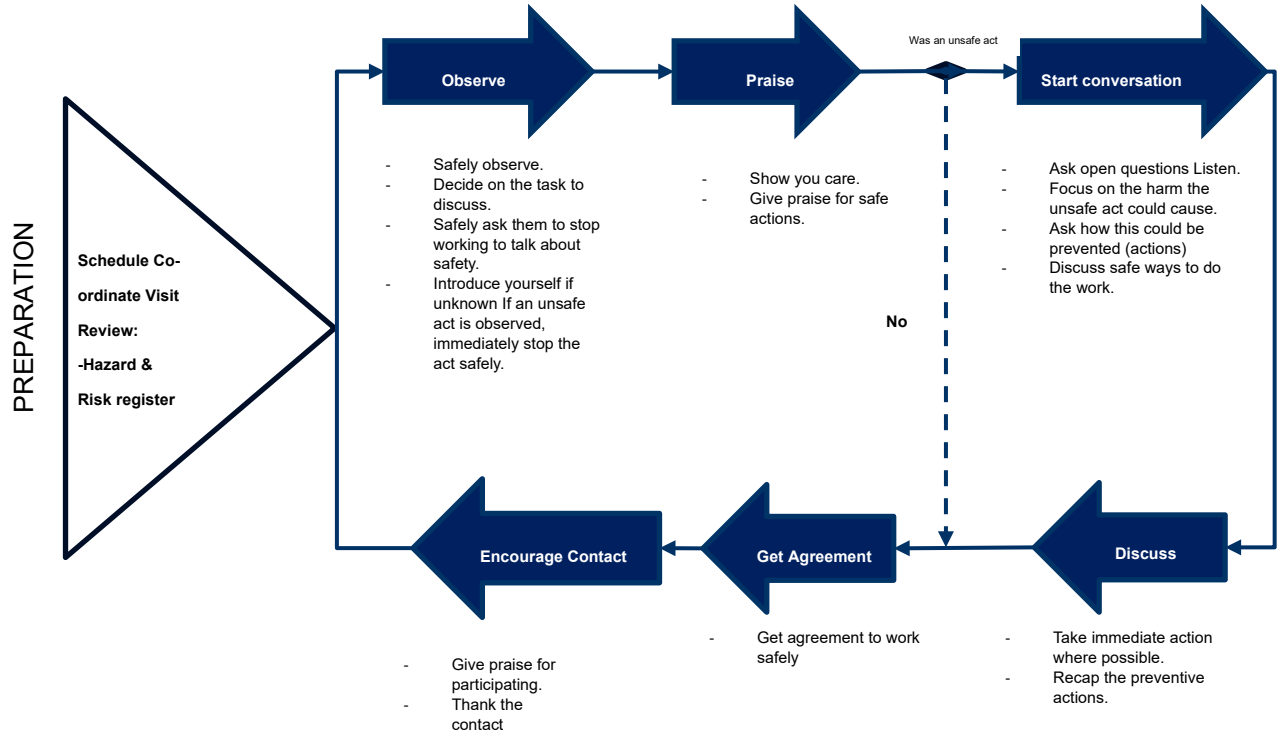


Figure-8: Six Process Step

6.3.16.6 What to look for

Safety Observations should primarily focus on behaviours that have the potential to cause injury. Findings from incident/near miss investigations and previous observation specific to the workplace should be reviewed and used to determine where to focus observations. The following categories have been developed to assist in identifying unsafe acts and behaviours:

Reactions of people: Are individuals modifying their behaviour from unsafe to safe when they see a leader in the area? This could include adjusting body positions, PPE, using correct tools, grabbing handrails, securing loose hoses, or putting on seatbelts.

Positions of people: Are individuals positioning their bodies in a way that reduces the potential for injury? This includes considering ergonomics in various environments and assessing risks of being crushed, struck, or having objects fall on them.

Personal Protective Equipment (PPE): Are individuals using task-specific PPE correctly and is it in good condition? Is the PPE appropriate for the associated risk?

Procedures: Are adequate procedures in place, understood, and being followed? Do procedures provide specific guidance on safely controlling identified risks?

Tools and Equipment: Are the proper tools being used correctly and in good condition? Are any homemade tools being used, and if so, have they been approved?

Orderliness & Housekeeping: Is the work area orderly and kept clean? Are housekeeping standards being followed?

Each of these categories has subcategories, and Observers should refer to these details while conducting Safety Observations.

All observed unsafe acts, behaviours, and conditions in any area or location shall be addressed immediately. Ignoring or overlooking such issues implies passive approval of unsafe practices. All Observers shall model the safe behaviours they expect from personnel. This aligns with the proverb, "You get the level of safety that you demonstrate that you want."

6.3.16.7 Schedule

A critical factor in the success of the Safety Observation program is conducting observations consistently and at a reasonable frequency. Safety Observation rounds should be conducted across all shifts and all areas to ensure all personnel benefit from the program.

- A schedule for safety observation by individuals in plant shall be prepared in advance. The schedule shall be prepared in such a way that any major/critical activity being performed in that area is covered in the observation process.
- All staff at the site (L-7 and above, including safety professionals) shall carry out assigned nos of 4 SO's every month and each SO visit shall have observations.
- A schedule for SO rounds should be prepared for shutdown and critical activities.
- The SO subcommittee shall assist in preparing the schedule.
- Each HOD shall provide the schedule for the next month as part of the MIS to Apex Safety Committee.
- The gap between two consecutive SO rounds should be uniformly distributed across stipulated period.
- Each safety observation round will typically have multiple contacts, and each contact should ideally be for around 15 minutes to keep the process effective.

6.3.16.8 Results

During Safety Observations, all issues or concerns raised shall be addressed promptly. The goal is to correct unsafe acts and conditions during the Observation round whenever possible. If issues or concerns cannot be immediately corrected, they will be addressed through a corrective action plan for resolution. In such cases, work can only proceed if alternative controls are provided to mitigate the risk until a permanent solution is implemented.

In instances where a high-risk situation (with potential for fatality or serious injury) is identified, the Observer shall immediately request to stop the work safely and notify the concerned Head of the Department/Area In-charge as well as the Site Safety Head.

Safety Observations shall be recorded and communicated within 24 hours to the observation Area In-charge/Location Supervisor and the respective Head of Department where the Observation was conducted. The observation Area In-charge/Location Supervisor is responsible for closing any actions within their area of responsibility. If unable to do so, they should promptly escalate open actions to the relevant Head of Department/Head of Section with a copy to the Central Safety Committee.

The Head of Department/Head of Section responsible for corrective action shall submit the action plan to the Chairman of the Central Safety Committee within 48 hours of receiving the Observation report. The Chairman will ensure that corrective actions are tracked to completion and provide status updates to the Secretary of the Site Central Safety Committee monthly. The Element Owner will receive a fortnightly report of outstanding actions relevant to their functions from Heads of Departments/Heads of Sections and ensure timely closure. A monthly close-out report will be copied to the Central Safety Committee Chairman.

6.3.16.9 Analysis of Results

The Secretary of the Central Safety Committee will compile the Key Performance Indicator (KPI) data and conduct the analysis of the Safety Observations.

The Site Safety Head will compile the KPI data for Safety Observations conducted by Safety Professionals. The Safety Department will also assist the Secretary of the Central Safety Committee in compiling and analysing Site-wide Safety Observation data whenever necessary. Additionally, the Safety Observation data gathered by Safety Professionals shall be provided to the Secretary of the Central Safety Committee for their respective area, ensuring inclusion of the data in their analysis.

6.3.16.10 Repetitive Contacts

When discussing safety behaviours with Contacts during Safety Observations, Observers may encounter situations where a specific Contact has already been addressed regarding the same or similar unsafe behaviour. Such repetitive unsafe behaviour cannot be tolerated and should be addressed promptly.

It's essential to understand that the Safety Observation process is not a disciplinary system. Repetitive unsafe behaviour will not be considered part of the Safety Observation process and will be handled through existing disciplinary systems.

It's crucial to maintain a clear distinction between the Safety Observation process and disciplinary actions to uphold its positive nature. Additionally, the Safety Observation Process does not prevent immediate disciplinary action for safety violations involving "Zero Tolerance" behaviours.

6.3.16.11 RACI Chart

Activities	Department Head	Site Head/ Head Operations	Section In-charge	Safety
Effective Leadership	R	A	C	I
Competent Workforce Deployment	A	C	R	I
Develop Safety Governance Framework	R	A	I	C
Implement Assurance Processes	C	R	I	A
Review Safety Performance	R	A	C	I
Conduct Safety Training	A	R	C	I
Monitor Compliance with Safety Standards	C	A	R	I
Incident Reporting	C	A	R	I
Risk Assessments	I	R	A	C
Emergency Preparedness Planning	R	A	C	I

R=Responsible **expected to participate in the activity and contribute the best of his/her abilities**
A =Accountable **ultimately responsible for the results**
C = Consulted **contributes towards decision making**
I = Informed **kept informed but need not participate in the effort.**

6.3.16.12 Training

Site Safety Observation Subcommittee convenor is responsible for arrangement of training and Central Safety Committee Chairman is responsible to ensure all personnel are trained to conduct effective Safety Observation as per the schedule. Site Head will ensure that resources are provided for Safety Observation training as per the guidelines. Training records should be maintained by Site Safety Head.

6.3.16.13 Record Keeping

All scheduled Safety Observations shall be recorded through Company reporting platform for three reasons:

- To ensure that scheduled Safety Observations are conducted as per the specified frequency.
- To facilitate trend analysis for continual improvement.
- To capture action items to ensure resolutions in a timely manner.

Reporting guidelines for Safety Observations:

- Safety Observation observations should be reported in Company reporting platform immediately after the observation but not in the presence of the Contact observed.
- Record the Safety Observation team members, the location, time, and duration of the Safety Observation in Company reporting platform.
- Do not use names of individuals with whom Safety Observations are conducted.
- Describe safe behaviors and wellness observed during the Safety Observation.
- Note any unsafe behaviors and any corrective actions taken during the Safety Observation. Also, document any unsafe conditions that were not corrected.
- Mark all actions related to unsafe acts/conditions as closed or open. Include the name of the Responsible Area In-charge against each unsafe situation.
- Follow-up responsibilities for the Area In-charge:

- Ensure corrective actions have been completed.
- Review findings to identify trends and safety strengths and concerns.
- Develop action plans to address negative trends and concerns.
- Note any items requiring follow-up in the next Safety Observation round as determined by the Chairman of the Central Safety Committee.

6.3.16.14 Safety Management System Expectations

Number	Expectation
1	Each JSW site shall establish an appropriate Safety Observation (SO) program to continuously identify potential at-risk behaviours (unsafe acts), unsafe conditions, and their management. Safety Observation training shall be regularly provided to all employees and contractors, including supervisors. Safety Observation records shall be entered and maintained in the Company reporting platform Company reporting platform software system.
2	All personnel have a responsibility to: • Carry out their work in compliance with standards, procedures, and work instructions. • Recognize and reinforce positive behaviour. • Stop inappropriate/unsafe behaviour when witnessed. • Halt any activity that they believe poses an unacceptable risk to their or others' health, safety, or the environment, which may hinder our goal of zero harm.
3	Procedures shall be established to collect, analyse, and communicate observation data and trends in improving effectiveness. The Group's online system, called Company reporting platform, shall be used to capture these Safety Observation and other data.
4	Line managers shall provide leadership in the use and conformance with the observation and other behaviour improvement program.
5	A formalized motivational technique /program shall be formulated to recognize safe behaviour, performance, and innovation.
6	Consequence management/ progressive disciplinary procedures shall be in place to deal with safety violations committed by employees and contractor employees in line with General Condition of Contracts (GCC) as part of safety requirement.
7	Manufacturing sites shall assign existing safety committee or constitute Safety Observation and Assurance subcommittee to develop, oversee and monitor the program focused on promoting safe human behaviour.

6.3.17 Corrective and Preventive Actions of Incident Learnings and for Non-Conformance

Procedures shall be established and maintained for the identification, internal and external reporting, investigation of non-compliance and non-conformances, and the implementation of corrective actions to prevent recurrence by improving the Business Management System. These CAPAs shall be reviewed at unit level.

Number	Expectation
1	Each JSW site shall establish procedures for defining responsibility and authority for: • Handling and investigating any non-compliance with legislation, regulations, JSW policy, standards, and site or business procedures. • Identifying root causes and acting to prevent recurrence or mitigate any consequences arising from such non-compliance. • Initiating and completing corrective and preventive actions in response to non-compliance. • Confirming the effective implementation of all corrective and preventive actions taken.
2	Any corrective or preventative action taken to eliminate the causes of actual and potential non-compliance shall be appropriate to the magnitude of problems and commensurate with the risks encountered.
3	All occurrences of variance, non-compliance, and the corrective action shall be documented, investigated, and appropriately remedied.
4	Care should be taken to update the documented procedures resulting from corrective and preventative actions, which shall be appropriately communicated and implemented.

6.3.18 Record Keeping

All records generated as an outcome of implementation of the system shall be maintained as verifiable evidence and shall be stored as appropriate.

Number	Expectation
1	Each JSW business and site shall establish procedures for the identification, maintenance, and disposition of records. The records shall be: • Legible, identifiable, and traceable to the activities involved with defined retention times. • Stored and maintained to prevent loss and unintended use. • In auditable form to support the annual or other periodic performance data provided to the JSW corporate or business. • Used in improvement planning.
2	Few examples of documented information include: • Reports of tests, inspections, assurance, audits, and reviews • Situations of non-compliance and of improvement actions • Any incidents and follow-up actions • Completed PTW or MOC documentations. • Key performance indicators • Inspection and maintenance reports of safety-critical equipment i.e. equipment providing a control and recovery function. • Data obtained from monitoring as input to performance records. • Results of emergency drills and exercises • Training records.

6.3.19 Performance Measurement, Monitoring and Reporting

The evaluation process for the functioning and effectiveness of the management system is crucial for continual improvement. It encompasses assessing the capabilities of personnel, maintaining assets and infrastructure, reviewing processes, and refining procedures. Corrective actions should be promptly implemented by designated individuals within specified timeframes. The evaluation process follows the Plan-Do-Check-Act (PDCA) cycle to ensure systematic and iterative improvement.

Action	Description
PLAN	• **Set Clear Goals**: Define what you want to achieve with the activity and determine the resources (time, money, people) needed. • **Involve Everyone**: Make sure all relevant parties—like employees, contractors, and stakeholders—are engaged in the process. Their input is important. • **Identify Risks**: Look for potential problems that could arise during the activity. Think ahead to prevent issues. • **Assess Remaining Risks**: After trying to eliminate risks, evaluate what is left. Create plans to manage these remaining risks effectively.
DO	**Execute the Plan**: Carry out the activity according to the established plans. Monitor the process to ensure everything is going as intended. Address any new risks that come up in real-time.
CHECK	**Monitor Progress**: Continuously check if the activity is following the plan. Evaluate how well the risk management strategies are working. Look for ways to improve processes.
ACT	**Review and Learn**: After completing the activity, review the results. Identify what went well and what didn't. Use these insights to make improvements for future activities and enhance your overall safety practices.

Performance indicators shall be established, monitored and results reported in a way that can be externally verified.

Number	Expectation
1	Compliance with strategic objectives, annual plans, and safe work procedures shall be monitored against set performance criteria
2	Plans and procedures for health monitoring, industrial hygiene monitoring, and workplace permissible exposure limits of notified substance monitoring shall be established and maintained in accordance with applicable legislation and group requirements.
3	Procedures for the calibration and maintenance of measuring and monitoring equipment shall be established and documented, including inspection, maintenance, and timely replacement of personal protective equipment (PPE).
4	A documented procedure for the periodic evaluation of compliance with relevant legislation and regulations shall be maintained. Each JSW site shall ensure that applicable regulatory reporting requirements are identified and complied with.
5	Each JSW site shall regularly measure, record, review, analyse and report key performance indicators (KPIs) as established by JSW Safety Dashboard. Sites shall report the performance of their KPI's in Company reporting platform (OHS Information Management System) periodically.

6.3.20 Incident Reporting and Investigation

All incidents shall be reported, investigated to identify root cause(s) and recommendations should be acted upon in a time bound manner.

Incident Information Protocol - Fatality					
Reporting Flow	**Time Frame**	**Action**	**By whom**	**To Whom - Steel & Coated**	**To Whom- Other Businesses**
Preliminary Information	Immediate	Communicate via phone/SMS followed by FIR (First Information Report) within 02 hours for Fatal Cases and Catastrophic Incidents (Major Fire, Explosion, Gas Release, Media Attention) and within the same shift for LTI/ HIPO	**Fatal Cases and Catastrophic Incidents -** Site President/ Site COO/ Business Head **LTI/ HIPO -** Site H&S Head	**Fatal Cases and Catastrophic Incidents -** GSC Chairman, JMD, COO, CHRO, Group Safety Head and GSC Members **LTI/ HIPO -** Group Safety Head and Respective Business Head and HR Head	**Fatal Cases and Catastrophic Incidents -**GSC Chairman, JMD, COO, CHRO, Group Safety Head and GSC Members **LTI/ HIPO -** Group Safety Head and Respective Business Head and HR Head
		Communicate via phone/SMS followed by FIR (First Information Report) within 02 hours	Site H&S head	Group Safety Head and HR Head	Group Safety Head, Business Corporate Safety Head and Business HR Head
Reporting in System	Within 24 hrs	Report in 'MySetu'	Head of the Department	As per 'MySetu'	As per 'MySetu'
Investigation Report	21 Days	Incident Investigation Report Submission	Incident Investigation Team	COO & WTD, CHRO, CEO Coated and Group Safety Heads	Business Heads, COOs, Business Safety Head, Group Safety Head, Business HR Head
Health Status Update for LTIs cases	Every Day	Based on Hospital Report	By Company Doctor and Site H&S Head	Group Safety Head and HR Head	Group Safety Head, Business Corporate Safety Head and HR Head

Number	Expectation
1	JSW Sites shall maintain procedures for reporting and investigation of hazardous situations, near misses and incidents in compliance with JSW Incident Reporting and Investigation Standard (JSW/GHS/GS-02). The procedures shall conform to the JSW Standards. The JSW Sites shall foster a culture of openness in reporting all incidents and near misses
2	Incidents shall be investigated in a timely manner, with accountabilities assigned, and progress on recommended actions shall be monitored until close-out. Incident (including near miss, Fire, Property damage, process incident etc.) up to the severity of Lost Time Injuries investigation shall be completed within 7 days,whereas Fatal and High Potential incident shall be completed within 21 days. To ensure that these investigations are carried effectively and thoroughly: Employees shall be aware of the incident reporting procedures and participate in incident investigations; and

Number	Expectation
	Training shall be provided in incident investigation to appropriate staff throughout the organization.
3	Any corrective or preventative action taken to eliminate the causes of potential incidents shall be appropriate to the magnitude of problems and commensurate with the health and safety risks encountered.
5	Employees and contractors shall be made aware of the incident reporting procedures (JSW/GHS/GS-02 Incident Reporting and Investigation) and participate in incident investigations,
6	JSW Site shall implement and record any changes in the documented procedures resulting from corrective and preventative action. Lessons learnt from accidents and incidents shall be disseminated to relevant personnel and contractors
7	Feedback procedures should be encouraged and rewarded

6.3.21 Inspection Program

An inspection system shall be established to review and verify the adequacy and continued effectiveness of the site management system to achieve goal of zero harm.

Number	Expectation
1	Each JSW Business and location shall establish and maintain inspection programs and procedures/checklists addressing, at a minimum, the following: • The types of routine and technical inspections to be conducted, including leadership teams conducting plant tours and walkabouts, supervisory inspections, and technical inspections such as structural, mechanical, electrical, lifting tools and tackles, machines, firefighting facilities, etc. • The objectives and criteria for inspections to be conducted. • The responsibilities, competencies, and resources required. • Frequency of inspections • Checklists as per national or equivalent standards • Non-conformance, corrective, and preventive actions • Monitoring and review • Internal reporting
2	Senior management shall undertake regular site inspection tours/walks to observe behaviours, conditions of the site, and to provide feedback on what has been observed to enable improvement.

6.3.22 Assurance Program

Each Site shall conduct self-assurance program to ensure compliance with this STANDARD as part of its safety assurance program. Third party system audit shall be conducted by Group Safety or external consultants to ensure compliance with the standard.

6.3.23 Group Safety Council Review

This sub-element of Robust System defines the process of group safety council review which helps the senior management team to ensure suitability and effectiveness of management controls needed to achieve our goal of zero harm and to implement corrective measures as required.

6.3.24 Legal and Other Requirements

Each JSW site shall ensure the establishment of a process for compliance with legal requirements. This process shall, at a minimum, include the following:

- Identification of applicable local, regional, and national legislative requirements for the safe design, operation, and maintenance of its activities, products, and services.
- Listing of conditions laid down under different licenses or permits, with a system to ensure continual compliance with those conditions.

- Identification of other requirements as subscribed by JSW, business, or site management that are relevant to activities, products, and services. These requirements may include:
- Voluntary commitments and agreements with government and other agencies
- JSW Policy, Technical Standards & Procedures
- ISO Standards
- Standards & Guidelines from National and International Institutions
- Communication of requirements to personnel responsible for ensuring compliance, including those who may be affected.

7. TRAINING AND AWARENESS

Each JSW Business & site shall ensure that all personnel (i.e. management, especially temporary workers, contractors, visitors, and any other parties) are aware of H&S risks to which they are exposed. Also, to ensure they are competent and have received appropriate training to perform tasks related to their functional area specific for implementing management system requirement and performance criteria to achieve our goal of zero harm.

8. NEW PROJECTS, MERGERS AND ACQUISITIONS

When designing new projects, a safety management plan shall be developed and implemented during the execution phase to integrate safety requirements into each stage of project planning and development.

During strategic decisions regarding mergers and expansion of existing businesses, safety management shall be integral to the decision-making process. This applies to the sale, lease, transfer, or purchase of assets, concessions, and licenses. The mergers and acquisitions team shall identify and analyse the safety aspects and related potential liabilities associated with the proposal to acquire or divest businesses or assets. This team shall include a competent safety professional.

Procedures and checklists shall be established to conduct assessments of risks and liabilities (structural, mechanical integrity of physical assets, legal, etc.) when considering the acquisition or divestment of businesses or property.

The mergers and acquisitions team shall give due consideration to the results of the risk assessment process, identified safety-related liabilities, past safety incidences, ongoing litigations, etc.

9. STAKEHOLDER ENGAGEMENT

JSW Business companies and site management shall create a stakeholder identification and engagement process to allow mapping of potential stakeholders' concerns relating to workplace safety, implementation of the management system, safety plan, and defining engagement processes. This shall include but not be limited to JSW personnel, technology suppliers, service providers, design, operation, and maintenance contractors, and responsible government agencies.

Community awareness and emergency management programs shall be established as per applicable local legislation and related JSW Management Standard. The process of stakeholder engagement shall be developed according to the requirements, and relevant documented information shall be maintained.

10. MANAGEMENT OF RECORDS

JSW sites shall establish and maintain comprehensive records to support the Safety Management System (SMS). These records ensure compliance, enable performance monitoring, and facilitate continuous improvement. The following types of records should be maintained:

- **Incident Classification Records:**
  Detailed records of incident classifications, including the impact, consequence, and any loss of containment.
- **Classification Criteria Documentation:**
  Up-to-date documentation of the criteria used for classifying incidents and any subsequent revisions or updates made to these criteria.

- **Investigation Reports:**
  Comprehensive reports covering the level of investigation, key findings, and approved corrective or preventive actions.
- **Internal Audit Documentation:**
  Plans, scopes, and schedules of internal audits.
  Records of audit findings, including compliance assessments, effectiveness evaluations, and areas of improvement.
- **Performance Data:**
  Data related to defined safety performance indicators and their trends, enabling monitoring of the SMS's effectiveness over time.

All records shall be retained in accordance with the site's record retention policy and be readily available for review during audits, inspections, or performance evaluations.

11. EMERGENCY PREPAREDNESS AND RESPONSE

Each JSW Business and site shall document and maintain an appropriate emergency preparedness and response plan as detailed in Section 6.3.11 of this document.

12. ROLES AND RESPONSIBILITIES

The overall responsibility to implement this Standard lies with the respective Business Heads and COOs

13. DEFINITIONS

Term	Definition
JSW Company	A legal entity which is controlled by the JSW Group, by virtue of their full/majority ownership or otherwise.
JSW Site	The operational and managed sites of JSW Company or JSW Business.
Accident	It is an undesirable event which has resulted into human injury, illness, or death.
Accident Investigation	It is a well-structured and organized effort to analyse accident by use of proper and adequate tools and technique to identify gap in management system and other supporting factors which has resulted into accident and by taking adequate actions on these identified gaps, similar accident can be prevented.
As Low as Reasonably Practicable (ALARP)	To reduce a risk to a level which is ALARP involves management balancing reduction of probability of and consequences arising out of an event against the time, trouble, difficulty & cost of achieving it. This level represents the point, objectively assessed, at which the time, trouble, difficulty, and cost of further reduction measures become unreasonably disproportionate, keeping people and assets safety, to the additional risk reduction obtained. Acceptable Risk: Risk that has been reduced to a level that management formally accepts about its legal obligations and Occupational Health & Safety policy (ISO: 45001:2018).
Assurance	Systematic, independent, and documented process for obtaining “defined evidence” and evaluating it objectively to determine the extent to which “assurance defined criteria” is fulfilled.
As Built Drawings	Revised set of drawing submitted by a supplier, commissioning agent, contractors upon completion of a project or a particular job. This reflects all changes made in specification or working drawing during the construction process and depicts the exact dimension, geometry, and location of all elements of the work completed

Term	Definition
	under the contract.
Change	A change involving any or all the following: Plant – Hardware changes- such as equipment, operating systems, infrastructure, layout, hardware/software, technology. Processes – Change in inputs- such as raw materials and Controls such as legal, customer requirements. People – Changes in the personnel supporting the activity/operations, including JSW employees and contractor personnel. Procedures – Changes to operating procedures, management systems.
Contractor	Any third-party organization which is engaged or commissioned by JSW Business / JSW Company/ JSW site to undertake work or provide services.
Consequence	The result of an accidental event sequence (fire, explosion, toxic gas dispersion, etc) that could affect people, the environment, operating location's assets, or reputation.
Competence	Ability to apply knowledge and skills to achieve intended results.
Competent Person	A Competent Person at JSW is an individual with the necessary qualifications, knowledge, and experience to identify hazards, assess risks, and ensure safety standards are met in the workplace. This person has the authority to enforce safety measures, conduct inspections, and ensure compliance with relevant regulations and company policy to maintain a safe and efficient environment
Critical Activity	Activity that should be carried out to prevent events with potential to cause serious harm to people, the environment, Operating location's property and / or reputation and can reduce the impact of such an event
Direct Cause	The immediate cause that resulted in the incident/accident. The event, situation or condition that resulted in the incident/accident.
Event	With reference to Occupational Safety, it is defined as incident which has caused or had potential to cause human injury, illness, process disturbance, environment damage or adverse impact on assets, organizational reputation and / or society.
Hazard	The potential to cause harm, including ill health and injury, damage to property, products or the environment, production losses, increased liabilities, or loss of reputation. Source or situation or act with a potential for harm in terms of injury or ill health, damage to property, damage to the workplace environment or a combination of these.
Hazard Analysis	The systematic process of developing an understanding of hazards. The process consists of hazard identification, assessment, and risk determination
Hazard Identification (HAZID)	A study to identify hazards and their effects management.
Hazard & Operability study (HAZOP)	One of the structured risk identification and analysis tool that is used at various stages of design engineering and process safety review.
Human Factor	A discipline concerned with designing machines, operations, and work environments so that they match human capacities and limitations.

Term	Definition
Illness/ Ill health	Identifiable, adverse physical or mental condition arising from and/or made worse by a work activity and/or work-related situation.
Incident	Work related event(s) in which an injury or ill health (regardless of severity) or fatality occurred or could have occurred. Note 1: An accident is an incident which has given rise to injury, ill health, or fatality. Note 2: An incident where no injury, ill health, or fatality occurs may also be referred to as a "near-miss", "near-hit", "close call" or "dangerous occurrence". Note 3: An emergency is a particular type of Incident.
Lagging Indicator	The measurement of an activity or outcome that is a post-cursor to an event taking place, typically seen as reactionary / reactive.
Leading Indicator	The measurement of an activity or outcome that is a precursor to an event taking place, seen as proactive.
Line Management	It is leadership tree involving employee from the business floor to the key. organisational stakeholder.
Fatality	The death of a worker (employee, contract employee or third party) in connection with any employment activity or arising from a work-related injury or disease sustained or contracted while in the organization's employment including incidents of workplace violence, and when an employee is a victim of a crime that occurs at a place of employment.
Lost Time Injury / Lost Workdays Case*	A lost time injury or workday case is any work-related injury or illness or adverse health condition or exposure which renders the injured person (employee or contractor) temporarily unable to attend next scheduled work shift after the day on which injury occurred. NOTE: A. Restricted Work-Day Case or Medical Treatment Case are not LWC, provided that the person can return to work within his/her normal working day and assigned any job /duty other than his normal work schedule because of an injury. B. Calculating total numbers of LTIs involves numbers of LTIs and fatalities. *NOTE: This definition is for JSW internal reporting purposes. Please note that legal definition may differ from county to country.
Restricted Work Case (RWC)	Any work-related injury, adverse health conditions or exposure that temporarily prevents the person from performing any or all his / her assigned tasks for any part or entire assigned shift.
Medical Treatment Injury / Illness*	Any injury/illness which because of its severity requires treatment by a physician or by a registered medical professional under a standing order of a physician. This is not counted in Lost Time Injuries provided it does not escalate to meet the Lost Time Case (LTC) definition. *NOTE: This definition is for JSW internal reporting purposes. Please note that legal definition may differ from county to country.
First Aid Injury*	Any injury/illness that requires First Aid treatment only at site, with no necessary follow up visit to the medical facilities. The following are generally considered First Aid Cases (e.g. one-time treatment and subsequent observation of minor injuries): *– Application of antiseptics during visit to medical personnel.* *–Treatment of first-degree burn(s).* *–Application of bandage(s) during first visit to medical personnel.* *–Removal of foreign bodies not embedded in eye if only irrigation is required.*

Term	Definition
	–Removal of foreign bodies from wound, if procedure is uncomplicated, for example, by tweezers or other simple technique. *–Use of non-prescription medications and administration of single dose of prescription education on first visit for minor injury or discomfort.* *–Application of hot or cold body contacts during first visit to medical personnel.* *–Application of ointment to abrasions to prevent drying or cracking.* *–Application of physiotherapy during first visit to medical personnel.* *–Observation only for injury during visit to medical facility.* *NOTE: This definition is for JSW internal reporting purposes. Please note that legal definition may differ from county to country.
Lost Time Injury Frequency Rate (LTIFR)*	Number of lost time injury including fatality case per million employees and contractor's man-hour worked. It is calculated by multiplying the number of LTI (Fatalities + Lost Workday Case) by 1,000,000 & dividing by the exposure hours worked during the reporting period. **LTIFR** = (No. of LTIs x 1,000,000) / Total Man-Hours Worked in Reporting Period *NOTE: This definition is for JSW internal reporting purposes. Please note that legal definition may differ from county to country.
Total Workdays Lost	Total workdays lost due to lost time injuries
Man-hours Worked	It is the total number of employee hours worked by all employees working in the industrial premises, offices, or project work sites. It includes managerial, supervisory, technical, clerical, and other workers including contractors' labor. It will involve actual hours worked by employees or contractor's employees with timecard and eight hours for those without timecard.
Management of Change for Safety Management	Management of change (MOC) is a process for controlling modifications to facility design, operation, organization, or activities to make certain that no new hazards are created and that the risk of existing hazards to employees, process, the public, or the environment is not increased unintentionally
Method Statement	A document that details the way a work task or process is to be completed. It should outline the hazards involved and include a step-by-step guide on how to do the job safely. It should also detail the control measures that should be introduced to the process to ensure the safety of anyone who is affected by the task or process.
Management System	The framework of policy, processes, procedures, practices, structure, responsibilities, competencies, and resources used to ensure that it fulfil all actions required to achieve its business objectives and goals.
Near Miss	An incident that did not result in but could have reasonably resulted in undesirable consequences to personnel (injury/illness), and/or to the assets (damage/loss) or to the neighboring community and environment.
Observation	An act of noticing or paying attention to someone engaged in some activity at any workplace, identifying safe and unsafe acts, surrounding conditions, and interacting with them for reinforcing positive behavior and correcting at risk behavior.
Performance indicator	Comparative, quantitative measures of actual events, against previously specified targets, which provide a qualitative indication of future projected performance based on current achievement. It also reflects the level of progress made tactically or operationally in optimizing output in line with the set of standards or goals.

Term	Definition
Process Safety Information	Complete and accurate written information concerning process chemicals, process technology, and process equipment, which is essential to an effective process safety management program and to a process hazards analysis.
Process Hazard Analysis	An organized and systematic effort to identify and analyze the significance of potential hazards associated with the processing or handling of highly hazardous chemicals using one or more formal hazard analysis techniques. PHA is usually conducted by a multidisciplinary team of experts.
Quantitative Risk Assessment (QRA)	Quantitative evaluation of the risk imposed by a system design, whether those risks are from human, hardware or software failures, or environmental events, or from combinations of such failures/events.
Risk	The product of the measure of the probability of occurrence of an undesired event and the potential consequential adverse effects that this event may have on people, the environment, assets, or reputation. Combination of the likelihood of occurrence of a hazardous event or exposure(s) and the severity of injury or ill health that can be caused by the event or exposure(s).
Routine Activity	A routine activity refers to a regular, repetitive task or operation that is performed as part of normal business or operational procedures. These activities are typically well-defined and follow established protocols or standard operating procedures (SOPs). Routine activities are integral to maintaining consistent performance, ensuring safety, and achieving organizational goals. They often include daily, weekly, or periodic tasks that support the smooth functioning of operations, such as equipment maintenance, quality checks, and administrative tasks. Effective management of routine activities is essential for operational efficiency and risk mitigation.
Safety Critical Equipment	Equipment, which have critical role in safeguarding asset integrity as identified by businesses (such as leak detection/sensors/ trips/alarms, fire protection, flameproof electrical etc.).
Safe	A condition in which all hazards inherent in an operation have either been eliminated or are controlled such that their associated risks are both below a tolerable threshold and are reduced to a level which is as low as reasonably practicable (ALARP).
Safety Observation Process	A structured and planned pro-active two-way safety observation and feedback process with people at any workplace to achieve positive change in people's behavior towards safety to: a. Recognize and reinforce positive safety behavior. b. Identify and correct behavior at risk and c. Engage in conversation regarding safety concerns or issues.
Stakeholders	Persons or groups that are directly or indirectly affected by a new or existing project/organizational activity as well as those that may have interests in it and/or the ability to influence its outcome, either positively or negatively. This can refer to employees, customers, shareholders, lenders, communities, suppliers, industry, governments and interested third parties.

Term	Definition
Stakeholder Engagement	An umbrella term encompassing a range of activities and interactions between JSW Company and stakeholders over the life of a project/business that are designed to promote transparent, accountable, positive, and mutually beneficial working relationships. Stakeholder engagement includes: • Stakeholder identification and analysis • Information disclosure and communication • Problem/conflict anticipation and prevention • Ongoing consultation and formation of partnerships • Development of grievance resolution mechanisms and negotiated problem solving. • Regular reporting forums and procedures
Sub-contractor	A contractor directly engaged or commissioned by a principal contractor to undertake work on behalf of JSW.
Total Reportable Injury Frequency Rate (TRIR)* or Total Reportable Case Frequency Rate (TRCF)	Number of total reportable injuries (Fatality + LTI + RWC + MTC) per million man-hours worked. *TRIR does not include First Aid Cases, Near Miss Cases, Unsafe Acts or Unsafe Conditions.* **TRIR** = (Total No. of Reportable Injuries x 1,000,000) / Total Man-Hours Worked in Reporting Period *NOTE: This definition is for JSW internal reporting purposes. Please note that legal definition may differ from county to country.
Third Parties	Any individual or group who does not have direct connection with the activities or services of the JSW companies but who might be affected by it.
Unsafe Acts	Any deviation from specified requirements, operating procedures, rules, and regulations, recognized safe practices, permit to work conditions that increases the likelihood of risk and may result in an injury.
Unsafe Conditions	Any physical condition, which may lead to an incident or injury if remain uncorrected or unaddressed. These conditions may be due to design, maintenance and operational errors or substandard practices.
Workplace	Establishment or facility at a particular location containing one or more areas and people are employed to work there. It may be office, factory, warehouse, or any other place under control of JSW businesses.
Zero Harm	No harm to anyone, any time while at work

14. ABBREVIATIONS

Term	Acronyms
ALARP	As Low as Reasonably Practicable
BSC	Business Safety Counsil
EPR	Emergency Preparedness and Response
FTA	Fault Tree Analysis
FAC	First Aid Case
FMEA	Failure Mode and Effect Analysis
GRI	Global Reporting Initiative
HAZID	Hazard Identification
HAZOP	Hazard & Operability Process
HIRA	Hazard Identification & Risk Assessment
ILO	International Labour Organization
ISO	International Organization for Standardization
JHA	Job Hazard Analysis
JSA	Job Safety Analysis
KPI	Key Performance Indicators
LOTO	Lock Out and Tag Out
LTI	Lost Time Injury
LTIFR	Lost Time Injury (Lost Time Injury Frequency Rate)
LWC	Lost Work-Day Case
MTC	Medical Treatment Case
OSHA	Occupational Safety and Health Administration
OEM	Original Equipment Manufacturer
MS	Management System
PHA	Process Hazard Analysis
PSM	Process Safety Management
PHR	Process Hazard Review
PFD	Process Flow Diagram
PPE	Personnel Protective Equipment

Term	Acronyms
PSI	Process Safety Information
P&ID	Piping & Instrumentation Diagrams
PSSR	Pre-Start Up Safety Review
PTW	Permit to Work
QRA	Quantitative Risk Assessment
RWC	Restricted Workday Case
SDS	Safety Data Sheet (Note: This is a new term used in United Nation's Globally Harmonized Systems of Hazardous Chemical Classification and Labelling Guidelines in place of earlier used Material Safety Data Sheet).
SMS	Safety Management System
SOP	Standard Operating Procedure
TS	Technical Standard
TRIR/TRCF	Total Reportable Injury Frequency Rate or Total Reportable Case Frequency Rate
UA	Unsafe Act
UC	Unsafe Condition
UN	United Nations

15. ANNEXURE

15.1 ANNEXURE -1: HEALTH AND SAFETY POLICY

Better Everyday

JSW Health and Safety Policy

The JSW Group is committed to:

Providing a safe and healthy working environment and achieving an injury and illness free work place. While safety is everyone's prime responsibility, senior leaders demonstrate visible commitment through their behaviors. Leadership will be held responsible & accountable for these safety behaviors. To meet its commitment,

JSW Group will:

- Endeavor to prevent all injuries and work related illness.
- Recognize Health and Safety as an integral part of its operations. Promote "Zero Harm" in all its operations.
- Comply and aspire to exceed applicable statutory Health and Safety requirements and set the highest standards.
- Impart and enhance the skills and competencies of employees, associates, contractors, suppliers and vendors through appropriate training to help them work safely.
- Assess risks and provide controls for Health and Safety hazards in its operations and activities. Conduct regular assurance programs and take timely actions resulting from it.
- Promptly report incidents, investigate for root causes and ensure lessons learnt are shared and deployed across the Group companies.
- Influence its business partners in enhancing their Health and Safety standards.
- Make safety as the condition of employment for all employees including associates and contractors.
- Set Health and Safety metrics as indicators of safety excellence journey, monitor progress and continually improve performance

Parth Jindal
Chairman, Group Safety Council

16. REFERENCES

References Document	Full Title, Brief Description, and Web Links
1. Occupational Safety and Health Administration (OSHA)	OSHA is a part of the United States department of labour to ensure safe and healthful working conditions for workers by setting and enforcing standards by providing training, outreach, education, and assistance. https://www.osha.gov/
2. International Organization for Standardization (ISO)	ISO is an independent non-government membership organization and the world's largest developer of voluntary international standards. They give world class specifications for products, services, and systems to ensure quality, safety, and efficiency. http://www.iso.org/iso/home.htm a) ISO 45001 Occupational health and safety management systems b) ISO 55001: requirements of an asset management system c) ISO 55002: Useful guidance for applying ISO 55001 d) ISO 55000: Overview, principles, and terminology
3. International Labor Organization (ILO	http://www.ilo.org/global/standards/subjects-covered-by-international-labour-standards/occupational-safety-and-health/lang--en/index.htm
4. International Finance Corporation	IFC Contains the most updated versions of the World Bank Group Environmental, Health and Safety Guidelines (known as the "Health and Safety Guidelines"). The Health and Safety guidelines contain the performance levels and measures that are normally acceptable to IFC, and that are generally considered to be achievable in new facilities at reasonable costs by existing technology. World Bank Group Environmental, Health, and Safety Guidelines (ifc.org) http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines
5. British Standard Institute	BSI is the business standards company that equips business with necessary solutions to turn standards of best practice into habits of excellence. http://www.bsigroup.com/en-AU/Standards/Safety/
6. American National Standards Institute	As the voice of the US standards and conformity assessment system, the American National Standards Institute empowers its members and constituents to strengthen the US marketplace position in the global economy while helping to assure safety and health of consumers and the protection of the environment. ANSI Safety Standards http://webstore.ansi.org/safety_standards/default.aspx?source=ohs



JSW Group

MANAGEMENT STANDARD

Contractor Safety Management

JSW/GHS/GS-03

MANAGEMENT STANDARD Contractor Safety Management

Management Standard Title:	**Contractor Safety Management**	**Date of Revision**	10.12.2024
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Date	Revision Number	Change Summary
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1. PURPOSE

The purpose of this standard is to set out the minimum requirements for health and safety management in contracts for JSW Business Units/Sites. It identifies and describes the activities associated with the management of contractor health and safety within the formal framework of the contract, encompassing the pre-contract award, execution, and post-execution phases.

The objectives of this standard are to:

- Define the minimum health and safety requirements to be met at each stage of the contract.
- Develop a strategy for the proactive management of contractor health and safety.
- Describe a planned approach to managing contractor health and safety that will ensure continual improvement in health and safety performance for all contractor activities and facilities.
- Outline the roles and responsibilities of key personnel in contractor health and safety management.
- Provide means to monitor the implementation of health and safety requirements.
- Provide defined measures to address health and safety non-compliance by contractor companies, including interventions and, if necessary, stopping work or terminating the contract if safety performance does not improve after repeated follow-ups.

This standard is targeted principally at contract administrators at JSW Business Units/Sites and contractor personnel tasked with planning health and safety requirements in contracts, tender preparation and evaluation, contract award, and subsequent contractor management.

All requirements set out in this standard are mandatory, and it is the responsibility of JSW Business Unit/Site senior management to ensure full implementation and that contractors are aware of and compliant with these requirements. Any request for variance shall be formally raised and reviewed by the JSW-approved Contractor Safety Management Sub-Committee and the Group Safety Steering Council.

2. SCOPE

This Standard applies to all JSW companies and subsidiaries, managed Business Units/Sites/Locations, corporate/regional offices, research and development facilities, new projects, merged and acquired entities. This standard is relevant to all JSW company employees, contractors and subcontractors, including those hired for short term or limited duration [1] projects as by Site/Business. Conformance to the requirements in this standard is applicable throughout the entire lifecycle of a Project/Business Unit/Site/Location, including planning, assessment, exploration, evaluation, design, development, operation and closure.

In the Standard, the following verbal forms are used to indicate requirements, recommendations, permissions, or capabilities:

- “shall” indicates a requirement.
- “should” indicates a recommendation.
- “may” indicates a permission.
- “can” indicates a possibility or capability.

3. REVIEW

The standard shall be reviewed at least every 5 years. However, if incidents occur where the root cause is attributable to the contracting process, an additional review may be conducted sooner if deemed necessary. Suggested measures shall be considered to incorporate inputs from Management of Change systems or process findings. If such changes are identified, a brief addendum to the standard shall be prepared, outlining the change and its key requirements.

[1] The Site/Business shall evaluate the nature of projects and define their classification as short-term, long-term, routine, or non-routine.

4. PROCESS FLOW



Figure-1: Contractor Safety Management

5. CONTRACTOR SAFETY MANAGEMENT PHASE

5.1 PHASE-1: PRE-QUALIFICATION

5.1.1 Objectives

The objectives of the Pre-Qualification Phase are:

- **Determine Health and Safety Impacts:** Evaluate the health and safety implications of the project's scope, schedule, and execution strategy.
- **Assess Health and Safety Requirements:** Review and assess the health and safety requirements for each contract.
- **Confirm Suitability:** Ensure the contract scope, schedule, and strategy are suitable and aligned with health and safety standards.
- **Prepare Health and Safety Documents:** Develop and integrate health and safety-related contract documents incorporating applicable requirements based on the scope of work.
- **Identification of Prospective Vendors:** Identify and establish a list of contractors based on their past performance and resource availability.
- **Pre-Qualification of Contractors:** Ensure that contractors meet all pre-qualification criteria, including health and safety standards, before inviting them to bid.

5.1.2 Facilitating Tender Document Sharing and PQA Questionnaire

The commercial team will distribute the tender documents, including the technical scope and the Pre-Qualification Questionnaire (PQA), to selected contractors. Contractors should provide a technical proposal and complete the PQA.

A typical Pre-Qualification Questionnaire includes, but is not limited to:

- Written Health and Safety Policy
- Health and Safety Organization Chart and Job Descriptions
- Written Health and Safety Responsibilities for Resources
- Records of Job-Specific Training for Employees
- Injury Records
- Progressive Consequence Management Record
- Safety Communication Program Availability
- Reward and Recognition System
- Accident/Incident Reporting System
- Risk Assessment Procedures
- Emergency Response Protocols

The PQA baseline should be consistent across businesses. Contractors shall have a minimum CARES score to qualify for entry from one business to another or between units without additional PQA for similar jobs/activities. Existing vendors performing low or medium-risk jobs should not be awarded high-risk jobs/activities without re-assessing PQA.

5.1.3 Cross-Functional Pre-Qualification (CFPQ) Team

Ensure effective pre-qualification and comprehensive integration of health and safety considerations, the Business Unit should establish a Cross-Functional Pre-Qualification (CFPQ) team with the following focus areas:

- **Procurement:** Develop and maintain a pre-qualification process to ensure contractors meet procurement criteria, including health and safety standards.
- **Maintenance:** Address maintenance-related pre-qualification requirements, focusing on health and safety impacts.
- **Operation/Production:** Integrate operational and production requirements into the pre-qualification process, emphasizing safe operational practices.

- **Support Services (OH&S, Human Resources):** Include H&S and Human Resources in the pre-qualification process to ensure compliance with health and safety regulations and support systems.

The CFPQ team is responsible for developing and maintaining these processes, ensuring comprehensive evaluation criteria are in place.

5.1.4 Outline Contractor Scope of Work

The Contract Custodian Manager and Field Contract Administrator (FCA) shall define the contractor's scope of work in sufficient detail to identify major hazards and health and safety impacts. This should include, but not limited to:

- Type of activities and special safety considerations (e.g., industrial hygiene, process safety)
- Major hazards and H&S impacts
- Location of site(s), workplace, and accommodation
- Timing and sequence
- Personnel involved
- Plant and equipment used
- Materials and consumables
- Mode of transport
- Any specific health check-up requirements
- Any Local statutory requirement w.r.t work

Experience from previous projects should be utilized, including but not limited to:

- Contractor's health and safety performance on current JSW Business Unit/Site projects
- Close-out reports from similar projects
- Records of previous health and safety performance
- Similar activities in relevant countries
- Recent health and safety audits
- General background information on planned operations

The scope should include requirements for a health and safety management system and specific tasks with targets and deliverables by the Contractor.

5.1.5 Preliminary Risk Assessment

During the Pre-Qualification Phase, Business Unit should identify and assess the hazards and risks associated with the contractor's scope of work. Update these assessments as needed throughout the process. Refer to the **JSW Hazard Identification and Risk Analysis Standard (JSW/GHS/GS-17)** for guidance.

5.1.6 Contract Schedule and Strategy

Contract Schedule: The contract schedule should be developed with careful consideration of health and safety requirements, particularly allowing sufficient time for mobilization and demobilization. The schedule should highlight health and safety requirements that require special emphasis in later contract phases, such as asbestos management, industrial hygiene, confined space entry, hazardous material handling, emergency response procedures, and any other critical safety protocols identified during project planning.

Contract Strategy: Business Unit should ensure no activity begins without an established and approved contractor health and safety plan. The strategy should be based on the preliminary risk assessment and recorded by the Contract Administrator.

Factors to consider in framing the strategy include but not limited to:

- Number of contracts and interfaces
- Availability of existing contracts
- Contractor and JSW Business Unit/Site resources and skills
- Local environment
- Contract/Project Schedule
- Competitive situation
- Laws and Regulations

The interface between JSW Business Unit/Site and Contractor is an area that needs careful review and clear definition within the contract documents. The following example illustrates the problem.

In manufacturing operations, Contractors utilize JSW owned cranes for material handling across various production sites, it is imperative that:

- The contractor ensures regular maintenance and inspection of the cranes to uphold operational integrity and safety standards.
- Personnel operating the cranes possess verified competency through training and certification programs, ensuring safe and efficient handling of materials.

5.1.7 Risk Management Assurance

The following risk mitigation assurance gate checks shall be made to ensure risks are adequately addressed during the Pre-Qualification Phase:

- **JSW Business/Site Led** - Conduct a preliminary risk assessment for the scope of work.
- **JSW Business/Site Led** - Develop an initial strategy for managing risks and activities related to sourcing.

5.2 PHASE-2: TENDER DOCUMENT PREPARATION/ CONTRACT PREPARATION

5.2.1 Objectives

The objectives of this phase are:

- **Establish Tender Documentation Requirements:** Develop and finalize all tender documents and associated materials for distribution to potential bidders
- **Respond to Bidders/Contractor's Health and Safety Clarification Requests:** Address any questions or clarifications from bidders regarding health and safety.
- **Ensure Compliance and Transparency:** Prepare for an effective and compliant tendering process.

The following sections provide further detail on these activities.

5.2.2 Develop and Issue Tender Documentation

Preparation: FCA in consultation with commercial team and CAM shall create detailed tender documents, including technical specifications, scope of work, and health and safety requirements. These documents should be structured to incorporate both the General Conditions of Contract (GCC) and the Job Contract Conditions (JCC)

Standard Forms: Include necessary standard forms such as the Pre-Qualification Questionnaire (PQA), contract templates, and required certifications.

5.2.3 Establish Communication Protocols

Commercial team should develop following:

- **Bidder Communication:** Set up protocols for interaction with bidders, including methods for submission and clarification procedures.
- **Clarification Procedures:** Establish procedures for handling and responding to requests for clarification from bidders.

5.2.4 Pre-Award Clarification

JSW Business/Site should issue clarification requests to the tenderers when required. A pre-award meeting with each potential contractor should be used to clarify and further assess the suitability of the contractors' health and safety plan and associated documentation.

5.3 PHASE-3: CONTRACT AWARD/ TENDER EVALUATION AND FINALIZATION

The objectives of this phase are:

- **Establish Tender Evaluation Criteria:** Define the criteria to evaluate tenders, ensuring they meet health and safety requirements.

- **Evaluate Bids and Award Contract:** Assess bids based on established criteria and award the contract accordingly.

5.3.1 Contract Award/ Tender Evaluation Criteria

The evaluation criteria cover the specific health and safety requirements for the tender. In this phase, the criteria shall be established to measure the adherence to the health and safety requirements and technical aspects of JSW Business Unit/Site.

Key considerations specific to health and safety plan shall include, but not limited to:

- Assess the overall risks associated with the scope of work, as evaluated by the contractor.
- Evaluate the contractor's ability to deliver the scope of work while managing identified risks, based on an effective health and safety plan, including any bridging or interface requirements.
- Review the contractor's capacity to implement necessary remedial actions to address gaps identified by JSW Business/Site in the contractor's capability assessment. This should be assessed by a team that includes a Field Contract Administrator (FCA), Health and Safety (H&S) Professional, Commercial Team, and Subject Matter Expert (SME).
- Define the scope of the health and safety plan, detailing the hazards to be addressed.
- Identify applicable laws, regulations, health and safety requirements, and JSW Business Unit/Site procedures relevant to the tender.
- Outline the JSW Business/Site and contractor interfaces and supervision strategy.
- Identify and schedule required JSW Business/Site and contractor training.

Define the minimum health and safety mobilization requirements. If any special health and safety provisions are to be included in the tender documentation, the Field Contract Administrator (FCA) shall ensure these requirements are clearly communicated to the bidders within the specification.

The Contract Custodian Manager (CCM) and the Field Contract Administrator, in collaboration with the Subject Matter Expert (SME), should establish evaluation criteria for the technical aspects.

During the contract award (Tender Evaluation and Finalization phase), the FCA and Commercial Team will assess each contractor's submission against JSW Group/Business/Site criteria and requirements. The evaluation process will include:

5.3.1.1 Submission Assessment

- Reviewing each bid for compliance with specified criteria, including health and safety requirements outlined in the JSW Contractor Pre-Qualification Questionnaire (PQA) (Annexure – 3).
- Tailoring the PQA questionnaire to the complexity/criticality of the scope of work, with approval from the Contractor Safety Management (CSM) Subcommittee.
- Job Risk and Benchmark Scores – Classify the job risk as High, Medium or Low
- Benchmark Scores are as follows:

Job Risk Category	Benchmark Score	Contractor Safety Management Criteria
High Risk Jobs	85% and above	Comprehensive health and safety plan Adherence to ISO 45001 or equivalent Competent workforce Low incident record Detailed emergency plans Never blacklisted from JSW Group of Companies
Medium Risk Jobs	Between 61% and 84%	Adequate risk assessments Basic safety protocols in place Qualified workforce

Job Risk Category	Benchmark Score	Contractor Safety Management Criteria
		Incident record review Emergency procedures defined
Low Risk Jobs	Less than 60%	Unacceptable safety management practices Immediate corrective actions required Failure to meet even basic safety standards Reevaluation post-correction
High Risk, Medium Risk and Low Risk Jobs are classified in Annexure-5		

5.3.1.2 Gap Analysis and Action Plan

The Purpose of Gap Analysis and Action Plan is to establish a pathway for contractors to address safety deficiencies, ensuring they meet the requires standards before contract award.

Initial Pre-Qualification Assessment: **Contractor Scoring below 60% -**

- Scores below 60% are deemed unacceptable.
- These contractors are disqualified from the current bidding process and will not proceed further.
- Contractors may reapply in future opportunities after addressing deficiencies independently.

Contractor Scoring between 60% and the benchmark (Between 61% to 84%) –

These contractors are eligible for further review and improvement through a gap analysis.

Gap analysis shall be conducted by Field Contract Administrator for contractors scoring within the acceptable improvement range. FCA shall identify specific gaps in safety practices, procedures, or qualifications that caused the lower score.

Action Plan Development for Contractors eligible for improvement, an action plan shall be created, outlining clear steps and deadlines to address deficiencies.

The plan shall include defined metrics to meet the benchmark for the applicable risk category.

The action plan shall be approved by the site safety team. Contractors should implement the corrective measures within six months.

A follow-up pre-qualification assessment will only occur if the contractor demonstrates substantial progress and compliance with the action plan.

5.3.1.3 Evaluation Method

- Conduct initial checks to determine if the contractor is pre-approved by the Business/Site Contractor Safety Management (CSM) subcommittee. If approved, the FCA proceeds with technical evaluation.
- For non-approved contractors, verify the submission of a completed PQA. If available, evaluate the PQA score against established baseline criteria.

5.3.1.4 Guidance and Compliance

- FCA assisting contractors in completing missing or incomplete PQAs to ensure compliance with health and safety requirements.

5.3.1.5 PQA Exemption

Certain contractors or bids may be exempt from specific health and safety requirements under predefined conditions. This exemption should be justified and documented by the Field Contract Administrator (FCA) and approved by the Contractor Safety Management Subcommittee. Exemptions may apply but not limited to:

Housekeeping outside main plant.

- Courier Services
- Incoming material transport contractors (excluding compressed gas cylinders)
- Expert Services
- Consultant and Class room training persons
- Contractor hires under CSR activities
- Government Auditors
- IT related repairing services
- Grocery Suppliers
- Gift Suppliers
- Medical Services including calibration of medical instruments.
- On site/Off site vehicle repairing
- Horticulture services outside main plant
- Fly ash transporter, where the buyer appoints the transporter.
- Local contractor recommended by the Plant Head/ Head Thermal
- Dog Handling Services
- On demand vehicle
- Lignite survey agency/contracts
- Auditors (IMS, Others)

5.3.1.6 Decision Making

- Inform the CSM subcommittee and Commercial Team if a contractor declines to complete the PQA, resulting in bid rejection.

5.3.1.7 Technical Evaluation and Approval

- Proceeding with technical evaluation for bids that meet or exceed baseline PQA criteria.
- Submitting the technical evaluation results to the Contract Custodian Manager (CCM), CSM Chairman/Convener, and Contract Administrator Manager (CAM) for final approval.

5.3.2 Tender Response Preparation

The contractor shall provide all requested information and pertinent documentation that demonstrates compliance to JSW Group's evaluation criteria.

5.3.3 Contract Award

The commercial team will finalize the tender, based on Technical, H&S & Commercial Considerations, and release the Purchase Order to the finalized Contractor, so that they can render their services to the company.

5.3.4 Risk Management in Tender Evaluation and Finalization Phase

The following risk mitigation assurance "gate checks" shall be made to ensure the risk-based approach has been adequately captured in the Tender and Award Phase of the contracting process before proceeding to the Contractor orientation and training Phase:

- **JSW Business Unit/Site** – Defining Approved and Non approved contractor as per PQA evaluation.
- **JSW Business Unit/Site –** Establishing risk-based health and safety contract specifications.
- **Contractor** – Develop and submit a bid which is conformant with JSW group requirements.
- **JSW Business Unit/Site** -Tender evaluation process and award of contract.

5.4 PHASE-4: CONTRACTOR ORIENTATION AND TRAINING

5.4.1 Objectives

The objectives of this phase are:

- **Hold a Kick-off Meeting:** Facilitate a kick-off meeting to establish effective communication and alignment on health and safety priorities.
- **Conduct a Risk Assessment:** Perform a comprehensive risk assessment and review risk controls between the JSW Business Unit/Site and the contractor.
- **Set Subcontractor Management Protocols:** Establish clear principles and protocols for managing subcontractors, where applicable.
- **Conduct a Readiness Review:** Ensure that all necessary preparations for mobilization are complete.
- **Verify Submissions:** The contractor representative shall submit a verified list of employees/personnel aligned with human resource requirements, along with the necessary tools, equipment, and consumables, to the Contract Custodian Manager.
- **Verify Medical Fitness:** Ensure all personnel have the required medical fitness for work.
- **Provide Safety Induction and Training:** Conduct safety induction and other necessary training for all personnel.
- **Begin Mobilization:** Commence mobilization once all requirements are met.

5.4.2 Kick-Off Meeting

A kick-off meeting focused on health and safety shall be held with the contractor immediately after contract award and before any work begins. For new contractors, the kick-off process should involve both the JSW Business/Site Contract Administrator and the contractor's local management.

If the contractor is mobilizing directly at the worksite, the kick-off meeting can be held on-site. If not, the initial kick-off may need to take place at the contractor's base office, authorizing the mobilization of key personnel to the site. A follow-up local kick-off meeting should then be held immediately before work starts.

The JSW Business Unit/Site Field Contract Administrator (FCA) is responsible for establishing clear communication protocols and ensuring that the contractor’s workforce and supervisors are aware of the following, at a minimum:

- Site hazards of the operation detailed in the scope of work,
- Site-specific hazards associated with the scope of work.
- Health and safety requirements, procedures, and relevant regulations.
- Emergency response protocols and incident reporting procedures.
- Competency requirements for personnel and supervisors.
- Health and safety management for subcontractors.
- Review and implementation of the Contractor's Health and Safety Plan and Welfare Management Plan.
- Execution of JSW Group’s contractor health and safety performance management standards.

5.4.3 Risk Assessment and Review of Control

A risk assessment shall be performed early in the pre-mobilization phase and should incorporate findings from the Preliminary risk assessment done by JSW Business Unit/Site during the planning phase. FCA should provide preliminary risk assessment to contractor to further perform detailed risk assessment. Any recommendations that arise from the risk assessment exercise shall be tracked by JSW and Contractor and closed prior to mobilization.

5.4.4 Pre- Mobilization Audit

At this stage, FCA in consultation with Site Health and Safety representative should conduct an audit to verify the compliance to the health and safety requirements utilizing the guidance checklist (refer to Annexure 7) and confirm Contractor's readiness for mobilization. The audit may provide findings to capture in an update to the health and safety plan, related to risks and recommendations.

5.4.5 Review and Finalize Contractor Health and Safety Plan

Contractor shall prepare the Health and Safety Plan for the complete scope of work and obtain approval from JSW Business Unit/Site Field Contract Administrator prior to mobilization. The resources required at this stage should not be underestimated where health and safety aspects are to be covered as applicable.

5.4.6 Subcontractor Management

The Contractor shall inform JSW Business Unit/Site during the tender period if they wish to hire Subcontractors for the execution of the contract. The Contractor shall only hire Subcontractor(s) who are already pre-qualified with JSW Business Unit/Site JSW Business Unit/Site should identify and compile a list of approved subcontractors who are pre-qualified, maintaining their prequalification scores as per the baseline criteria."

Contractor shall be fully responsible and accountable for the health and safety performance of their Subcontractors, and ensure Subcontractors deliver their scope in compliance with JSW Group health, safety, requirements.

5.4.7 Resource Mobilization and Personnel Management

The contractor representative shall submit the list of employees/personnel, along with the tools, tackles, and consumables required, to the Field Contract Administrator. Upon approval from the Field Contract Administrator, the contractor representative shall upload the personnel details to initiate the "gate entry" process. The HR representative shall validate and verify all relevant supporting documents and evidence for each personnel seeking gate entry, according to HR guidelines.

5.4.8 Medical Fitness/ Fitness to Work

Contractor shall ensure that all personnel engaged in the work are medically fit for the job to be undertaken. Even if the health screening is in JSW scope, contractors need to do a check on conditions like general health and epilepsy before deployment of workmen.

Contractor shall be able to demonstrate that personnel, selected for positions for which Fitness to Work medical evaluation is required, if in the opinion of JSW Business Unit/Site and reflected in relevant medical report, any personnel are not medically fit to work, then JSW Business Unit/Site reserves the right to refuse permission for those personnel.

5.4.9 Safety Induction Training

All contractor employees shall be knowledgeable about the various risks and hazards associated with JSW site-specific operations. The training program addresses essential topics across four levels, tailored to the job scope: awareness, detailed and comprehensive, advanced, and information communication, with each level reflecting the required depth of information.

5.4.9.1 Site Specific Induction Training Program

This mandatory safety induction training for all contractor personnel aims to ensure awareness of JSW's basic safety rules, including emergency procedures. The training duration will comply with legal, statutory, and site safety requirements. Validation will be carried out through written and/or verbal assessments using models, images, photographs, examples of unsafe acts/conditions, PPE demonstrations, safety signage, and best practices. For optimal effectiveness, batch sizes should not exceed 20 participants. The HSE departments will maintain attendance and training records for plants and mines, respectively.

Refresher induction training will be conducted as required by legal or statutory regulations or at the discretion of the Contractor Safety Subcommittee chairman, who may also adjust the frequency if needed. The course content will focus on site-specific basic safety rules relevant to contractors. Topics covered in the site safety orientation training will include, but are not limited to:

- Basic information about site facilities and areas

- JSW Safety Policy and commitment to safety
- General site information, including site-wide procedures and rules
- Area/task-specific details, including site conditions and any special considerations
- Personal safety and conduct guidelines
- Meaning of signs and warnings
- Proper use of PPE (JSW/GHS/GS-05)
- Housekeeping practices
- Reporting workplace hazards, substandard acts, and conditions
- Reporting injuries and near misses
- Emergency procedures
- Overview of applicable JSW Group safety standards
- Safety activities and programs, including disciplinary measures and incentives

5.4.9.2 Site-Specific Safety Procedures/Rules Training for Supervisors

This mandatory safety training is specifically designed for contractor supervisors and tailored to include at least a one-day module or as required by business-specific needs. Organized monthly by the safety department with approval from the Rules and Procedures Subcommittee, the number of sessions may vary based on nominations. The typical module covers, but is not limited to, the following topics:

- Review of site-specific basic safety rules, critical safety rules, and activities
- Legal requirements related to Health, Safety, and Environment (HSE)
- Work permit procedures (PTW, JSW/GHS/GS-08)
- Risk assessment techniques
- PPE: selection, use, maintenance, and replacement (JSW/GHS/GS-05)
- Incident reporting and investigation procedures
- Emergency and evacuation protocols
- Practical demonstrations, including fire extinguisher use, hose handling, SCBA operation, and case studies as needed

5.4.9.3 Job-Specific Toolbox Talks

Contractor job supervisors are responsible for conducting toolbox talks with their working crews to raise awareness about site-specific, department-specific, and job-specific risks, as well as necessary precautions. This method effectively provides on-the-job training and communicates hazard information. Toolbox talks should be categorized as follows:

5.4.9.4 Periodic Toolbox (Theme-Based) Talks

Organized weekly on common and trade-specific safety topics. Supervisors ensure all workforce members are uniformly covered on all topics, and attendance records should be maintained for each session.

5.4.9.5 Job-Specific Toolbox Talks

Conducted before the start of each job, supervisors explain job-specific safety risks and precautions to the crew in a clear and understandable manner. Records of these talks should be maintained.

In addition to the above:

- Contractors are required to submit a PowerPoint presentation or video of their safety induction and obtain approval from JSW Group before distribution.
- ID cards shall be issued to workmen. If this is not within JSW Group's scope, contractors should issue ID cards with recent photographs, including emergency contact numbers and blood group.

5.4.10 Commence Mobilization

Field Contract Administrator shall ensure that contractor initiate mobilization according to the approved health and safety plan and that contractor is fully aware that accountability for Subcontractors health and safety is a sole ownership of the Contractor.

5.4.11 Risk Management in Contractor Orientation and Training Phase

The following risk mitigation assurance “gate checks” shall be made to ensure the risk-based approach has been adequately captured in the contractor orientation and training phase of the contracting process before proceeding to the contractor work coordination and auditing phase:

- **JSW Business Unit/Site and Contractor jointly** – Conduct a kickoff meeting.
- **Contractor –** Finalize Health and Safety plan.
- **JSW Business Unit/Site –** Approve health and safety plan.
- **JSW Business Unit/Site –** Conduct Pre-mobilization audit.
- **JSW Business Unit/Site –** Review and approve all required contract documentation.
- **JSW Business Unit/Site –** conduct a readiness to mobilize review.
- **JSW Business Unit/Site –** Review and finalize Contractor’s Health and Safety Plan
- **JSW Business Unit/Site and Contractor -** Carry out health and safety induction/other training (As required).

5.5 Phase-5: Managing the Work (Contractor Work Coordination and Audit)

The objectives of this phase are:

- **Engagement and Commitment:** Ensure that leadership and line management are actively engaged and committed to health and safety issues.
- **Policy Reinforcement**: Reinforce health and safety policies, goals, and targets.
- **Resource Provision**: Allocate adequate resources, including competent personnel and training programs.
- **Risk Assessment**: Perform activities with proper risk assessments and implement effective control measures.
- **Toolbox Meetings**: Conduct daily toolbox meetings and regular health and safety meetings.
- **Monitoring**: Continuously monitor the quality, condition, and integrity of plant, equipment, and tools.
- **Emergency Preparedness**: Develop and implement Emergency Response Plans and conduct regular exercises and drills.
- **Incident Management**: Report, record, investigate, and follow up on all incidents and non-compliances.
- **Audit Trail**: Maintain a thorough audit trail with follow-up and close-out of action items.
- **Health and Safety Inspections**: Conduct regular health and safety inspections, audits, and reviews of the contractor's activities, including the contractor’s internal health and safety control system for subcontractors.
- **Health and Safety Assurance Program**: Implement the Health and Safety Assurance Program or Health and Safety Plan, as applicable.

5.5.1 JSW Safety Management Standards and Critical Safety Rules

All personnel engaged in the work shall be familiar with and always comply with the applicable JSW Safety Management Standards. If any part of the work is not covered by these standards, or if the relevant standards are deemed insufficient or unclear for a specific activity, the Contractor shall immediately inform JSW of the missing or inadequate requirements. JSW and the Contractor will then collaboratively develop and agree on additional or revised safety management standards to mitigate and reduce the risk associated with that part of the work to ALARP (As Low as Reasonably Practicable).

All personnel shall also be familiar with and adhere to the JSW Critical Safety Rules. If personnel are visiting or working on a JSW worksite, they shall always comply with these Critical Safety Rules.

5.5.2 Application of Health and Safety Performance Management Mechanism

The Contractor Field Safety Audit (CFSA) is a program focused on ensuring contractor compliance with the established rules, standards, and procedures of JSW Group sites. The CFSA is to be conducted by the FCA and may include the Contractor's safety supervisor.

The CFSA provides the contractor's team with insights into their current level of compliance with safety standards, enabling them to make corrections as needed, ensuring that no safety violations occur at any time.

Major Benefits of Field Audits:

- Raise safety awareness among contract workers
- Prevent injuries and property damage
- Verify understanding and compliance with standards and contractual agreements
- Identify weaknesses in safety systems
- Assess contractor performance and quantify results
- Identify and correct unsafe conditions
- Provide continuous improvement data through leading indicators from regular weekly audits

The Contractor Field Safety Audit (CFSA) tracks key information, including the description of the violation, the contractor's name, the designation of "Good Citizens" and "Violators," the number of violations, and the severity of each violation. Severity is measured on a scale from 1 to 5, where Severity 1 represents minor issues, and Severity 5 represents imminent danger.

- **Severity 1**: Minor issues, such as an untidy work area or trash on the ground, that do not meet expectations but pose minimal risk.
- **Severity 2**: Moderate issues, such as rubbish blocking access or excessive accumulation of trash, which may cause inconvenience but do not pose immediate danger.
- **Severity 3**: Violations of rules or procedures that do not immediately lead to major hazards but should still be addressed to prevent escalation.
- **Severity 4**: Serious hazards that present imminent danger of causing serious injury, even if a person is not currently at risk. These situations shall be addressed urgently.
- **Severity 5**: Imminent danger that requires immediate corrective action to prevent serious injuries or fatalities, such as a worker at height without fall protection. Work should be stopped immediately until the hazard is rectified.

$$\textbf{Severity Index} = \sum \frac{Violation * Severity}{Total\ Number\ of\ Violations}$$

World Class sites have severity index varying between 0.8 to 1.5.

5.5.2.1 CFSA Frequency

Type of Contract based on Risk identified (As per Annexure- 5)	CFSA Frequency
High Risk (Category-1)	Weekly- At least-one, Preferable two
Medium Risk (Category-2)	Fortnightly
Low Risk (Category-3)	Monthly

Audit Report: The CFSA report for the site shall be prepared based on the risk-based frequency outlined in the CFSA frequency table (High Risk: Weekly, Medium Risk: Fortnightly, Low Risk: Monthly) to ensure continuous monitoring of contractor safety. Furthermore, all contractors shall undergo an assessment every six-month based on the JSW CARES (Contractor Assessment and Rating for Excellence in Safety) program. Based on the results of the assessment (STAR Rating), areas for improvement should be identified, and the Contract Custodian Manager shall initiate the necessary corrective and preventive actions.

Contract Termination or Penalties: The Apex Committee has the authority to terminate the contract or impose monetary penalties if the contractor's safety performance fails to improve despite repeated follow-ups. These conditions will be clearly outlined in the contract and will be binding on the contractor.

5.5.3 Competence Assurance

During the execution of the work, the JSW Business Unit/Site shall monitor the contractor's competence assurance and training programs to ensure they meet the requirements outlined in the Health and Safety Plan. The process should incorporate skill assessments to verify that workers possess necessary capabilities to perform their tasks safely and effectively. If necessary, the JSW Business Unit/Site shall identify any additional needs arising from local conditions. The monitoring process shall include verifying the contractor's commitment to the following:

- Maintaining an H&S Training Matrix that covers all workers and the risks associated with their specific activities.
- Providing training in accordance with the risk matrix and properly recording the training.
- Adhering to the contractor's personnel recruitment criteria.
- Demonstrating the qualifications, abilities, and skills of personnel.
- Providing the necessary induction program for all workers.
- Training personnel in the standards and procedures to be followed.
- Ensuring the completion of health, safety, and job-related training.
- Ensuring the availability of health and safety documents, instructions, information leaflets, and newsletters, with particular attention to the use of local languages and clear visual messages.

5.5.4 Health and Safety Administration

- Assigning a dedicated safety personnel at each site is optimal but may not always be feasible for roles with fewer employees or involving low-risk tasks.
- Regardless of workforce size, roles categorized as high risk from the Preliminary risk assessment, such contractors should always have a dedicated safety professional assigned.

The following table outlines staffing requirements for roles categorized as medium or high-risk.

Number of Site staff (including workmen)	Nature of Job risk	Minimum H&S manpower	Minimum requirements of competency
Staff ≤ 10	Low	1. Safety coordinator – not required. 2. Trained & Certified first aider & fire warden – 1 no. each	1. Contractor Supervisor can also act as one Safety coordinator. 2. Certification from 3rd party for first aid and fire-fighting training
Staff < 10	Medium / High	1. Safety Professional– not required. 2. Trained & Certified first aider and fire warden - 1 no. each	Dedicated safety professional with minimum of 5 years' experience holding at least diploma / graduation in general academics and a professional safety diploma from a govt. recognize institute.
Staff 11 – 50	Low	1. Safety Professional– 1no. dedicated 2. Trained & Certified first aider and fire warden - 1 no. each for every 10 people	Dedicated safety professional with minimum of 3 years' experience holding at least diploma / graduation in general academics and a professional safety diploma from a govt. recognize institute.
Staff 11 - 100	Medium / High	1. Safety Professional– 2no. dedicated 2. Trained & Certified first aider and fire warden - 1 no. each for every 10 people	Dedicated safety professional with minimum of 5 years' experience holding at least diploma / graduation in general academics and a professional safety diploma from a govt. recognize institute.

Number of Site staff (including workmen)	Nature of Job risk	Minimum H&S manpower	Minimum requirements of competency
Staff 100+	Low / Medium / High	Safety Professional– 1no. dedicated as head. One additional safety professional for every 50 staff Trained & Certified first aider and fire warden - 1 no. each for every 10 people	For Head - Dedicated safety professional with minimum of 10 years' experience holding at least diploma / graduation in general academics and a professional safety diploma from a govt. recognize institute. For assistance – minimum 5 years' experience is a must.
Construction Projects	Low / Medium / High	As per the conditions of contract. If there is nothing specific in contract, the following to be complied. Safety Professional– 1no. dedicated as head. Upto 50 workers - One safety steward 51 to 100 workers - 01 number of additional safety steward every 50 workers 101- 500 workers – 01 number of additional safety steward every 100 workers > 501 workers – 01 number of additional safety steward every 150 workers and 01 Safety supervisor for every 500 workers Trained & Certified first aider and fire warden - 1 no. each for every 25 workers	For Head - Dedicated safety professional with minimum of 10 years' experience holding at least diploma / graduation in general academics and a professional safety diploma from a govt. recognize institute. For assistance – minimum 5 years' experience is a must.

5.5.5 H&S Committee

- Every contractor is expected to form a safety committee specific to the plant with nominations from all their staff including their workmen, for reviewing their safety performance.
- H&S committee shall meet at least once in a month and the meeting shall be chaired by contractor owner / Site in-charge to discuss the safety issues and the safety performance.
- Minutes of the meeting is recorded, documented and corrective / preventive actions are followed up and closed.

5.5.6 Reporting of Incidents

Contractors shall ensure the following:

- Prompt reporting of all incidents to JSW within the shift or within 24 hours, followed by recording and thorough investigation.
- Encouragement, recording, and investigation of near misses.
- Cascading of the incident reporting procedure to staff and workmen during safety induction sessions.

5.5.7 Investigation and Communication of Lesson Learnt

Contractors are responsible for ensuring the following:

- Conducting thorough incident investigations and maintaining records, employing effective methods such as why-why analysis for comprehensive analysis.
- Investigating near misses and disseminating findings to all personnel through toolbox talks.
- Promptly implementing and documenting recommendations from incident investigations.

5.5.8 Monthly Reporting

- All contractors should report their safety statistics and performance on monthly basis to JSW.
- The statistics should include manhours worked, details of incidents like first aid cases, LTIs, Safety inspections conducted, etc.,
- Contractors shall use their own reporting format or JSW monthly reporting template which shall be provided if required post award of the contract.

5.6 PHASE-6: FINAL CONTRACT EVALUATION (JSW CARES)

In this phase, the focus is on the final evaluation of health and safety performance and ensuring all health and safety activities are completed effectively. The Contractor's Health and Safety Plan remains the primary tool for monitoring these activities. Key focus areas include:

- **Continuous Monitoring:** Ongoing compliance with health, safety, and welfare requirements.
- **Waste Management:** Proper management and disposal of waste.
- **Action Close-Out:** Resolution of all outstanding health and safety actions.
- **Site Restoration:** Restoration of the site to its original or an agreed-upon condition.
  Please Refer Annexure-4, for more guidance.

5.6.1 Contract Close-Out Report

The JSW Business Unit/Site Field Contract Administrator, supported by HSE representatives, shall prepare a Contract Close-Out Report. This report will be provided to the Contract Award Manager (CAM), Contract Custodian Manager (CCM), Contractor Safety Management (CSM) Subcommittee, and the commercial team.

The report will include:

- **Details from Factual Documentation:** Comprehensive documentation collected throughout the contract duration.
- **Effectiveness Assessment:** An evaluation of the effectiveness of the Contractor’s Health and Safety Plan.
- **KPI Performance:** Highlights of how health and safety issues were managed based on Key Performance Indicators (KPIs).
- **Hazard and Risk Assessment:** Incorporation of any new hazards, effects, impacts, and threats identified into the risk assessment and management process for future contracts.
- **Unanticipated Issues:** Identification of areas not anticipated in the plan, how these issues were addressed, and recommendations for future approaches.
- **Positive Aspects:** Highlighting successful aspects that should be utilized in future projects.
- **Significant Incidents:** Summary of significant incidents and High Potential Outcomes (HIPOs).

5.6.2 Health and Safety Performance Evaluation

The health and safety performance of each contractor, as documented in the close-out report, will be considered for future contract awards. This evaluation helps ensure that only contractors with a proven track record of effective health and safety management are considered for future projects.

6. REWARD, RECOGNITION, AND PROGRESSIVE CONSEQUENCE MANAGEMENT

Reward & Recognition:

Business Units or Sites should actively encourage contract workers to adhere to health and safety requirements and promptly report near-misses. To support this, units should implement reward and recognition initiatives that align with the Group's directives.

PCM (Progressive Consequence Management):

Units or business units should apply the existing Group Progressive Consequence Management (PCM) document to address non-compliance and safety issues. Additionally, they may develop and implement unit-specific or business-specific corrective action frameworks as needed.

7. EMERGENCY RESPONSE AND PLANNING

JSW Site shall prepare and maintain a comprehensive emergency response plan specific to contractor safety management. This plan shall address potential risks and hazards associated with contractor activities and include:

- **Accidents or injuries** resulting from unsafe practices by contractors.
- **Hazardous material spills or releases** during contractor operations.
- **Fires, explosions, or equipment malfunctions** during contractor-managed tasks.
- **Falls from height or scaffold collapses** involving contractor personnel.
- **Confined space incidents** involving contractor workers.

8. TRAINING

To ensure that SCA (Site Contract Administrator), FCA (Field Contract Administrator), relevant line managers, contractor site in-charges, managers, supervisors, and other personnel can safely and effectively perform their responsibilities in alignment with this standard, it is crucial that they are adequately trained and skilled.

8.1 TRAINING CONTENT

Training for all relevant employees shall cover the following key areas:

- **Requirements of the Standard:** Understanding the specific requirements and expectations outlined in this standard.
- **Risk Assessment:** Conducting thorough risk assessments of jobs or projects to ensure the selection of suitable and competent contractors.
- **Contract Evaluation Process:** Learning the procedures for evaluating contracts effectively.
- **Contractor Field Safety Audit (CFSA):** Understanding the CFSA process, including recording findings, performing meaningful analysis, and taking corrective actions.

8.2 AUTHORIZATION AND CFSA TRAINING

Employees authorized to conduct CFSA and implement corrective actions shall receive additional, specialized training. This training ensures that they can identify risks accurately and implement effective measures to mitigate those risks.

8.3 TRAINING RECORDS

Business Unit/Site shall maintain detailed training records for each employee, including:

- Employee’s name
- Training date
- Training content covered

8.4 RETRAINING REQUIREMENTS

Retraining shall be provided under the following circumstances:

- **Changes in CSM Process**: When there are updates or changes in the Contract Safety Management (CSM) Process that impact the contracting process and monitoring systems.
- **Observations or Incidents:** Following observations, incidents, or audits that indicate a lack of understanding or compliance with this standard.
- **Periodic Retraining:** At least once every three years following the initial training.

9. MANAGEMENT OF RECORDS

Records to be maintained by the concerned department are as follows:

- Documentation of contractor evaluations, including safety performance, certifications, and compliance with legal and regulatory requirements.
- Signed agreements outlining the contractor's responsibility to adhere to the organization’s safety standards and policies.
- Records of safety inductions, orientations, and specific training provided to contractors before starting work.
- Completed safety checklists and inspection records for contractor activities, including observations and corrective actions taken.
- Documentation of all incidents, near-misses, or accidents involving contractors, including root cause analysis and corrective actions implemented.
- Records of contractor safety performance evaluations, including regular audits, inspections, and compliance checks.
- All records related to contractor safety management should be retained for a minimum of five years or as per organizational policy and legal requirements.

10. LEGAL AND OTHER REQUIREMENTS

JSW site shall access, identify, evaluate, and keep up to date the Contractor Safety Management requirement as per prevailing law in operation.

11. RACI MATRIX

Contract Phases	Activity	Techno Commercial	Contract Administrator Manager	Contract Custodian Manager	Field Contract Administrator	Site EHS Team	HR	Contractor	CSM Subcommittee
Prequalification	Outline Contractor Scope of Work	I	I	A	R	C	I		_
	Preliminary Risk Assessment	I	I	A	R	C	C		
	Development of Contract Schedule and Strategy	A	I	R	R	C	I		
	Identification of Prospective Vendors	A	I	R	R	C	C		
	Facilitating tender document sharing and PQA Questionnaire	A	I	R	R	C	I	I	I
Tender Document Preparation/ Contract Preparation and Evaluation	Tender Response Preparation	R	I	I	I	C	I	A	
	Pre award clarification	A	I	R	R	C		I	
	Tender Evaluation	R	I	A	R	C	C	I	I
	Contract Award	A	I	R	R	C	I	I	I
Contractor Orientation and Training	Kick off meeting	A	I	R	R	I	I	R	I
	Risk Assessment and Review of Control	I	I	R	R	C	I	A	I

	Subcontractor Management	I	I	I	I	I	I	A	I
	Resource Mobilization	I	I	R	R	C	R	A	I
	Medical Fitness to work	I	I	I	R	C	C	A	I
	Safety Induction training	I	I	R	R	C	C	A	I
	Review and Approve Contractor H&S Plan	I	I	A	A	C	I	R	I
	Commence Mobilization	I	I	I	R	C	I	A	I
Contractor Work Coordination and Auditing	Conduct CFSA		I	I	A	C	C	A	I
	Ensure Safe Execution of work as per H&S Plan		I	R	R	C	C	A	I
Final Contract Evaluation	Management of demobilization activities	I	R	A	R	C	C	I	
	H&S Performance evaluation report	I	I	A	R	C	C	I	

Note:

R = Responsible — expected to participate in the activity and contribute the best of his/her abilities
A = Accountable — ultimately responsible for the results
C = Consulted — contributes towards decision making
I = Informed — kept informed but need not participate in the effort.

12. KEY PERFORMANCE INDICATOR

JSW Business Unit/Site should develop their Key Performance Indicators (KPIs) based on local requirements to ensure compliance with standard requirements.

13. ASSURANCE

Each site shall conduct self-assurance program to ensure compliance with this STANDARD as part of its Safety assurance program. Third party system audit shall be conducted by Group Safety or external consultants to ensure compliance with the standard.

14. DEFINITIONS

TERMS	DESCRIPTION
ALARP	As Low as Reasonably Practicable - Means to reduce a risk to a level, which is as low as reasonably practicable and involves balancing reduction in risk against the time, trouble, difficulty and cost of achieving it. This level represents the point, objectively assessed, at which the time, trouble, difficulty and cost of further reduction measures becomes unreasonably disproportionate to the additional risk reduction obtained
Approved Contractor	A contractor who has submitted a pre-qualification questionnaire and who has scored "at or above" the baseline score set by the respective plants CSM Sub-Committee to qualify to provide services.
Assurance Gate Checks	The “assurance gate check” placed at the end of each phase stage is only for double-checking to confirm that risk aspects for the phase have been adequately covered. The “assurance gate check” is not a milestone requirement nor a decision to progress from one phase to the next one.
Bid	A response to a Request for Quotation (RFQ) or Request for Tender (RFT)
Bid Clarification Meeting	A meeting between representatives from JSW Business Site and an approved bidder to discuss and review details regarding the bid package with respect to safety and relevant technical standards and expectations for the contracted work. Safety roles and responsibilities, safety procedures, safety equipment, special safety precautions and all other safety expectations of sites regarding the services to be provided by the approved bidder shall be discussed at this meeting. This meeting shall be convened, before the commercial bid from the approved bidder is accepted.
Bid Package	Complete set of documents (e.g., drawings, specifications, scope, site conditions, safety requirement, commercial documents, Legal requirements, special conditions, general conditions, and applicable site procedures) prepared by or for JSW GROUP Sites on which the contractor bases its bid.
Bidder	An entity that submits the Bid in response to an RFQ or RFT or any other form of invitation extended by JSW Group.
CARES	Contractor Assessment and Rating for Excellence in Safety
Contract	It is an agreement between parties as agreed by both the parties which are enforced by law. It is a legally binding agreement.
Contract Administrator Manager CAM	The person whom JSW holds accountable for the overall direction and coordination of all contracting activity at a site. Generally, this is the Plant Head who approves supply / service purchase requisitions submitted by Head of Department / Section and coordinate with Head, Site Purchase / Materials department for release of order and ensure safe accomplishment of job/s. However, for larger plants, Plant head shall nominate other senior staff as Contract Administrator Manager.

TERMS	DESCRIPTION
Contract Custodian Manager CCM	The CCM (appointed by the CAM) is primarily responsible for ensuring the Contractor complies with all OH&S obligations which have been agreed in the contract. Generally Departmental heads are the CCM of the contracts awarded within their functional areas.
Contractor	A party to a Contract with a member of the JSW Group for the provision of service and performance of works. The term “Contractor” as used in the JSW Group Contracts Procedure is synonymous with the terms “Consultant” and “Service Provider”
Contractor Field Safety Audit	An audit performed on contractors by the FCA and their team of execution staff at a frequency based on the risk level of the contractor (High Risk: Weekly, Medium Risk: Fortnightly, Low Risk: Monthly). The Plant Apex Committee shall devise a customized CFSA checklist tailored to the safety maturity level of the plant. The audit evaluates the contractor's adherence to safety standards, and the overall compliance score shall be expressed as a percentage.
Contractor HSE Performance Management Mechanism	A binding document between JSW Group and Contractors that is intended to measure and monitor Contractors HSE performance during the execution phase
Contractor HSE Plan	A Contractor's proposal as to how he intends to implement the HSE requirements as outlined initially by the JSW Group. For the selected Contractor, this becomes the plan on which the HSE terms in the contract are based
Contractor Representative	The person appointed in writing by the Contract Manager to supervise the execution of the contract activities
Contractor Site Representative	The person appointed in writing by the Contract Manager to assist the Contractor Representative in supervising the execution of the contract activities on a given site
EPC	Engineering Procurement and Construction
Field Contract Administrator	A line person, generally Section In-charge, who serves as the primary liaison with contractor personnel while on-site work is in progress
General Conditions of Contract	Outline the standardized terms and conditions that apply to all contractors, ensuring consistency and adherence to organizational policies.
H&S Critical Activities	Activities that are important in preventing events with potential to cause serious harm to people, the environment or property or which can reduce the impact of such an event
Hazard	Any substance, physical effect, or condition with potential to harm people, property or the environment or adversely affect company reputation
HIPOs	High Potential Outcomes
HIRA	Hazard Identification and Risk Assessment
HR	Human Resources
JSA	Job Safety Analysis
Job Contract Conditions	Specify the project-specific terms, including tailored health and safety requirements, technical specifications, risk assessments, and any unique obligations pertinent to the scope of work.
LTIs	Lost Time Injuries
PCM	Progressive Consequence Management
Pre- Mobilization meeting	A meeting between the selected contractor and JSW before the contractor mobilizes their work force and equipment to execute the job specified in the contract
Pre-Qualification Assessment	A process to assess and approve a contractor indicating suitability to perform the task based on Health & Safety policies, procedures, capabilities, resources and past performance – incident data, legal compliances, and reputation.
Procurement	Term used to cover the whole cycle of activities, which need to be performed to acquire and deliver to a user an item of material or a service, from conception of the need through design, purchasing, storage and delivery to ultimate disposal

TERMS	DESCRIPTION
SCA	Site Contract Administrator
SCBA	Self-Contained Breathing Apparatus
Scope of Work	The description of work with established parameters of the work required to achieve the objectives of a project or activity

15. ANNEXURES

15.1 ANNEXURE -1: CONTRACTOR HEALTH AND SAFETY PLAN GUIDELINES

Typical elements that shall be considered as a minimum when developing a Contractor Health and Safety Plan for a contract are mentioned below. The extent and description of the individual elements would depend on the complexity of the contract.

Element -1: Effective Leadership

- Visible Leadership
- Commitment
- Structured System
- Individual Accountability
- Policy
- Strategic Objectives
- Dissemination

Element-2: Competent Workforce

- Safety Organization
- Governance Structure
- Resources
- Roles, Responsibilities & Accountabilities
- Competency Assurance
- Subcontractor

Element -3: Robust System

- Risk Evaluation and Management Program
- Process Safety Management
- JSW Critical Safety Rules
- Annual Plan
- Asset Integrity Management
- Group Standards
- Process for Document Control
- Management of Change
- Emergency Preparedness and Response
- Implementation
- Job Hazard Analysis
- Corrective & Preventive action for non-conformance
- Record Keeping
- Performance measurement, monitoring, and reporting
- Incident Reporting and Investigation
- Inspection Program
- Management Review

15.2 ANNEXURE -2: THE INVITATION TO TENDER LIST

Sr. No.	Description	Yes	No	Remarks
1	Has a defined scope of work been included in the bid package			
2	Has a customized Safety Plan (Contractor Safety Manual) for JSW GROUP Sites been included in the bid package? * Depends on size of work			
3	Is there a provision of contract termination for failure to comply with EHS mandatory requirements?			
4	Has the following clause been included —The Contractor shall deploy safety officers as mandated in the Safety plan / General Contract Conditions			
5	Has the following clause been included —The contractor shall provide orientation /induction training to his entire workforce prior to deploying			
6	Has the following clause been included —The Contractor shall conduct weekly safety meetings, twice daily toolbox meetings, monthly gate meetings as per the requirements of the safety plan			
7	Has the following clause been included —The Contractor shall ensure proper housekeeping, ensure segregation of waste at identified bins			
8	Has the following clause been included —The Contractor shall thoroughly assess the work scope, properly understand the hazards and risks associated with the job and carry out risk mitigation measures			
9	Has the following clause been included —The Contractor shall carry out proper safety planning for the work scope, which includes but not limited to proper access, egress, assembly point, storage areas, waste disposal, movement of manpower and equipment, inspection schedules of plant and machinery, rigging plans etc.			
10	Has the following clause been included —The Contractor shall ensure deployment of skilled and competent personnel for welding, crane operations, equipment operators, riggers, electricians etc.			
11	Has the following clause been included —The Contractor shall submit work method statements, safe operating procedures and JSA/ SWP to company for review and approval?			
12	Has the following clause been included —The Contractor shall obtain work permits from JSW GROUP Sites personnel prior to starting the job.			
13	Has the following clause been included —The Contractor shall ensure that all his workforce working at heights are specifically trained and have been medically certified?			
14	Has the following clause been included —The Contractor shall ensure that their workforce shall use proper scaffolds of approved quality and not using temporary work platforms?			
15	Has the following clause been included Contractor shall ensure that all his workforce is provided with approved Personal Protective Equipment (PPEs).			
16	Has the following clause been included —The Contractor shall comply with the EHS requirements as required by JSW GROUP sites			
17	Has the following clause been included Contractor shall provide a detailed breakup of their estimate for compliance to safety as per the requirements of the JSW GROUP Site Safety Plan?			
18	Has the following safety expectation has been agreed – to get average severity index of site under CFSA shall be <2.5 and numbers of 4s and 5s will always be ZERO.			
19	Ensure there is no ambiguity nor any surprises.			

15.3 ANNEXURE-3: CHECKLIST FOR CONTRACTOR PRE-QUALIFICATION

(*Few fields in score filled for reference purpose only)

JSW Contractor Pre-Qualification Questionnaire
Use of this self-assessment is mandatory as per Group Health & Safety Standard.
You are free to ask for additional information.

Business		**Site**	

1. Scope

This assessment is used by JSW to assess the extent its contractor's development and commitment to OH&S. The questionnaire considers a wide range of requirements pertinent to OH&S and based on the response, JSW will determine whether the contractor will qualify for any work at JSW site. **Note**: Compliance to Questions marked in RED font are pre-requisite for the contractor to start work at site. (10 Mandatory questions)

2. Contractor Details		**3. Contractor Organisation** (please provide copy of organisation chart)			
Name:		**Key Roles**	**Number**	**Injuries/Illnesses 12 Month History**	
Postal Address:		Managers		Fatal Incidents	
Street Address:		Job Supervisors		Lost Time Injuries	
Contact Person:		Safety Supervisors		Lost Time Injuries Frequency Rate (LTIFR)	
a) Title:		Employees: Skilled		Medical Treatment	
b) Name:		Employees: Un-Skilled		Number of Sites/Projects	
c) Mobile No:		Sub-Contractors		Disabling injuries	
Company Phone & Fax:		Any other details:		Near miss/near hit incidents	
Company Website:				Incidents causing property damage during contract	
Contact Email ID:	-				
Project or type of work:				Illness caused by workplace factors	
Previous JSW Contracts:					

3.1. Contractors Profile: - Contractor's scope / Type of Work (Description of service):

3.2 Insurance (Mandatory requirement - Contractor not eligible to qualify, if any of this minimum legal requirement is not met)

		Yes/No/NA		Yes/No/NA
A	Public liability insurance Covered?	Yes	D) Motor vehicle insurance available?	Yes
B	Professional indemnity insurance available?	Yes	E) Employers' liability insurance available?	Yes
C	Product liability insurance available?	Yes	Provide evidence by showing a copy of your insurance policies.	

#	DESCRIPTION - SECTION A	YES / NO / NA	EVIDENCE ALIGNS WITH JSW REQT.	SCORE
4	**General OH&S Systems - Documents & Evidence**			
4.1	**Policies**			
A	Does your organization have a written health and safety policy?	Yes	Meets Requirement	3
B	Does your organization have a Smoking, drug and alcohol policy?	Yes	Needs Improvement	1
C	Does your organization have a written Environmental policy?	Yes	Needs Improvement	1
	Provide evidence by supplying policies of relevant document			
	Subgroup total			**5**
4.2	**Responsibilities**			
A	Do you have an OHS organisation chart (with names) & their Job description?	Yes	Needs Improvement	1
B	Has the organisation have written OHS responsibilities for all the below mentioned categories?	Yes	Meets Requirement	3
	Management	Yes	No score for these sub-criterion	
	Supervisors	Yes		
	Employees / Workers	Yes		
	Subcontractor Employees	Yes		
	Provide evidence by supplying policies of relevant document	Yes		
C	Does your Site safety supervisor have recognised Health & Safety Qualification? (PGDIS, DIS, NEBOSH, Certificate Course)	Yes	Needs Improvement	1
	Subgroup total			**5**
4.3	**Training & Communication**			
A	Does your organization have a formal employee induction program? (Induction module to be submitted to JSW)	No	No Evidence	0

B	Does the written OH&S induction module include instruction on the following (as minimum):			
	1. All your OH&S policies	Yes	Needs Improvement	1
	2. Incident Reporting	Yes	Needs Improvement	1
	3. Roles & Responsibilities	Yes	Needs Improvement	1
	4. Toolbox meetings	No	Needs Improvement	0
	5. Emergency procedures	No	Needs Improvement	0
	6. First Aid facilities	NA	Needs Improvement	
	7. Safety rules / Cardinal rules and consequences	No	Needs Improvement	0
	8. Seat belt & mobile phone usage guidelines	No	Needs Improvement	0
	9. Mandatory PPEs for different kind of activities.	No	Needs Improvement	0
	10. Hazards associated with the respective nature of work	No	Needs Improvement	0
	11. Learnings from past incidents	No	Needs Improvement	0
C	Does your organization have a process to record job specific health, safety, environmental training for employees? (submit training matrix as an evidence)	No	Needs Improvement	0
D	Does the training matrix include the following training programs?	No	Needs Improvement	0
	1. Permit to work system	No	Needs Improvement	0
	2. Fire Fighting	Yes	Needs Improvement	1
	3. First aid	No	Needs Improvement	0
	4. Mechanical Handling (Cranes, Hydras / any load handling equipment, MEWP etc,)	No	Needs Improvement	0
	5. Working at Height (Use of lifelines, Fall arrest system, Safety nets etc.,)	No	Needs Improvement	0
	6. Manual Handling	No	Needs Improvement	0
	7. Use of Power tools and Hand tools	No	Needs Improvement	0
	8. Chemicals Safety	No	Needs Improvement	0
	9. Driving safety	Yes	Needs Improvement	1
	10. Hazard Recognition and control	Yes	Needs Improvement	1
	11. Housekeeping (Including 5S)	NA	Needs Improvement	
	12. Right use of PPEs	No	Needs Improvement	0
	13. Any other Job Specific Training (like confined space entry, sand blasting / painting, Scaffolding, Electrical safety etc.,)	Yes	Needs Improvement	1
	(Provide evidence of training contents of above modules)			
E	Does your organization have a qualified and competent trainer for above trainings? (Submit evidence)	Yes	Needs Improvement	1
F	Does your organization have a process to maintain records of employee induction & Training? (Submit record of any one site)	Yes	Needs Improvement	1
G	Does your organisation have safety communication program at client site?			
	1. Toolbox talk	No	No Evidence	0
	2. Self initiative of Mass Safety Communication / participation	Yes	Needs Improvement	1
	3. Self Initiative of Various Safety Events and celebrations such as National safety day, World Health Day, etc., / participation	Yes	Needs Improvement	1

	Sub group total			**11**
4.4	**Selection of sub-contractors (In the case of sub-contractor is hired for the proposed job, in that case sub-contractors will also undergo the evaluation process)**			
A	Does your organization have a process for selection of sub-contractor?	Yes	Needs Improvement	1
B	Is the performance of sub-contractors monitored as work is being undertaken? pl. selects Not applicable if the job is not assigned to sub-contractors)	Yes	Needs Improvement	1
	Provide evidence by showing your process to engage subcontractors and monitor them during their work.			
	Sub group total			**2**
4.5	**Health Monitoring**			
A	Does your organization have a system in place to carryout medical fitness test prior to hiring? (submit the parameters for medical fitness)	Yes	Needs Improvement	1
B	Does your organization have a system in place to monitor the health of employees at regular intervals?	Yes	Needs Improvement	1
	Provide evidence by showing a copy of your medical fitness reports / Health checks (without disclosing any individual, personal data relating to an employee).			
	Subgroup total			**2**
4.6	**OH&S Recognition**			
A	Achievements / Awards recognised by clients / govt bodies / any their bodies	Yes	Needs Improvement	1
B	Do you have Safety Rewards & Recognition program at client site?	Yes	Needs Improvement	1
C	Is your organisation Certified (OH&SAS 18001 / ISO 45001 & ISO 14001)	Yes	Needs Improvement	1
	Provide evidence by showing a copy for each of the above			
	Subgroup total			**3**
4.7	**Plant and equipment**			
A	When using plant and equipment either owned by you or from any other party (leased, hired, borrowed etc) do you have systems in place to ensure that:			
	1. All plant / equipment is fitted with safety devices as prescribed by legislation e.g. machine guards	Yes	Needs Improvement	1
	2. Plant and equipment fitness certificate as per legislation is available & Valid? (Ex: - Crane test certificate, Earth moving equipment test certificate etc.,	Yes	Needs Improvement	1
	3. Your employees have the correct licenses and/or certificates to operate the plant and equipment?	Yes	Needs Improvement	1
	4. Your employees who are to operate the plant and equipment are trained in its safe use?	Yes	Needs Improvement	1
	Provide evidence of training records and licenses/certificates of above			

B	Does your organization have in operation a method or system for recording regular inspections and maintenance of hand tools, machinery (cranes, vehicles, boom lifts, hoists/lifting tools, etc) and electrically operated equipment? If so describe (attach details if additional space is required)	Yes	Needs Improvement	1
	Subgroup total			**5**
4.8	**Accident / Incident Management**			
A	Does your organization have an accident/incident reporting system?	Yes	Needs Improvement	1
B	Does your organization have an accident/incident investigation process?	Yes	Needs Improvement	1
C	Does your organization have a system to report incidents/accidents to the principal they are working for?	Yes	Needs Improvement	1
D	Confirm that your organization has not been prosecuted for an OH&S violation in last 3 years?	Yes	Needs Improvement	1
	Provide copies of your Accident/Incident management system as evidence			
	Subgroup total			**4**
4.9	**Personal Protective Equipment (PPE)**			
A	Has your organization assessed the jobs/tasks that require PPE?	Yes	Needs Improvement	1
B	Does your organization provide/supply PPE to all employees as required?	Yes	Needs Improvement	1
C	Does the PPE provided comply with IS codes and any other legal requirements? Provide Test certificates / PO order	Yes	Needs Improvement	1
	Provide evidence of your PPE requirements, compliance & Supplier information			
	Subgroup total			**3**
4.10	**Occupational Health & Safety management system**			
A	Does your organization have the following safe work procedures in your safety plan / manual?			
	1. Fall protection	Yes	Needs Improvement	1
	2. Scaffolding/working platform	Yes	Needs Improvement	1
	3. Floor/wall/roof openings guards	Yes	Needs Improvement	1
	4. Mobile equipment safety	Yes	Needs Improvement	1
	5. Housekeeping	Yes	Needs Improvement	1
	6. Fire protection	Yes	Needs Improvement	1
	7. Injury treatment procedure	Yes	Needs Improvement	1
	8. Rescue/evacuation procedures	Yes	Needs Improvement	1
	9. Hazard recognition (JSA, HIRA, Protocols, Method statement etc)	Yes	Needs Improvement	1
	10.Toxic substances	NA	Needs Improvement	
	11.Trenching/excavation	Yes	Needs Improvement	1
	12.Signs, barricades, flagging	Yes	Needs Improvement	1
	13. Electrical safety	Yes	Needs Improvement	1
	14. Rigging/crane safety	Yes	Needs Improvement	1

	15. Confined Space entry and working	Yes	Needs Improvement	1
	16. Welding/ Hot work permit procedures	Yes	Needs Improvement	1
	17. Synthetic fibre (Belt Slings & Similar items) handling procedures	Yes	Needs Improvement	1
	18. Lockout/tag out procedures	Yes	Needs Improvement	1
	19. Manual handling	Yes	Needs Improvement	1
	20. Compressed gases/gas cylinders	Yes	Needs Improvement	1
	21. Eye protection PPE	Yes	Needs Improvement	1
	22. Hearing protection PPE	Yes	Needs Improvement	1
	23. Foot protection PPE	Yes	Needs Improvement	1
	24. Respiratory protection PPE	Yes	Needs Improvement	1
	25. Chemical protective clothing	Yes	Needs Improvement	1
	26. Fall-protection PPE	Yes	Needs Improvement	1
	27. Hand protection PPE	Yes	Needs Improvement	1
	28. Other – Please explain	NA	Needs Improvement	
B	**When working on the following utility services, does your organization have and follow safe work procedures: (Electric supply, Gas lines, Water supply or any other utility lines)**	NA	Meets Requirement	
	Provide evidence by showing copies of safe work procedures			
C	**Prior Exposure of contractor related to similar work environment / similar hazards (For BTG, BOP, Coal Handling, Ash Handling, Chimney, working on sloped roof etc., - to be verified during the interview process)**	Yes	Needs Improvement	1
	Subgroup total			**27**
4.11	**Safety Inspections & Audits**			
A	Does your organization have process to develop a site specific 'Safety Inspection & audit Program'? Share a sample plan for evidence	Yes	Needs Improvement	1
B	Does your organization have process to systematically identify and record significant hazards in the place of work? Copies of Inspection program / Matrix, Checklists etc., shall be demonstrated as evidence.	Yes	Needs Improvement	1
C	Does your organization have a system in place to control the hazards?	Yes	Needs Improvement	1
D	Does your organization have a system to advise JSW of any hazards, which will be introduced due to their scope of work?	Yes	Needs Improvement	1
E	Does your organization have a system to ensure the safety of visitor / other people working in the vicinity?	Yes	Needs Improvement	1
F	Do you have internal / external audit mechanism to ensure safety management system implementation at site?	Yes	Needs Improvement	1
	Subgroup total			**6**
4.12	**Emergency preparedness and response**			
A	Does your organization have emergency response procedures to deal with work-site emergencies?	Yes	Needs Improvement	1

B	Will your organization have trained first-aiders on site who can respond in the event of an emergency? Provide copies of certificate	Yes	Needs Improvement	1
C	Will your organization have trained fire-fighters (fire wardens) on site who can respond in the event of an emergency? Provide copies of certificate	Yes	Needs Improvement	1
D	Are you equipped to rescue personnel from height when they need to be evacuated / rescued from height?	Yes	Needs Improvement	1
	Number of first aiders: / Number of fire Fighter (Fire Wardens):			
	Provide evidence by showing a copy of your emergency plan			
	Subgroup total			**4**
	Total Score			**77**
	Total number of Not applicable criterion			**5**
	PQA Score (%)			**35%**
	Adjustment for Fatal incidents	2		**-10%**
	Final PQA Score (%)			**25%**

5. Conditions

All Contractors, sub-contractors and their employees are expected to comply with JSW Occupational Health & Safety Policy.

Signed on and behalf of the contractor by:	
Full name of the representative:	
Signature:	
Date:	

6. JSW Evaluation

This section is to be completed by the JSW Representative to determine if the contractor should be accepted as an "Approved Contractor"

7.1	**The assessment of the**	**7.2**	**Recommended as an "JSW Approved Contractor"**

contractor is a:			
Pre-Qualification			
Re-Qualification		Contractor Category	

Type of Work Approval:	(Please mention the type or scope of work contractor is approved)

7.3 Authorisation

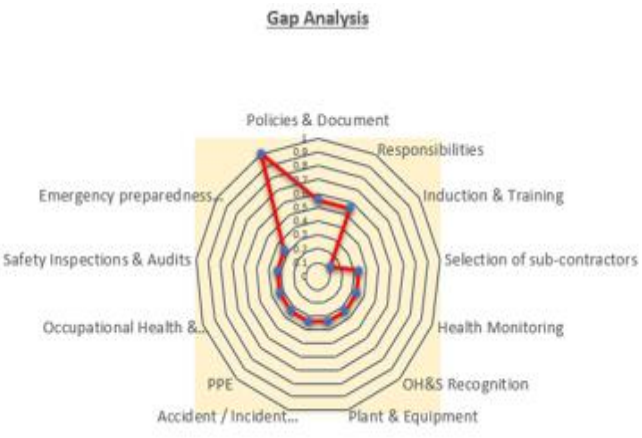
Having reviewed the information provided above and assessed the follow-up reports I acknowledge the Contractor's suitability as an "Approved Contractor":

Signed for and on behalf of JSW Ltd:	
Name of PQ Team Leader: (PQ team leader will be CSM chairman, or a person designated by him)	
Date:	

Scoring Matrix		
Score	**Description**	**Explanation**
0	No	No Evidence of system or process
1	Needs Improvement	Informal process/system exists
3	Meets Requirement	Formal System & Process exist

Negative Marks for Fatal Incidents

If one incident (-5), two incident (-10), three incident (-15). More than 3 incidents in a year, qualification of contractors to be decided by individual plants' CSM committee. This criterion is designed for



Brownfield contractors can be revisited by individual business conditions.

Summary of Scoring - Criteria wise

Criterion	% Score
Policies & Document	
Responsibilities	
Induction & Training	
Selection of sub-contractors	
Health Monitoring	
OH&S Recognition	
Plant & Equipment	
Accident / Incident Management	
PPE	
Occupational Health & Safety management system	
Safety Inspections & Audits	
Emergency preparedness and response	

15.4 ANNEXURE -4: CONTRACTOR ASSESSMENT AND RATING FOR EXCELLENCE IN SAFETY (JSW CARES)

15.4.1 Introduction

Continuously improving the safety performance of the Contractor becomes a critical component of Contractor Safety management process. In this regard, JSW felt it is high time to introduce a comprehensive safety performance assessment and rating system for all its contractors across the JSW Group. JSW intend to use this **CARES** system, as a progressive capability building tool for our contractors to improve and excel in their respective safety management system & performance.

The overall goal of this assessment is to provide clear and measurable value to the contractor and aid their improvement processes and prioritizing of such improvement actions. The Assessment report provides both technical as well as administrative guidance and makes recommendations that may be utilized to execute the H&S management System more effectively at our plants / project locations.

15.4.2 Assessment Scope

This assessment is applicable to all contractors (both Operations and Project sites). Some of the criteria may not be applicable for contractors of Brown field Construction projects. The applicability will be decided by the respective Plant / Project safety heads in consultation with the Plant / Unit / Project Heads.

15.4.3 Assessment Method

The Assessment will be undertaken based on JSW standards & Conditions of Contract. The answers of the Assesses will be verified by the Plant H&S team through Sampling of documents, site inspection and the procedures adopted for specific operations.

15.4.4 Assessment Criteria

JSW have identified the following 14 Criterions based on the criticality as well as the Incident proneness based on our past incident records, on which the individual contractors will be assessed.

Sl.	Criterion
1	H&S Administration
2	H&S Communication & Training
3	H&S Inspection & Assessment
4	HIRA & Emergency Preparedness
5	Reporting of Incidents & Incident Investigation
6	Housekeeping
7	Health, Hygiene & Welfare
8	Fire safety
9	Electrical Safety
10	PPEs
11	Work at Height
12	Gas cylinders
13	Lifting operations & Gears
14	Hand tools & Power tools

15.4.5 Evaluation

The numerical scoring (S) has been weighed on the following basis.

Score	Description
0	No System exist
1	System exists – But Inconsistent implementation
3	System Exist – Consistently Implemented

The Factor of Criticality (F) is allotted based on the vulnerability, past records and management focus areas. This factor will be reviewed from time to time and can be modified by the Group safety to suit the actual The Factor of Criticality (F) is determined based on:

Vulnerability: The level of risk inherent to the contractor's tasks (e.g., high-risk activities like working at height or handling hazardous materials).

Past Records: History of incidents, near misses, or safety violations involving the contractor.

Management Focus: Priority areas identified by management that require strict safety oversight. condition at plant / project sites.

Factor of Criticality (F)	Basis for Allocation
Low (1)	Minimal risk tasks, no history of incidents, low management concern.
Medium (2)	Moderate-risk tasks, occasional incidents or violations, moderate management focus.
High (3)	High-risk tasks, frequent incidents or violations, significant management focus area.

1.0 - H&S Administration		S	F	TS
H&S Staffing at site	1. Dedicated Safety personnel / Nominated safety personnel posted at site			
	2. Experienced Safety Personnel (at least 3 years in Safety)			
	3. Safety Head with minimum 5 years' experience in Safety function			
	4. Qualification of Safety personnel (Engineering. or Science Graduate / Engineering Diploma)			
	5. Safety personnel with Diploma / Certificate course in safety			
	SCORE			
H&S Committee (Management review)	1. H&S Committee established for effective safety management review process			
	2. Committee meets at least once in a month			
	3. Meeting chaired by contractor owner / Site In-charge			
	4. Minutes of the H&S meeting prepared and corrective actions followed up			
	SCORE			
Safety Induction & Screening	1. Safety screening & induction system in place			
	2. Safety Induction relevant to scope of works & JSW critical rules are included			
	3. Skill assessment of workers in place prior to hiring			
	4. ID cards are issued to workers			
	SCORE			
H&S Documentation (Each one carries one mark)	1. Toolbox talk records available with signature of participants			
	2. Safety Induction modules & records available			
	3. Risk assessments of all work documented			
	4. Method statements of critical activities available			
	5. Incident reports are available			
	6. Safety Statistics are available			
	7. Safety initiative reports are available			

	SCORE			
Visitor Management	1. Safety induction for visitors is in place			
	2. Visitor pass is issued at the gate			
	SCORE			
2.0 - H&S Communication & Training		**S**	**F**	**TS**
TBT (Toolbox Talks)	1. Daily Toolbox talks are conducted			
	2. Relevant and effective toolbox talks conducted			
	3. TBT is given by the Executing supervisor / site in-charge / shift supervisor			
	4. Random check of Worker's understanding of JSW critical safety rules			
	SCORE			
H&S Training Matrix & Compliance	1. Training Matrix is in place covering all workers and related risks			
	2. Compliance to Training Matrix is more than 80%			
	SCORE			
Promotional Activities	1. Safety Rewards & Recognition system is in place and workers recognised periodically			
	2. National Safety Day, Fire Day, Health Day etc. celebrated at site			
	3. Safety campaigns conducted at the site			
	SCORE			
H&S Posters	1. General safety Posters displayed at the site			
	2. Safety Posters relevant to work displayed at conspicuous locations			
	SCORE			
H&S Signage	1. General safety Signages displayed			
	2. Safety signages relevant to work displayed at required locations			
	SCORE			
3.0 - H&S Inspection & Assessment		**S**	**F**	**TS**
Planned General Safety Inspections & Compliance	Done but infrequent			
	Done periodically			
	Corrective and Preventive actions recorded & followed up			
	Actions closed on agreed target time			
	SCORE			
H&S Specific Inspections & Compliance	PPE Inspection			
	Housekeeping Inspection			
	Specific Inspections			
	Corrective and Preventive actions recorded & followed up			
	Actions closed on agreed target time			
	SCORE			
H&S Audits & Compliance	Contractor has a system of Internal Safety Audit			
	Internal Audits conducted periodically & recommendations complied			
	External Audits are also conducted periodically & recommendations complied			
	Recommended actions including client recommendations closed on time			
	SCORE			
4.0 - HIRA & Emergency Preparedness		**S**	**F**	**TS**
Risk assessment	All critical activities of the contractors are identified & a generic risk assessment is available			
	Risk assessed and suitable control measures are cascaded to all workers			
	Risk assessment is reviewed periodically and updated			
	SCORE			
Method statement	All critical activities identified in the scope of work shall have a detailed method statement clearly elaborating each steps involved			
	Clear understanding and compliance of the method statement at all locations			
	SCORE			
PTW System & Compliance	1) PTW system is understood & followed. (Check the understanding of the contractor workers on PTW system)			
	2) Contract workers are trained in PTW system. Formal training module and training record available			
	3) There was no Instance of PTW violation recorded. (All conditions of PTW complied)			

	4) Any work requiring PTW is conducted without a valid PTW where applicable (shall be given ZERO marks against this criteria)			
	SCORE			
Emergency Preparedness & Response	1) All Emergency scenarios are identified			
	2) Check the understanding of plan by randomly interviewing contract employees			
	3) The contractor is equipped with necessary resources to face the identified emergency scenarios			
	4) Mock drills were conducted periodically, recorded, and submitted to JSW			
	5) Documented emergency response plan is available and communicated			
	6) Certified First aider & Fire warden are available for every shift			
	SCORE			
5.0 Reporting of Incidents & Incident Investigations		**S**	**F**	**TS**
Prompt Reporting of Incidents to JSW	1) Incidents are promptly reported to JSW			
	2) Near misses reporting is encouraged Near misses are recorded			
	3) Incident reporting procedure is cascaded during Safety induction (Check with workers)			
	4) Interview employees to assess OPEN reporting of incidents			
	SCORE			
Investigation & Communication	1) Incident Investigation are done, and records are available with contractor (maximum marks can be awarded if proper method like why-why analysis is done)			
	2) Near miss are investigated and communicated			
	3) Interview employees to assess communication of past incidents			
	4) Contractor employees are aware of other relevant incidents through TBTs			
	5) Incident investigations recommendations are promptly closed			
	SCORE			
6.0 Housekeeping		**S**	**F**	**TS**
Housekeeping	1) Contractor keeps the access / egress always clear for workers / plant / equipment movement			
	2) A Place is allotted for everything			
	3) Everything is observed to be stacked safely in its place			
	4) 5 S Inspections conducted at regular intervals and records available			
	SCORE			
7.0 Health, Hygiene & Welfare amenities		**S**	**F**	**TS**
Health, Hygiene	1) Medical examination of workers as per legal requirement			
	2) Drugs & Alcohol policy implemented			
	3) Safe Transportation facility provided for workers			
	4) Proper utilisation of Restroom/ Eating area			
	5) Health & Hygiene promotional activities are conducted			
	6) Random breath analyser testing conducted periodically			
	7) Fogging & Pest control done periodically			
	SCORE			
Welfare amenities	1) Proper restroom available for workers			
	2) Adequate washroom facilities available			
	3) Adequate Drinking water facilities			
	4) Canteen / Eating area available for workers			
	SCORE			
8. Fire Safety		**S**	**F**	**TS**
Fire Safety	1) Fire safety Assessment is done & recorded			
	2) Identified control measures like adequate fire extinguishers are implemented			
	3) Fire safety assessment and control measures are cascaded to all workers			
	4) At least one trained fire warden is available every shift / location			
	SCORE			
9. Electrical Safety		**S**	**F**	**TS**
Electrical Safety	1) Electrical safety Assessment is done & recorded			
	2) Identified control measures are implemented			
	3) Electrical safety assessment and control measures are cascaded to all workers			
	4) Qualified and competent electrician is available per shift			

	SCORE			
10. Personal Protective Equipment (PPE)		**S**	**F**	**TS**
PPEs	1) PPE matrix is available & approved by JSW			
	2) PPEs are allotted as per the approved PPE matrix			
	3) PPEs Quality meet IS standard requirements			
	SCORE			
11. Work at Height		**S**	**F**	**TS**
work at Height	1) Workers are issued height pass before working at height			
	2) All control measures are implemented at height to prevent fall of men / materials			
	3) Full body harness with double lanyard and shock absorber used			
	4) MEWPs are used to minimise risk			
	SCORE			
12. Compressed Gas Cylinders		**S**	**F**	**TS**
Compressed Gas Cylinders	1) Colour code is maintained legibly			
	2) Cylinder Cap provided for all cylinders			
	3) Flash back arrestors are fitted both at the cylinder side as well as at the torch			
	4) All Cylinders are secured in upright position. (Trolleys for Full cylinders)			
	5) O_2 / DA /LPG Gas Cylinders are stored with adequate safe spacing between them (10 feet / 3m)			
	SCORE			
13. Lifting Operations & Gears		**S**	**F**	**TS**
Lifting Operations	1) Lifting operations are conducted by Competent persons			
	2) Lifting plan is in place for critical lifts and lifts more than 2 MT			
Lifting Gears	1) All lifting tools and tackles are identified with unique number			
	2) All lifting tools and tackles are stored appropriately			
	3) Colour coding is done for all lifting tools and tackles			
	4) Lifting tools and tackles have valid 3rd party test certificate			
	5) No Damaged lifting tool found at work area			
	6) Discarded / Damaged tools are recorded at stores and suitably disposed off			
	SCORE			
14. Hand tools / Power Tools		**S**	**F**	**TS**
Hand / Power tools	1) All Hand / Power tools are identified with unique number			
	2) Inspection tag available for all Hand / Power tools			
	3) All power tools are double insulated			
	4) Inventory of all Hand / power tools are available at stores / Maintenance section			
	SCORE			
Score (A)				
Bonus score for ISO 45001 standard systems implementation (If No 0, If yes 10)				
Total Assessment Score				
Total Possible Score (Deduct Not Applicable score) + 10				

*Total Score = Score * Factor of Criticality--- S - Score; F -Factor of criticality; TS - Total Score*

The inclusion of criteria such as working at height, lifting operations and equipment, compressed gas cylinders, and hand/power tools is based on their criticality in relation to vulnerability and accident risk. Other high-risk activities, such as confined space entry and hot work, are covered under the Permit to Work (PTW) system. The assessment team will evaluate the elements of the assessed section based on their observations. For topics or sub-topics that are not applicable, no score will be assigned. Additionally, the periodical Contractor Field Safety Audits (CFSA), conducted by the Contractor Safety Management Committee, are also factored into the assessment.

Total Assessment score - 80%; CFSA score - 20%

Accordingly, the overall Assessment ratings shall be calculated as follows:

A. Assessment Rating = (Actual Score / Max Possible score) *

B. 100

CFSA Audit score = Contractor compliance in Percentage

C. Total Score of the Contractor for the month'20YY = 0.8 A + 0.2 B = _____%

15.4.6 Scoring

The score will be equated to Stars ranging from One to Five, five stars being the highest and most desirable rating. Points will be objectively awarded by Contractor based upon site Safety and Health conditions. Scoring will be as follows:

#	Score	Rating	Description	Achievable Star based on	Action
0	0-30%	Disqualified	The Contractor has lost the eligibility to be contractor.	NIL	PQA score to be reviewed — Contractor's to be reviewed by CSM committee and necessary corrective action to be taken.
1	31-40%	Fail	There is NO safety management in terms of actions, either by ignorance, Non-compliance or other reasons. The level is called "Lack of awareness''.	★	Contractor to submit an action plan to address the identified gaps and actions to be taken shall be complied within a month.
2	41-60%	Poor	Weak Safety system or process exists; little awareness; minimal or no ownership and commitment.	★★	
3	61-80%	Good	Safety Management system & process exist and documented; improving trend of system of Lead Indicator identification, reporting and compliance monitoring; system is implemented at the minimum levels; ownership and commitment visible at some extent	★★★	
4	81-90%	VERY GOOD	H&S Management System is addressed systematically, documented, and regularly updated, reaching the respective targets regularly; reporting and compliance monitoring; integration with other activities is at high levels; felt and visible ownership and commitment.	★★★★	Contactor to focus on continuous improvement.
5	91-100%	Excellent	An exceptional safety standard in line with National International Best Practices; ownership & commitment are demonstrated.; continual imp rovement is evident	★★★★★	Contractor to sustain performance

Assessment shall be done at least every six month; Assessment report shall be sent to the contractor and gaps shall be addressed for continual improvement.

15.5 ANNEXURE-5: CLASSIFICATION OF JOBS FOR CONTRACTORS (RISK BASED)

Sr. No.	Description of Job	Low	Medium	High
	CIVIL DEPARTMENT			
1	All civil jobs in foundations below Ground level			
2	All civil jobs in Superstructures up to +1.8 m level			
3	All civil jobs in superstructures above +1.8 m level			
4	Building painting-Interior & Exterior up to + 1.8m			
5	Building painting-Interior & Exterior above + 1.8m			
6	Structural painting up to +1.80 m			
7	structural painting above +1.80 m			
8	Replacement of roof sheets up to +1.8m			
9	Replacement of roof sheets above +1.8m			
10	Sanitary & plumbing jobs at up to +1.8mtr			
11	Sanitary & plumbing jobs above +1.8mtr			
12	Scaffolding work for misc. maintenance jobs.			
13	Rehabilitation of RCC Structures			
Operation/Process Department				
1	All jobs pertaining to production / process equipment			
2	All maintenance jobs irrespective of isolated equipment, shutdowns, breakdowns etc.			
3	All activities related to handling, storage, loading / unloading of hazardous, toxic, flammable chemicals.			
4	All maintenance activities on Process Critical Equipment			
5	All activities involving handling of material using heavy lifting equipment			
6	All activities near or over water bodies (Jetty, ports)			
Mechanical Department				
1	Lifting and lowering up to +5.0 m			
2	Lifting and lowering above +5.0 m			
3	Fabrication job-Heavy			
4	Fabrication job-Medium			
5	Fabrication job-Low			
6	Erection job up to +5.0 m			
7	Erection job above +5.0 m			
8	Routine maintenance job			
9	Transportation of heavy Techno-commercial			
10	Equipment commissioning			
11	Shutdown jobs			
12	Scaffolding job up to +6.0 m			

13	Scaffolding job above +6.0 m			
Electrical/Instrumentation				
1	Cable Tray Fabrication and Erection			
2	Cable Laying where platform not available			
3	Cable Laying where platform available			
4	Switch Yard projects/maintenance			
5	HV / LV Substation Construction			
6	HV / LV Substation Maintenance			
7	Lighting work with approach			
8	Lighting work without approach			
9	Distribution Transformer maintenance/project			
10	PLC system Erection and Commissioning			
11	Scaffolding work for Miscellaneous jobs			
12	Air conditioner maintenance			
13	Air conditioner installation			
14	Alternator maintenance			
15	Turbine project /maintenance			
16	Boiler project /maintenance			
17	DG Set project /maintenance			
18	Refractory / Insulation Work			
19	Hydraulic System project /maintenance			
20	Sampling			
22	Field instruments at Hard to access place			
23	Working on Electrical motor at Hard to access place			
24	Construction work above +1.8-meter height			
25	Construction work below +1.8-meter height			
26	Welding/Cutting job in hot area			

This annexure classifies jobs across various departments based on the associated risk levels. The classification is made based on the potential hazards and consequences that may arise from the execution of the jobs. The following risk categories apply:

Low Risk: Jobs with minimal health and safety hazards, where the potential for serious harm is very low. These jobs typically involve routine maintenance or administrative tasks with limited exposure to hazardous conditions.

Medium Risk: Jobs that carry a moderate risk of health or safety incidents. These jobs may involve work in areas with restricted access, the use of hazardous materials, or moderate equipment handling, requiring the implementation of safety measures but not necessarily requiring complex interventions or constant monitoring.

High Risk: Jobs that present significant potential for harm due to hazardous environments, handling of dangerous chemicals, high-altitude work, heavy equipment operation, or work involving complex and high-consequence risks. These jobs require rigorous safety protocols, close supervision, and specialized training for workers.

Note: This is a sample list; the site can add additional jobs based on specific risks and needs. The classification of jobs should consider both the nature of the work and associated safety concerns.

15.6 ANNEXURE-6: SAFETY UNDERTAKING FORM

JSW Group

CERTIFICATION OF UNDERSTANDING SAFETY REQUIREMENTS

Reference:

- Contractor Award Meeting / Discussions on dated _____.
- Contractor Safety Plan - *Document No: XX/CSM/2022*
- Tender Enquiry - *Document No:* _____.

With reference to the above, we, *M/s* _____ *(Insert the Company Name)* declare that we fully understand all applicable Safety requirements related to the performance of the services mentioned under this contract.

I _____ (*Insert Name and Title*) hereby certify that we will work to ensure complete compliance to Safety requirement as per plan, conduct audit and verify adherence to the Safety Standards of JSW.

If found defaulting or violating any of the requirements specified under applicable JSW standards, I/we shall be liable to monetary fines and other forms of penalties (including termination of contract) as per the provisions of the "H&S Infringement Template by Contractors" given in Annexure 08.

We, _____ hereby declare that all prices and costs for the implementation of the Safety requirements (specified herein) have been considered while preparing the final project estimate agreed between the JSW and _____ *(Insert the Company Name)*. I/ we further declare that we shall not have any claims in the future for any unforeseen/ unbudgeted expenses regarding the implementation of Safety requirements.

15.7 ANNEXURE-7: PRE-MOBILIZATION AUDIT CHECKLIST

A Pre-Mobilization audit is required to confirm that the Contractor is ready for mobilization as per the timeline agreed with the JSW Group. The scale of this audit will vary depending on the size, complexity & scope of the work.

#	Item Description	YES	NO	NA	REMARKS
1	**Contract Document** • Approved Scope of work /contract document available with the Contractor • Contractor reviewed all applicable HSE & Welfare requirements and developed status of proposed compliance against each				

#	Item Description	YES	NO	NA	REMARKS
2	**Health and Safety Plans (Engineering & Construction)** • Contractor developed Project Health and Safety Plan and Construction health and safety Plan as applicable to the scopeof work and obtained JSW Group approval. • Project Health and Safety Plan reviewed and approved by JSW Group representatives prior to mobilization. • Construction health and safety plan covers worksite, camp accommodation, waste management, transportation, and Emergency Response preparedness etc. • Construction health and safety plan reviewed by relevant field HSE Representative and approved by authorized JSW Group representative (e.g. contract Administrator).				
3	**Training & Competence** • Contractor developed health and safety Training Matrix in line with the Scope of Work, which shall include JSW Group mandatory Trainings and specialized trainings as applicable. • Training materials utilized are aligned with JSW Group expectations and verified by JSW Group Field health and safety staff. • HSE manning levels identified as per the scope ofwork and in consideration to the geographical locations. • HSE staff interviewed and approved or initiated theprocess of approval. • Contractor skilled workforce has a basic commandof English language				
4	**Equipment** • Contractor developed register of variousequipment proposed for mobilization with details ofcertifications as required (e.g. Heavy equipment, well control equipment, SCBA, gas detection, cranes, forklifts, man hoists etc.). • Confirmation of HSE-critical equipment register in place.				
5	**Emergency Response** • Alignment of Contractor's Emergency Response Plan with the JSW Group including Subcontractors' interfaces • Readiness with communication systems, training (fire teams, medics/first aiders), firefighting equipment etc. This shall cover both site-based and the camp-based. • Scenarios of emergency drills specified in the Emergency Response Plan				
6	**Accommodation Camp and Catering services** • Contractor proposed camp and catering have valid documents. • Contractor proposed camp has relevant licenses/approvals and in acceptance to the JSW Group representative				

#	Item Description	YES	NO	NA	REMARKS
7	**Pre-employment medical examination** • Contractor personnel proposed to be mobilized have completed pre-employment medical examinations with approved fitness to work issued in line with the JSW Group medical fitness assessment guidelines				
8	**Transportation** • Vehicles (Light and Heavy) proposed for the work are inspected (e.g. IVMS, ROP etc.) and accepted for use at site by the JSW Group as applicable. • Contractor developed journey management plan where required.				
9	**First aid and medical service provisions** • First Aid/Emergency room facilities have relevant valid licenses/approvals in place.				
10	**Personnel Protective Equipment (PPE) /Respiratory Equipment** • Samples checked to ensure that PPE & RPE are correctly selected as per the JSW Group specifications and requirements.				

15.8 ANNEXURE-9: CHECKLIST FOR PERIODIC/POST-CONTRACT EVALUATION

Sr. No.	Description	Yes	No	Remarks
1.	Has the Contractor completed the contract without any fatalities, Serious Injury?			
2.	Has a record of the safety statistics such as LWC, FAC, MTC, Near Misses been obtained from the Contractor?			
3.	Has the Contractor deployed adequate safety professionals? for job execution as defined in the Site			
4.	Have any of the Contractor workers and or his sub-contractors been terminated for gross violation of safety norms and requirements. If yes, obtain a list of such workers?			
5.	Has the Contractor paid adequate attention to housekeeping issues?			
6.	Has the Contractor been consistent in carrying out audits of his workforce and his sub- contractors for compliance to safety rules and procedures? If yes, whether average Severity Index of the site was ≤ 2.5 and violations of severity 3s were always < single digit numbers and 4s & 5s were Nil?			
7.	Has the Contractor deployed skilled and trained manpower for the job execution?			
8.	Has the Contractor provided Orientation training to all their work force?? If yes, obtain records?			
9.	Has the Contractor provided specific skill set training to his work force, if yes, obtain records?			

Sr. No.	Description	Yes	No	Remarks
10.	Has the contractor carried out emergency mock drills? If yes, specify?			
11.	Has the Contractor complied to the EHS expectations as outlined in the Site Safety Plan?			
12.	Has the Contractor deployed skilled and competent supervisors for job execution?			
13.	Did the Contractor site leadership demonstrate right attitude and behavior in the job executions?			

16. REFERENCE

Reference	Full Title, Brief Description and Web-links
International Labour Organization (ILO)	ILO's Core Labour Standard s is aimed at promoting opportunities for women and men to obtain decent and productive work, in conditions of freedom, equity, security and dignity. International labour Standards respond to a growing number of needs and challenges faced by workers and employers in the global economy. It covers the subjects covered by international labour Standard s and introduces some relevant conventions and recommendations. It also explains what problems exist in a particular field today and how international labour Standard s are helping to provide solutions. http://www.ilo.org/global/Standard_s/lang--en/index.htm
International Association for Contract and Commercial Management (IACCM)	IACCM is a not-for-profit professional organization for innovation in trading relationships and practices. IACCM's mission is to identify and promote the international Standard s and practices for defining and managing trading relationships. They develop and communicate leading practices that support economic growth and organizational success by ensuring commitments are ethical, achievable and sustainable. IACCM 2014 Whitepaper on the Basics of Contract and Commercial Managementhttp://www.apmg-international.com/nmsruntime/saveasdialog.aspx?lID=8156&sID=12573.
International Association of Oil and Gas Producers (IOGP)	IOGP is a global forum in which members identify and share best practices to achieve improvements in health, safety, the environment, security, social responsibility, engineering and operations. IOGP Standards on HSE Management – Guidelines for working together in a contract environment. www.ogp.org.uk/pubs/423.pdf
BS8903:2010 Principles and framework for procuring sustainably. Guide, and BIP 2203: 2011 Sustainable Procurement Guide	The BSI safety document provides clear and practical guidance towards sustainable development and supports in managing procurement issues and including their implementation in organizations and enterprises.

JSW Group

MANAGEMENT STANDARD: ROAD SAFETY
JSW/GHS/GS-04

MANAGEMENT STANDARD: ROAD SAFETY

Management Standard Title:	**ROAD SAFETY**	**Date of Revision**	10.12.2024
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1. PURPOSE

The purpose of this Standard is to establish JSW Group's requirements for managing risks associated with road, vehicle, driver, and traffic safety. This Standard aims to:

1.1 COMMUNICATE SAFETY REQUIREMENTS

Define JSW Group's safety requirements for managing risks related to road, vehicle, driver, and traffic safety.

1.2 REDUCE PHYSICAL INJURY

Minimize or eliminate the potential for physical injury on roads, thereby protecting human health and well-being.

1.3 PROTECT PERSONNEL

Safeguard personnel (both Company employees and Business Partners) from unreasonable risks of road incidents caused by poor vehicle design, faulty construction, deteriorated vehicle performance, or unsafe driver behaviour.

1.4 ENSURE SAFETY MEASURES

Outline measures to ensure that all vehicles, mobile equipment, roads, quarry ramps, haul roads, truck yards, and pedestrian footpaths are:

- Designed to be fit for purpose.
- Maintained in a serviceable condition.
- Operated by competent individuals in a safe manner.
- Ensure that risks of incidents are either eliminated or mitigated.

1.5 COVERAGE OF VEHICLE TYPES AND PURPOSES

Apply safety requirements to all categories of vehicles and purposes of travel, including:

- Vehicles owned by JSW or provided by third parties/contractors, regardless of type (light motor vehicles, heavy vehicles, etc.).
- Vehicles used for employee transportation, such as buses and company-hired taxis.
- JSW employees traveling for business purposes, whether in personal, company-owned, or third-party vehicles.

Note:

- For the purposes of this Standard, "vehicles" refers to any mechanically propelled or battery electric vehicles adapted for use on roads.
- This Standard is intended to complement, but not replace, any applicable government regulations. Local government regulations and legal requirements will take precedence over this Standard.

2. SCOPE

Road Safety Management Standard is mandatory and applies to all JSW Group companies and subsidiaries, managed sites, corporate offices, research and development facilities, new projects, merged and acquired entities. The standard is relevant to all JSW Group company employees, Contractors, Visitors, and workers who may be engaged through third-party Contractors and in JSW operations.

Conformance to the requirements in this standard is applicable to the entire lifecycle (including, exploration and planning, pre-feasibility and feasibility evaluation, construction, operation, closure, and activities during new acquisitions).

In the Standard, the following verbal forms are used to indicate requirements, recommendations, permissions, or capabilities:

- "shall" indicates a requirement.

- "should" indicates a recommendation.
- "may" indicates a permission.
- "can" indicates a possibility or capability.

3. REVIEW

This Standard shall be reviewed at least every five years or following a serious incident or high potential near miss. The review shall encompass the evaluation of the following aspects:

- **Risk Assessment Procedures:** Evaluate procedures related to the planning and management of road safety risks.
- **Road Traffic Management Practices:** Examine current road traffic management practices to ensure they effectively manage and mitigate traffic-related risks.
- **Training Records and Programs:** Assess records and programs for employee training on road hazards to ensure they are current and effective.
- **Technology and Innovations:** Assess whether new technologies or innovations in road safety could be integrated into current practices.
- **Industry Standards and Regulations:** Review any updates or changes to industry standards, laws, and regulations that may impact road safety practices.

3.1 RECORDS

Documented information of the following should be maintained:

- **Hazard Identification and Risk Assessment:** Records of hazard identification, risk assessments, identified scenarios, and control measures.
- **Inspection and Testing of Vehicles:** Detailed records of all inspections and tests performed on vehicles, including maintenance and repair activities.
- **Incident and Collision Records:** Documentation of incidents and collisions during road journeys, including investigation reports and corrective actions.
- **Vehicle Documentation (Site-Specific):**
  - Vehicle Registration/Permit/Insurance Certificates
  - Pollution Under Control Certificate
  - Vehicle Inspection and Maintenance Records
  - Motor Vehicle Incident Records
- **Training Records:** Documentation of all training programs and sessions related to road safety and vehicle operation.
- **PCM Records:** Records of Penalty and Compliance Measures (PCM) taken against violators.
- Inspection Records: Records of inspections conducted on roads to ensure safety and compliance.
- **Permits for Vehicle Maintenance:** Records of permits issued for vehicle maintenance tasks.
- **Journey Management Plan:** Documentation outlining safe travel practices, protocols, and risk mitigation strategies.
- **Compliance Documentation:** Records demonstrating compliance with relevant road safety regulations.
- **Emergency Response Plans**: Documentation of emergency response plans specific to road safety incidents.
- **Technology Utilization Records**: Records related to the use of technology for monitoring and managing road safety.

4. PROCESS FLOW

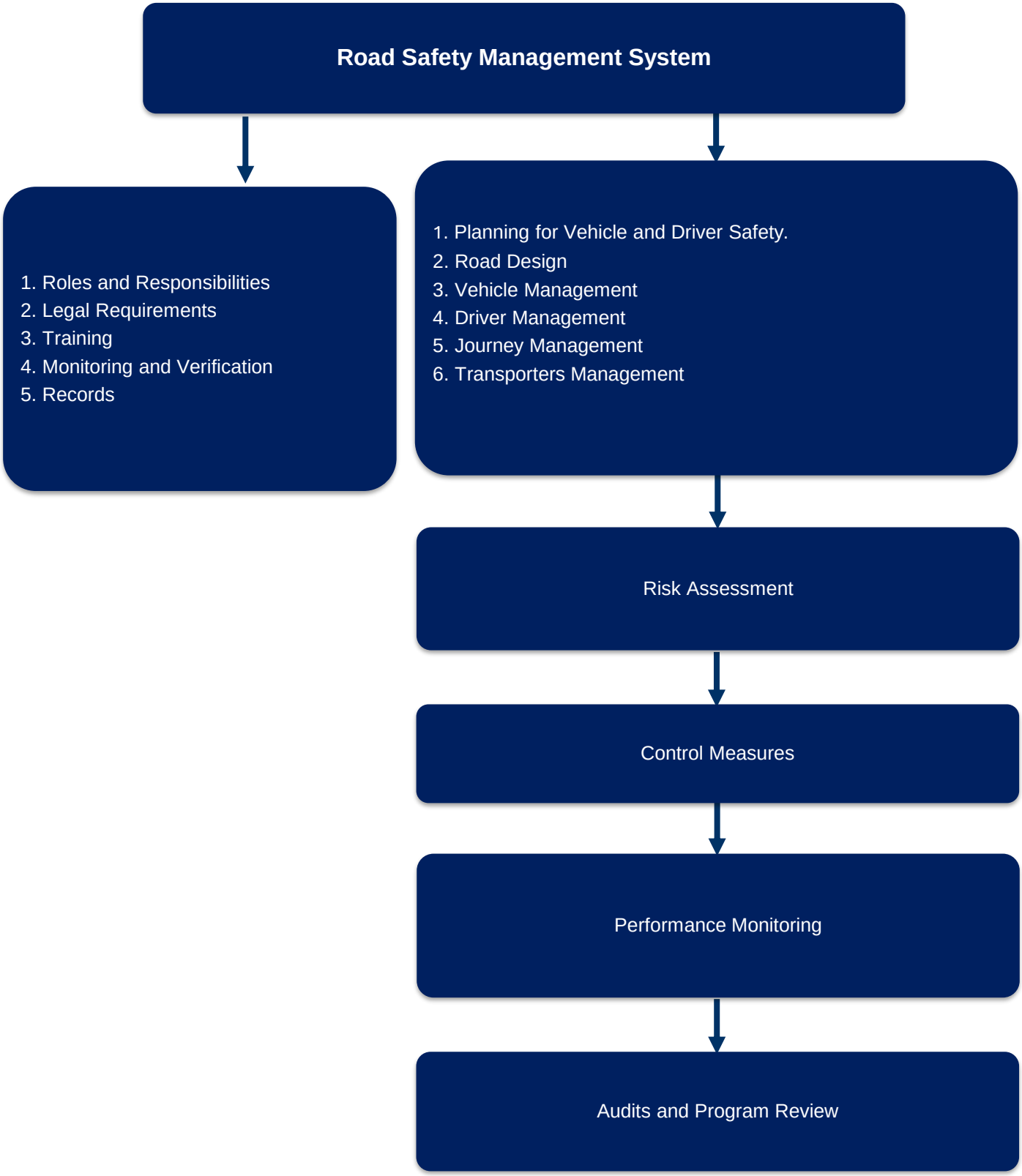


Figure-1 : Road Safety Management

5. HAZARD IDENTIFICATION AND RISK ASSESSMENT

JSW Business Unit/Site should conduct a systematic and structured risk assessment to identify, assess, and evaluate road safety hazards at the planning stage and should aim to reduce the risk involved in transportation of men and materials.

The risk assessment should address the following key areas, but not limited to:

5.1 SAFE SITE (DESIGN AND ACTIVITY)

Critical Hazards, but not limited to:

- Road Infrastructure
- Environmental and Functional Considerations
- Safety Features

Control Measures, but not limited to:

Road Infrastructure:

- **Design Controls:** Business Unit/Site should ensure proper design and maintenance of roads, crossover bridges, pedestrian walkways, road furniture, and markings. Implement traffic light and signage placement strategies and provide adequate turning radii and speed reducers at junctions.
- **Inspection Controls:** Business Unit/Site should regularly inspect and maintain road infrastructure, including signage, road markings, and traffic lights.
- **Environmental and Functional Considerations:**
- **Dust Control Measures:** Business Unit/Site should Implement dust suppression techniques.
- **Illumination and Visibility:** Business Unit/Site should install adequate lighting for all roadways and work areas.
- **Drainage Systems:** Business Unit/Site should maintain effective drainage to prevent water accumulation.
- **Facilities:** Business Unit/Site should Provide adequate driver restrooms, canteens, parking facilities, and refuge bays.
- **Safety Features:**
- **Segregation Measures:** Business Unit/Site should use guardrails, barriers, and other safety features to separate different types of road users.
- **Automatic Systems:** Business Unit/Site should install and maintain boom barriers, weighbridges, and access controls as required.
- **Slope Management**: Business Unit/Site should design and maintain slopes to ensure safe usage.

5.2 SAFE VEHICLE

Critical Hazards:

- Vehicle Selection
- Safety Features
- Vintage Criteria
- Inspection, Maintenance, and Repair

Control Measures:

Vehicle Selection & Procurement Controls: Ensure vehicles meet safety standards and specifications before acquisition.

Safety Features:

Verification Controls: Regularly check and maintain essential safety features (e.g., airbags, ABS).

Vintage Criteria:

Age Policy: Implement and enforce a policy regarding the maximum allowable age of vehicles.

Inspection, Maintenance, and Repair:

Maintenance Schedule: Develop and adhere to a routine maintenance and inspection schedule. Maintain detailed records of all maintenance activities.

5.3 SAFE DRIVER

Critical Hazards:

- Driver Selection
- Driver Training
- Driver Fatigue Management
- Journey Management Plan

Control Measures:

Driver Selection:

Recruitment Controls: Implement a rigorous driver recruitment process that includes qualification checks, experience assessments, and driving record reviews.

Driver Training:

Training Programs: Provide ongoing training programs on safe driving practices, defensive driving, and emergency response. Regularly update training content.

Driver Fatigue Management:

Fatigue Management Policy: Establish guidelines for work and rest periods, monitor driver hours, and implement measures to manage fatigue.

Journey Management Plan:

Planning Controls: Develop a comprehensive journey management plan that includes route planning, risk assessments, and safety protocols. Ensure the plan is followed for all trips.

6. SAFE SITE DESIGN AND ACTIVITY

6.1 SAFE SITE DESIGN

When designing road infrastructure at a JSW Business Unit/Site, the following considerations should be integrated to ensure safety and operational efficiency:

- **Traffic Flow**:
  - Design roadways to facilitate smooth and safe traffic flow tailored to the site's specific needs.
  - Implement road signages to indicate correct vehicular flow, including specific signs for mining operations and other site-specific needs.
- **Road Surface Suitability**:
  - Ensure road surfaces are appropriate for the type of vehicles and loads expected at the site.
  - Consider materials and construction techniques that enhance durability and safety suitable for industrial and mining environments.
- **Vehicle Density**:
  - Plan road capacity to accommodate the anticipated vehicle density, minimizing congestion and ensuring smooth traffic flow.
- **Parking Areas**:
  - Provide adequate parking areas within controlled zones to prevent obstruction and ensure safety, particularly for different types of vehicles.
- **Man-Machine Segregation**:
  - Implement measures to segregate pedestrians and vehicles to minimize risks.
- **Ingress and Egress**:
  - Design safe and efficient entry and exit points for vehicles to facilitate smooth transitions and minimize delays.
- **Vertical and Horizontal Obstructions**:
  - Identify and address potential obstructions, both vertical (e.g., overhead structures) and horizontal (e.g., barriers, poles), that may affect vehicle movement.
- **Future Expansion**:
  - Consider potential future expansions and extensions in the design to avoid rework and ensure scalability.
- **Cultural Heritage and Biodiversity**:
  - Align road routes with cultural heritage considerations and minimize impacts on local biodiversity within the controlled premises.
- **Mines-Specific Design**:
  - For business units with mines, design haul roads inside the mine according to applicable national/international standards.
- **Turning Radius**:
  - Ensure turning radii are sufficient to accommodate large vehicles and prevent accidents.
- **Road Signage**:
  - Implement road signages that clearly indicate correct vehicular flow and critical instructions, especially in mining areas.
- **Cat Lights/Studs and Speed Breakers**:
  - Provide cat lights or road studs for improved visibility at night and in low-light conditions.
  - Install standard speed breakers at appropriate locations to control vehicle speed and enhance safety.

6.1.1 Traffic Route Management

Traffic routes are to be established ensuring the segregation (separation) of pedestrians, light vehicles, and heavy vehicles/mobile equipment etc. All traffic routes in a workplace should have a driving surface that is suitable for its purpose and the surface of traffic routes should not be uneven, potholed, sloped, or slippery.

General principles that should be adopted when deciding on the suitability of traffic routes are as follows:

- Site should ensure development of traffic management plan by recognized external agency to ensure compliance with best practices.

- Traffic route layouts should be such that controlled premises are accessible through at least one contingent way.
- Site should consider provisions to prevent congestion/density of vehicles through engineering/administrative controls.
- Route should be designed to limit the reversing of vehicles as much as possible.
- Adequate Road furniture such as Signage, Road Marking, Speed Breakers with reflective stud, convex mirrors, traffic control devices and Barriers etc. should be provided in accordance with the national/international standards.
- Sharp or blind curve should be avoided. Any road having sharp or blind curve should be provided with speed breakers and suitable road furniture.
- Adequate drainage system with proper slope should be provided in the vehicle route to handle rainwater so that vehicle movement are not restricted due to flooding conditions.
- At mainstream four-way junctions, a roundabout of minimum width should be erected considering the width of largest vehicle (considering maneuvering radius) plying on the business/site without hinderance to vision.
- Barriers should be in place in areas wherever there is a vertical/horizontal interaction possible with the moving vehicles (e.g., high voltage installations, conveyor galleries, pipeline structures, power lines etc.).
- Men and Machine movement should be segregated by designated elevated pedestrian walkways with hard barricading along all the roads. Suitable zebra crossing, signages/traffic lights should be installed wherever designated road crossing exist.
- The traffic layout routes should be free from any kind of obstructions.
- When road blockages are undertaken, it should be pre-planned, approved, and communicated to all concerned including emergency response team along with alternative traffic routes proposed.
- Parking areas need to be controlled with barriers, signs, and bollards etc., on larger Business Units where there is a risk that vehicles or pedestrians may venture onto vehicle routes.
- All vehicles should be parked in the designated parking areas to avoid queuing inside the premises. Under unavoidable circumstances, a minimum distance of 3 meters should be ensured between the vehicles.

In undertaking the review, Business Units should carry out a visual inspection of their traffic routes by walking around the premises, making notes and taking photographs. Hazards and problem areas can be marked on a Business Unit plan. From this walkover, there is a need to assess whether existing precautions are enough or if more precautions are required.

Examples of checks to be made during this survey are outlined in Table below.

	Check the layout of the route is appropriate	
1	Are vehicles and pedestrians kept safely apart?	Yes/No
2	Are there suitable pedestrian (Zebra) crossings points on vehicle routes?	Yes/No
3	Are there suitable parking facilities for all parking needs?	Yes/No
4	Do the vehicle routes avoid sharp or blind bends?	Yes/No
5	Is a one-way system used on vehicle routes where this can be achieved?	Yes/No
	Check vehicle traffic routes suitable for the type and quantity of vehicles that use them	
6	Are they wide enough?	Yes/No
7	Are surfaces firm and even?	Yes/No
8	Are they free from obstructions and other hazards?	Yes/No
9	Are they well maintained?	Yes/No

	Check suitable safety features are provided where appropriate	
10	Are roadways marked where necessary?	Yes/No
11	Are road signs present and used where necessary?	Yes/No
12	Are safety features installed such as mirrors on blind bends, road? humps to reduce speed limits, barriers to keep vehicles and pedestrians apart?	Yes/No
13	Do drivers and pedestrians report at the site entrance for instructions before entering?	Yes/No

Table-1: Examples of Checks to be Made During Survey

General principles that should be adopted when deciding on the layout of the traffic route are as follows:

- Ensure routes are wide enough for the largest vehicle using them. Be aware of the types of vehicles frequenting the site.
- Entrances should be wide enough to allow two vehicles to pass without causing a blockage.
- The size and turning ability of the vehicles coming onto site should be considered as they need a certain amount of space to manoeuvre. If large goods vehicles are using the site, routes should be made wide enough for them to manoeuvre safely.
- Maintain the quality of outdoor traffic routes to meet modern public highway standards. Surfaces should provide good grip, be roughened if too smooth, gritted if slippery, and free from oil and debris. Extra grip may be needed on slopes.
- Ensure routes, including bridges, can support the weight of vehicles and their loads.
- Provide sufficient space to prevent overcrowding and ensure safety.
- Plan routes to avoid dangerous areas and unprotected edges. Provide goalposts or barriers for hazardous obstructions.
- Implement access controls and barriers in high-risk areas (e.g., near high voltage installations).
- Use permanent and engineered speed breakers to control vehicle speeds effectively. Ensure speed control measures are clearly signed and visible.



Figure-2 : Example of Hard Barriers

Suitable safety features should be provided on all traffic routes, this should include:

- Signs and signals should be in place to tell drivers about the routes they should take and instruct people to behave safely.
- Road Sign are broadly categorized into:
    - Danger Warning Signs
    - Regulatory Signs
    - Informative Signs

There are three types of traffic sign:

- signs that give orders,
- signs that warn and
- signs that give information.

Each type has a different shape. Circles gives orders, Triangles warn, and Rectangles inform, Business unit should adequately use and deploy traffic signs accordingly.

Mandatory Road Signs – These signs are obligatory, these signs indicate what shall one do, rather than shall not do.

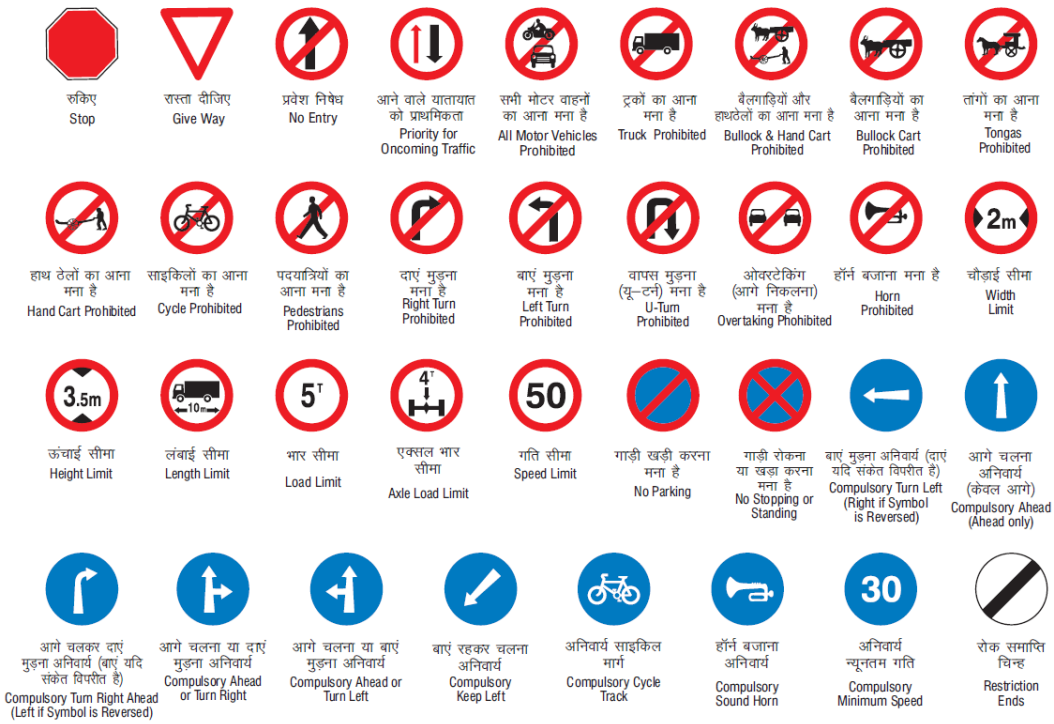


Figure-3 : Examples of Mandatory Road Sign

Cautionary Road Signs – These signs are meant to caution the driver about the hazards/situation lying ahead on the road, cautionary signs are triangular with red border.

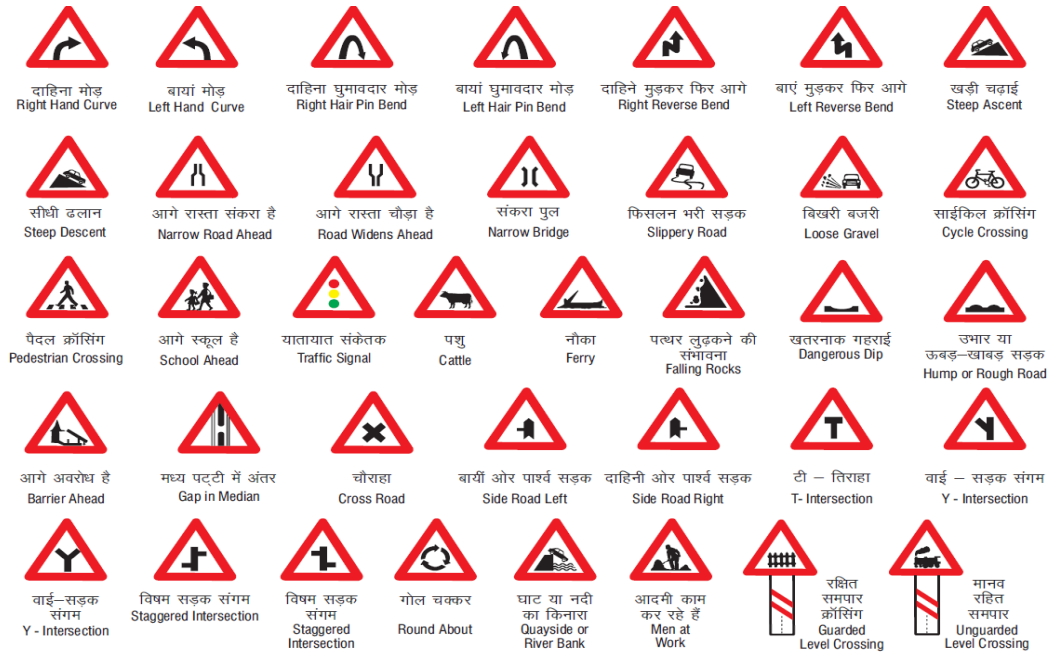


Figure-4 : Examples of Cautionary Road Signage

- If signs need to be visible in the dark, they will need to be reflective and ideally illuminated.
- Limiting speed is an important way of controlling traffic. The best way to do this is to use fixed features that means drivers cannot move too quickly. Examples include speed humps, narrow routes, rumble devices etc. These measures should be clearly signed and visible as in the examples below.



Example of a speed hump sign



Example of a speed hump

To standardize operations, the Group Safety Council (GSC) has recommended the following speed limits:

- **30 km/h** for Light Motor Vehicles (LMVs) on main roads.
- **20 km/h** for LMVs on connecting roads.
- **20 km/h** for Heavy Motor Vehicles (HMVs) across all roads.
- **HEMM** speed limits shall adhere to the transportation rules and DGMS guidelines submitted to regulators.

- It is recommended that speed guns are used on-sites to verify driver speeds. This will also assist in consulting /discussions with the driver if they breach the speed limits.
- Speed limit signs should be prominently displayed and repeated throughout the site's roads, not just at the entrance. Placement should be based on the size of the site and at locations where drivers require frequent reminders.

6.1.2 Pedestrians

6.1.2.1 Segregation of Pedestrians and Vehicles:

Pedestrian Walkways:

- All workplace routes should be suitable for their users. Where vehicles and pedestrians share a route, segregation should be ensured.
- A designated pedestrian walkway of 1.5 meters in width should be provided, with hard barricading and suitable zebra crossings where roads intersect.
- Pedestrian walkways should be marked with a yellow bed as per design safety standards.
- In cases of spatial constraints, adequate barricading should be provided for pedestrian safety. This requirement is compulsory for new sites and recommended for existing sites wherever feasible.

6.1.2.2 Pedestrian Safety Checklist:

Table-2: Pedestrian Safety Checklist

	What to Look For	Yes/No
1	Lack of clearly marked and signed pedestrian routes and crossings.	Yes/No
2	Pedestrian routes blocked by vehicles or equipment.	Yes/No
3	Large numbers of pedestrians and vehicles travelling on the same route at peak periods.	Yes/No
4	Unsuitable and dangerous pedestrian routes. (e.g., uneven surfaces)	Yes/No
5	Pedestrians being struck by vehicles because they are not seen by drivers.	Yes/No
6	Pedestrians entering dangerous and restricted areas such as turning areas and delivery bays.	Yes/No
7	Pedestrians feeling unsafe and insecure when walking to and within a site.	Yes/No
8	Locked emergency doors and gates.	Yes/No
9	Pedestrian routes that have poor drainage and are prone to flooding.	Yes/No
10	Are there safe crossing points for pedestrians?	Yes/No
11	Are noticeable shortcuts being taken?	Yes/No
12	Do footways have the appropriate signage?	Yes/No
13	Do footways have the appropriate guard rails?	Yes/No
14	Are any vehicles blocking pedestrian routes?	Yes/No
15	If the public use your site, are they separated from work traffic?	Yes/No
16	Are footways kept clear from obstructions and flooding?	Yes/No

6.1.2.3 Barrier Installation:

Barriers should be installed:

- Where pedestrians enter and exit buildings.
- At building corners.

- To prevent pedestrians from walking directly into roadways.

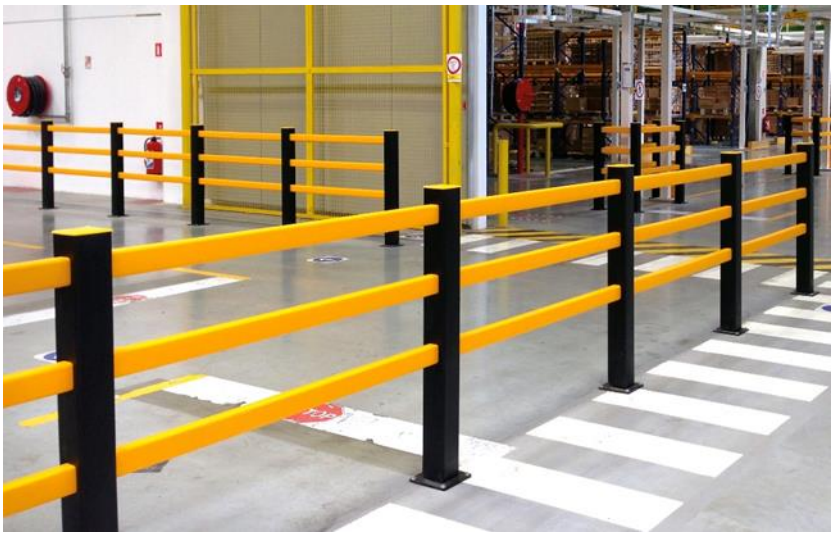


Figure-5 : Examples of Barrier on Walkway



Figure-6: Example of Pedestrian Barrier Outside Building Exit

6.1.2.4 Pedestrian Crossing Points:

- Provide clearly marked and signed pedestrian crossing points at all vehicle routes.
- Where traffic does not allow adequate gaps for safe pedestrian crossing, consider installing traffic lights or zebra crossings.



Figure-7 :Example of Pedestrian Crossing

6.1.2.5 Warning Signs and Visibility:

- Display warning signs indicating pedestrian crossing points.
- Ensure all pedestrians wear high-visibility clothing that meets day and night use requirements (e.g., a combination of fluorescent and retro-reflective material) and necessary PPE. This requirement extends to mine sites and mobile equipment.



Figure-8 : Example of Pedestrian Crossing Warning Sign

6.1.2.6 Pedestrian Safety Instructions:

- Adhere to pedestrian walkways and crossings, following all signage.
- Before crossing at designated points, ensure vehicle operators have seen you.
- Do not block or obstruct walkways with materials.
- Avoid working within walkways unless performing approved and planned maintenance activities with necessary controls.
- Prohibit horseplay on roads.
- Refrain from using mobile phones or similar devices while walking within the plant premises.
- Report any unsafe conditions related to walkways, roads, and road furniture using the company reporting tool.

6.1.2.7 Compliance and Implementation:

- Ensure these guidelines are integrated into site safety plans and communicated to all personnel.
- Regularly review and update safety measures in accordance with site-specific needs and regulatory changes.

6.1.3 Illumination

6.1.3.1 General Lighting Guidelines

Adequate Lighting for Safety:

- **Requirement:** Every workplace should have suitable and sufficient lighting to ensure safety and operational efficiency.
- **Details**: All traffic routes, manoeuvring areas, and yards should be adequately lit, with particular emphasis on areas near junctions, buildings, plant equipment, and pedestrian routes.

6.1.3.2 Lighting Standards and Compliance

Compliance with Standards:

- **Requirement:** Lighting should comply with OSHA Standard 1926.56 or equivalent standards to ensure safety and visibility.
- **Details:** Business units shall adhere to established standards for illumination to maintain safety during operations.

Lighting Areas:

- **Requirement:** Provide sufficient illumination in critical areas, including:
- **Vehicle Manoeuvring Areas**: Areas where vehicles circulate and interact with pedestrians.
- **Loading and Unloading Zones**: Areas designated for the handling of goods.

6.1.3.3 Avoiding Sudden Changes in Lighting Levels

Gradual Lighting Transitions:

Implement measures to provide gradual transitions between different lighting conditions (e.g., from dark warehouses to bright outdoor areas) to minimize glare and improve visibility.

Lighting Maintenance:

Regularly inspect and maintain lighting systems to ensure they are functional and meet safety standards. Conduct routine checks and address any issues promptly to maintain adequate lighting levels.

6.1.4 Design of Haul Roads in Mines[1]

Business unit shall ensure:

- All roads for trucks, tippers, dumpers, or other mobile machinery shall be constructed to suit their load capacity and maintained in good condition. No vehicle other than HEMM shall be used on haul roads except between designated points and when permitted in writing by the Business Head.
- Design, construction, dimension, and layout of haul roads shall be laid down at Business unit level in respect of each opencast mine.
- All haul roads in opencast workings shall be arranged to provide one way traffic having width of the largest vehicle plying on that road plus 5m. Where this is not practicable, no road shall be of a width less than three times width of the largest vehicle plying on that road plus 5m.
- All corners and bends on roads shall be made in such a way that the operators of vehicles have a clear view of distance of not less than 3 times the breaking distance as specified by the manufacturer in respect of the HEMM speeding at 40 Km/hour. Where it is not possible to ensure a visibility for a distance as mentioned above, there shall be provided with two separate roads of width not less than 2 times plus 3m of largest vehicle plying on the road with a strong road divider at centre with adequate lighting and reflector along the divider.

[1] Refer Gazette Notification G.S.R. 976 (E) – Ministry of Labor and Employment

- No road shall have a gradient steeper than 1 in 16, Ramps shall be used for crawler mounted machines only and not for tyre mounted machines. Gradient of ramps shall not be steeper than 1 in 10 and its length shall not be more that 50m at one stretch.
- Where any road existing above level of surrounding area, it shall be provided with strong parapet wall/embankment of following dimensions: i) Width at top-not less than 1 m. ii) Width at bottom-not less than 2.5m. iii) The height not less that the diameter of the largest tyre of the vehicles plying on the road. Dumping of mud or overburden shall not be treated as strong parapet wall.
- Separate haul road shall be provided for light vehicles plying in the mine premises. Where it is not practicable, definite turnouts, crossing points and waiting points shall be designated for use of vehicles.
- Pedestrian or two wheelers shall not be allowed to travel on the haul road made for trucks, tippers, dumpers, or other mobile machinery.
- Road signs with fluorescent paint shall be provided at every turning point for guidance of drivers especially at night times.
- At every curve, parapet walls or vertical posts with ‘Zebra’ line shall be provided to help the drivers to keep the transport vehicle on the track especially at night times.
- Suitable drainage system shall be provided and maintained on one side of the haul road.

6.2 SAFE SITE ACTIVITY

6.2.1 Road Repair Preparedness

JSW Business Units/Sites should develop and adhere to the following comprehensive road maintenance guidance, tailoring practices to site-specific conditions and requirements. This includes establishing detailed road maintenance procedures and inspection frequencies:

6.2.1.1 General Safety Guidelines:

- Ensure all maintenance workers are trained in road safety and foster a safety culture.
- Mandate the use of fluorescent orange safety jackets and ensure workers check for oncoming traffic before entering the road surface.
- Avoid sudden stops and always park maintenance vehicles off the road surface. Equip all maintenance vehicles with yellow flashing lights and "Maintenance Vehicle" signs.
- Maintain appropriate temporary signage, promptly remove or cover unnecessary signs, and clear accident scenes quickly. Schedule maintenance to avoid peak traffic periods.

6.2.1.2 Pavement Repair:

- Prioritize keeping all road surfaces in a safe condition for travel. Conduct regular inspections to detect and repair pavement failures promptly.
- Address common distresses such as potholes, subgrade failures, and alligator cracking. Ensure rapid completion of repairs for severe pavement issues.

6.2.1.3 Roadway Surface Maintenance:

Implement a regular inspection schedule for:

Infrastructure	Frequency
Signs	Annually
Road Markings	Annually
Guardrails	Monthly
Structures	Annually
Flexible and Rigid Road Conditions	Annually
Drainage Systems	Monthly
Fencing and Informal Settlements	Monthly
Illegal Access Points and Level Crossings	Monthly

6.2.1.4 Dust Control:

Adapt dust control systems on gravel roads to minimize safety hazards. Regularly identify and address roadway segments requiring dust control.

6.2.1.5 Railway Crossing Maintenance:

Inspect railway crossings weekly and immediately after nearby maintenance activities. Ensure crossings are clear of debris and notify railway operators if maintenance affects crossing operations. Maintain signage according to infrastructure standards.

6.2.1.6 Delineators and Guardrails:

Install and maintain delineators at road alignment changes, width changes, and roadside hazards. Regularly maintain guardrails to protect against obstacles, bodies of water, and steep slopes.

6.2.1.7 Litter Clean-Up:

Maintain clean roadways to prevent equipment damage and create a positive impression.

6.2.1.8 Sidewalk Maintenance:

Regularly inspect and maintain sidewalks adjacent to roadways.

6.2.1.9 Signage and Line Painting:

Check and maintain signage regularly to ensure functionality and compliance with standards. Perform night inspections to verify signage reflectivity.

- Conduct line painting as follows:
- Centre Lines: Annually
- Shoulder Lines: Annually, alternating sides
- Other Lines: Annually or biennially, based on traffic volume.

6.2.1.10 Roadway Illumination and Sweeping:

- Ensure proper illumination and functioning of traffic signals for safety.
- Conduct scheduled sweeping to remove debris from road surfaces and prevent damage. Ensure sweeping is performed at intersections, bridge decks, and raised medians.

6.2.2 Parking

Business unit should consider:

- **Parking for Heavy vehicle outside Plant:** Designated heavy vehicle parking area outside plant boundary with facility for coordinating traffic movement, rest rooms, cafeteria, bathrooms, and toilets facilities should be provided for drivers and helpers. Suitable Public Addressing system & or any other effective communication system should be installed in the Driver's Rest Area. Suitable means of training aid and or TV/ CD player should be installed for education and entrainment.
- **Parking for Heavy Vehicle Inside Plant:** There should be a designated temporary parking area with covered sitting arrangement and hard barricading to ensure isolation from moving vehicle. Basic amenities for the transportation staff should be provided nearby parking area.
- **Parking for Passenger vehicle:** There should be designated and marked parking place for employees, visitors, and vendors. It is recommended for upcoming project site; these parking places are kept outside the plant.
    - The parking area usage should not be more than 50 percent of allocated area for easy movement of the parked vehicle. There should be separate ENTRY and EXIT for vehicle in the outside parking area.
    - There should be separate ENTRY and EXIT for vehicle in the outside parking area. Wherever,

if this is not possible, there should be at least hard barricading separation between entry and exit.
  - For effective communication, suitable Public Addressing system & or any other means should be ensured.
- **Best practices on vehicle parking requires "Minimum 7 feet"** distance should be maintained between two trucks while parking in Series/ Parallel at all Permanent/ Temporary parking areas. The requirement should be mandatory for new site but should be deployed wherever possible at the existing site. However, marking should be made compulsorily.

In Parking areas, following minimum requirements should be ensured:
- Parking at Fish Bone area with proper marking or install stone blocks.
- Hand brake application in practice, ignition key removed; and wheel chocks placed at both front and rear.
- Safe distance between vehicle & inspector.
- Monitoring through CCTV Camera.
- All persons in area to wearing high visibility clothing.
- PA System
- Pedestrian Walkway with proper marking or install hard barricading.
- Road marking & signage
- Physical barrier
- Seat belt compliance.
- Ensure drive-through parking for all vehicles to avoid reversing; otherwise, use angled bays to minimize reversing.

6.2.3 Reversing Risk Management and Improvement Plan

6.2.3.1 Inventory of Reversing and Vehicle Interfacing Locations:

- JSW Business Unit/Site should compile a comprehensive list of all locations within the plant where reversing operations occur and probable vehicle interfacing is happening. Reversing inventory should detail specific areas, the frequency of reversing activities, and associated risks.

6.2.3.2 HIRA Update:

- Ensure that reversing and vehicle interfacing risks identified are accurately reflected in the Hazard Identification and Risk Assessment (HIRA). The HIRA should be updated to include details on reversing hazards, implemented controls, and any changes to risk levels based on new improvement measures. Vehicle interfacing risks should also be addressed similar to reversing.

6.2.3.3 Risk Reduction Strategies (Reversing):

- **Minimize Reversing Needs:** Design and organize the plant layout to reduce the necessity for reversing, such as implementing one-way systems where feasible.
- **Organize Business Units:** Arrange business units to minimize reversing requirements where one-way systems cannot be implemented.

6.2.3.4 Safety Measures:

- **Install Barriers:** Place barriers to prevent vehicles from entering pedestrian zones.
- **Designate Reversing Areas:** Clearly plan and mark designated reversing areas to ensure safe operations.
- **Control Access:** Keep people away from reversing areas and operations to prevent accidents.
- **Enhance Communication:** Use portable radios or similar communication systems to coordinate reversing activities and enhance safety.
- **Improve Visibility:** Increase drivers' ability to see pedestrians through better site lighting and visibility aids.
- **Equip Vehicles:** Install safety equipment on vehicles, such as reversing alarms, flashing beacons, and proximity-sensing devices, to assist drivers and alert pedestrians.

6.2.3.5 Implementation and Review:

- Implement the above measures and regularly review their effectiveness. Adjust procedures and controls as necessary to ensure ongoing safety and risk mitigation.

6.2.3.6 Signalling

Business units who use Banksman should consider.

- Only trained banksmen are used.
- they are always clearly visible to drivers.
- a clear and recognized system is adopted.
- they stand in a safe position throughout the reversing operation.

6.2.4 Loading and Unloading

Each JSW Business Unit or site should develop comprehensive, site-specific guidelines for loading and unloading operations. These guidelines should encompass the following elements to ensure safety, compliance, and operational efficiency:

a) All customer trailers/ trucks or spot haulers trucks should be inspected before entering an JSW site making sure that they are in a safe operating condition (tyres, brakes, steering wheels, reverse alarm, mirrors, signal and reversing lights, horn, etc. For regular / dedicated vehicle the system of inspection should be in the form of sample minimum check points/ Self- certification. **Annexure: 4**

b) It is recommended that minimum check points should be verified by Security while entry of vehicle in the truck parking yard/ at the main gate OR by location logistic head.

c) As part of the site circulation plan, a site waiting area or truck parking, even if it is outside the site, should be provided and managed.

d) Loads carried should meet the following requirements:

- Loads carried by vehicles should be safely secured and within the maximum permissible gross weight limits specified by the vehicle manufacturer for both rigid, tractor, trailer units, or within the legal limit where more restrictive. 2
- For all loadings where employees or contractors need to step up on the truck (e.g., Chemical/Dry cargo), the truck should be locked. Work at Height (JSW/GHS/GS-12) and LOTO (JSW/GHS/GS-07) procedures, along with adequate securing arrangements for covering and energy isolation, should be ensured.
- When a vehicle is parked, wheel chocks should be used under front and rear wheels from both sides.
- The site circulation plan should be developed to allow loading trucks without having to reverse into position. This should be followed while designing a new plant.
- While loading loose material, a safe loading practice should be implemented. The loading of material should be done from centre of the vehicle and heap of the material should not be allowed near the edge of the tail/side door to avoid spillage.

e) **Covering of material loaded on the vehicle (sheeting)**

- Loads of lighter and loose material should be covered by a sheet/ tarpaulin prior to travelling on the public highway. All vehicles delivering dry cargo should be fitted with a mechanical sheeting system that enables the driver to sheet the load either manually or automatically from ground level or from within the vehicle cab. However, to facilitate safe covering, securing arrangement should be provided at the site to ensure that people engaged in tarpaulin covering are safe from risk of falling.
- Unloading at customer Sites/ Locations should follow all JSW rules and procedures wherever group will be required to deliver the material at client place as per contractual term.

- [2] (Refer: RT11028/1112017-MVL Government of India Ministry of Road Transport 8.: Highways (Transport Division) Document download link ser no. 37 Dt. 07.08.2018: https://morth.nic.in/Circulars-Notifications-related-to-Road- Transport?page=3

- Information should be provided on the nature of the cargo and how it should be properly loaded, secured, and unloaded. This information should accompany the vehicle and be provided to all involved in loading, transportation and unloading activities.
- Prevent reversing as far as practicable. If reversing cannot be avoided, consider using 'banksmen' to guide drivers and make sure reversing areas are free of pedestrians. If you are using banksmen, make sure that only trained banksmen are used, they always remain clearly visible to drivers, a recognized system for communicating instructions is adopted; and they stand in a safe position throughout the reversing operation.

The loading and unloading area should be:

- Clear of traffic and people; on level ground and segregated from other work areas; clear of any overhead cables, pipes, or other obstructions; and protected from bad weather where possible.
- During loading / unloading, there should be a safe place where driver / crew can wait safely.
- Ensure necessary measures are in place to prevent vehicles being driven off prematurely – e.g. traffic lights on loading bays, vehicle or trailer restraints or securing keys in a 'custody' system, wheel chock etc.

f) All employees and contractors visiting customer Sites/ Locations should be made aware of the hazards associated with loading and unloading and be able to undertake an assessment of the risks. This can be achieved through a combination of communication (e.g., 2-way discussions), basic guidance, tools (e.g., hazard checklist) and formal training.

6.2.5 Preventing Vehicles from Overturning

JSW Business Unit/Site Management and Operators shall be responsible for implementing the measures to prevent truck overturns. Operator should:

- Be thoroughly familiar with the equipment, its operation, safe delivery unloading procedures and the unloading location.
- Ensure the truck is not loaded more than the Gross Vehicle Load Rating shown on the vehicle identification/serial number plate and ensure the load has been evenly distributed during loading.
- Perform a walk-around check of the equipment and site prior to setting up to unload. All potential concerns (unstable ground, sloping surface, high wind, illumination etc.) for imbalance conditions should be addressed before attempting to unload.
- Check prior to raising the body that it will not encounter power lines or other obstructions when in the fully raised position.
- Make sure the tailgate is in the OPEN position before unloading.
- Ensure he/ she stays at the controls while tipping and lower the body immediately if the body leans or shifts to one side while dumping. Subtle changes in mechanical equipment, such as sound, suspension, movement, or frame torque can provide early warning of load imbalance.
- Ensure the operator always remains in the cabin of the truck with seat belt fastened.
- Ensure the area is clear of pedestrians and equipment before unloading.
- Ensure the wheel stopper, berm or bund is at least half the height of the truck wheels before dumping in a hopper or pit.
- Do not drive, park, or unload next to any excavation.
- Ensure trucks and tractor-trailers have audible reversing alarms.
- To protect dump body hitting to the overhead electrical line/ structure while moving the tipper", device should be installed for "Dump body raised position indicator with warning". (Refer: DGMS circular No.6 of 2020 Dhanbad dated 27.02.2020)
- Vehicles should be equipped with tilt sensors and load cells. Tilt sensors help detect unsafe tilting conditions, providing early warnings of potential instability. Load cells measure and monitor the weight of the load, helping to prevent overloading and ensuring that the vehicle remains stable throughout operations.

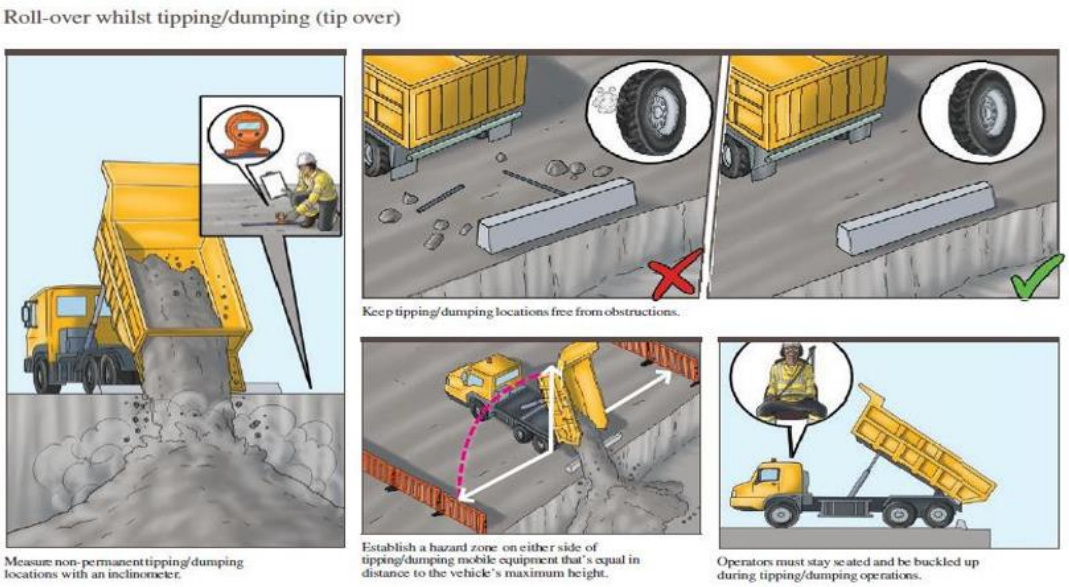


Figure-9 : Precautions to Be Taken to Prevent Roll Over While Tipping

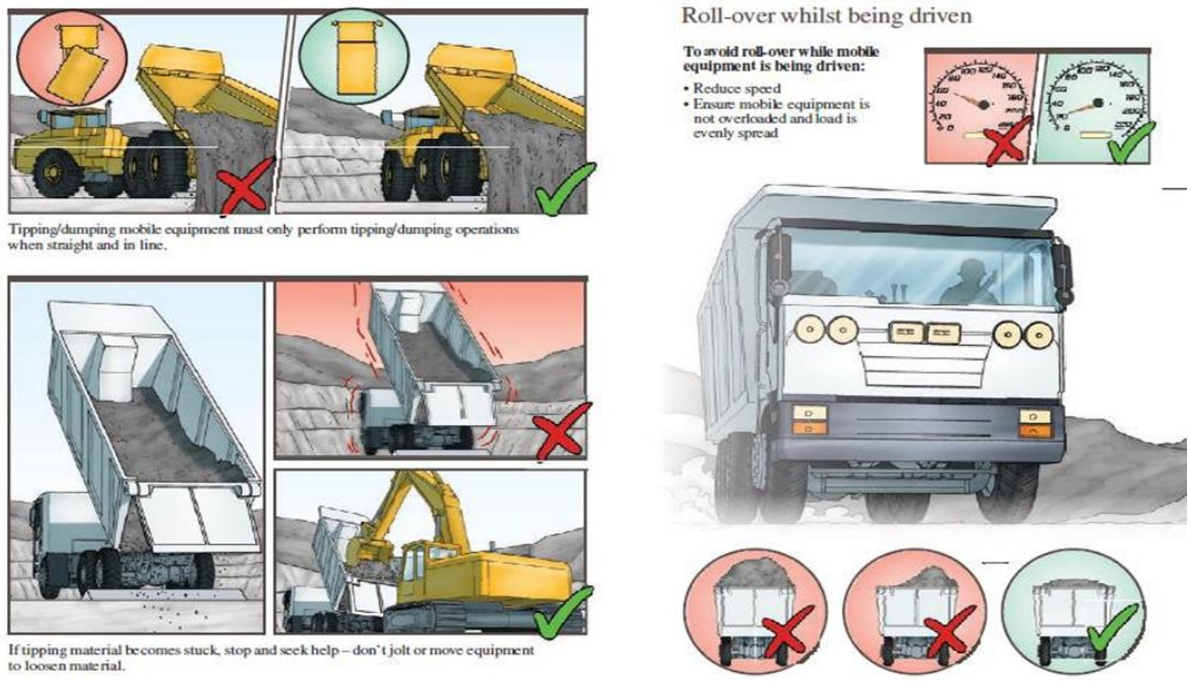


Figure-10 : Precautions to be Taken to Prevent Rollover While Driving

6.2.6 Towing Disabled Vehicles, Pulling and Retrieving Stuck Vehicles

6.2.6.1 General Towing and Jump Starting:

- Towing or manual pushing of breakdown or stuck vehicles within sites/locations is prohibited unless authorized by the Site/Location Head.
- For starting issues, use a battery booster mechanism. It is recommended to establish battery booster jump start systems at all sites/locations.

6.2.6.2 Operator Responsibilities for Disabled Vehicles:

- **Activate Hazard Lights:** Turn on four-way flashers (hazard warning lights). If this is not possible, use other available methods to alert others.
- **Communicate Location:** Inform concerned personnel of the parking location via radio, telephone, or other means.
- **Avoid Leaving Unattended:** Do not leave the disabled vehicle unattended.
- **Mechanic Notification:** If a mechanic is needed, follow the steps outlined below.

6.2.6.3 Responsibility and Communication:

- **Driver/ Operator:** Steer the vehicle to the side of the road, engage the handbrake, switch off the engine, remove the key, place wheel chocks, and inform the Transport Supervisor/owner.
- **Transport Supervisor:** Assess the vehicle and notify the Site/Location Logistic Head, Shift-in-Charge, and Duty Security Officer. The Duty Security Officer will then inform the Site Safety Head.
- **Shift-in-Charge:** Arrange for the vehicle to be barricaded and brief the Plant Logistics Officer about the nature of the breakdown.
- **Site Safety Head, Security Officer:** Decide whether to repair the vehicle inside the plant or send it for external repair.
- **Site Section Head, Site Safety Head:** For minor repairs, carry out work inside the plant/operational area with notification to the Business Head, taking permits, and conducting a risk assessment.
- **Site Safety Head, Competent Person:** For external repairs, perform a risk assessment and ensure proper towing using appropriate slings/tackles.
- **Site Safety Head, Security Officer:** After repair, check the vehicle's serviceability and certification before permitting it for loading/unloading.

6.2.6.4 Risk Assessment for Vehicle Repair/Maintenance:

- **Potential Hazards:** Assess risks including:
  - Vehicle being hit by another vehicle during repair.
  - Rollover of the breakdown vehicle.
  - Vehicle falling from a jack.
  - Injury due to falling/slipping tools or equipment.
  - Towing tackles breaking or hitting the towing vehicle.

6.2.6.5 Personal Protective Equipment (PPE) for Maintenance Staff:

- Safety shoes or appropriate footwear.
- Safety gloves (preferred).
- Reflective jacket.
- Safety goggles (if possible).

Refer PPE standard (JSW/GHS/GS-05) for more details on PPE.

6.2.6.6 Maintenance Procedure:

Ser. No.	Description	Responsibility
1	In case of breakdown Driver/ Operator will steer the vehicle to the side of the road, hand brake on, switch of the engine, remove the key, place the wheel chock, and inform the Transport Supervisor/ owner	Driver/ Operator
2	Transport supervisor after assessing the vehicle will inform the Site/ Location Logistic Head, shift in-charge and Duty Security officer. Duty Security officer will inform the Site Safety Head	Transport Supervisor, Site/ Location Logistic Head, Duty Security officer
3	Shift in-charge will arrange for the vehicle to be barricaded and brief the Plant. logistics officer about nature of the breakdown.	Duty Shift in-charge,

Ser. No.	Description	Responsibility
4	After getting brief information Site Safety Head, Security officer and Logistic duty shift in-charge will take decision to undertake repair inside the plant or send vehicle for repair to outside the plant	Site Safety Head, Security Officer
5	If minor repair is there, then it will undertake inside the plant/operational area. User department should notify to Department head and work to be done after taking permit and conducting risk assessment.	Site Section Head, Site Safety Head
6	If vehicle should be taken outside the Site/ Location risk assessment has to be carried out and vehicle will be towed using appropriate slings/ tackles (Tackles to be inspected for serviceability by competent person in plant)	Site Safety Head, Competent person
7	After repair, vehicle will be check for serviceability and certified by transporter. It will then bel permitted for loading/ unloading	Site Safety Head and Security officer

Table-3: Description and Responsibility

- Ensure all site-specific authorization and energy isolation procedures are followed as per site regulations.

6.2.7 Transportation of Protruding and Hazardous Materials

- **Protruding Material:**
    - HMV (Heavy Motor Vehicles): Protrusions should not exceed 1 meter from the end of the body.
    - LMV (Light Motor Vehicles): No protruding material allowed.

- **Vehicle Fitness:** Ensure the vehicle is fit for transporting protruding or hazardous material.
- **Dimension Measurement:** Measure dimensions of protruding material and ensure the centre of gravity is maintained for balance.
- **Route Survey:** Verify clearance along the route and ensure safety for transportation.
- **Dangerous Goods:** Notify relevant authorities as per local regulations and ensure compliance with transportation laws.
- **Night Transport:** Use red bulbs or flags for visibility of protruding materials.

6.2.7.1 Vehicles for Bulk Explosives or Hazardous Materials:

- **Vehicle Requirements:**
    - Display appropriate signage and Material Safety Data Sheets (MSDS).
    - Have means for emergency contact and suitable firefighting equipment.
    - Comply with legal permitting requirements.

- **Fire Prevention:**
    - Display relevant information about the load.
    - Use international signage for dangerous goods.
    - Maintain a manifest accessible on the vehicle.
    - Equip vehicles with spark arresters and static discharge systems.
    - Fit appropriate firefighting extinguishers based on engine rating.

Engine Rating	Extinguisher Agent	Extinguisher Size
Less than 100 kW	30B(E)	2kg - 3kg
101 kW to 200 kW	80B(E)	4.5kg - 9kg
Greater than 200 kW	120B(E)	40kg - 60kg

6.3 CYCLING SAFETY AND TRAFFIC MANAGEMENT

6.3.1 Personal Safety Gear

Cyclists should wear:

- A bicycle helmet.
- Clothing that will not get tangled in the chain, wheels, or obscure lights.
- A fluorescent high-visibility jacket to enhance visibility in low light conditions.
- Reflective tape on the helmet to improve visibility at night.
- Ensure cycling safety and traffic rules are part of the overall safety training program for all employees, emphasizing the importance of safe cycling practices.

6.3.2 Safe Cycling Practices

Cyclists should follow these rules:

- Never ride with one hand on the handlebars, except when signalling. Keep both hands on the handlebars.
- Keep both feet on the pedals.
- Use the cycle lane where provided.
- Do not carry items that could affect balance or get tangled with the cycle wheels or chain.
- Stop before entering moving traffic from driveways, parking lots, minor roads, or behind parked vehicles. Proceed only when the way is clear.
- Ride on the left side of the road, in line with other traffic.
- Be cautious when passing stopped vehicles as doors may open suddenly.
- Adhere to traffic signals as required for all vehicles.
- Avoid overtaking vehicles that are turning. Speed limits apply to cyclists as well.
- Follow all traffic light signals and laws to ensure safety.
- Equip the cycle with reflectors on the front, rear, and sides for increased visibility.
- Do not use headphones or earphones to maintain awareness of surroundings.
- Make eye contact with heavy vehicle operators to ensure they see you before proceeding.
- Recognize and reward employees who consistently demonstrate safe cycling behaviour and adherence to traffic rules.

6.3.3 Infrastructure and Facilities

6.3.3.1 Dedicated Parking:

- Install secure and weather-protected cycle parking facilities at strategic locations throughout the plant, including near main entrances, office buildings, and common areas.

6.3.3.2 Awareness-Raising:

- Educate cyclists about drivers' blind spots, particularly with vehicles commonly used within the plant.

6.3.3.3 Maintenance and Inspection:

- Regularly maintain cycling pathways to ensure they are free from hazards such as potholes, debris, and obstructions.

- Conduct periodic safety inspections of cycling infrastructure, including pathways, barriers, and signage, to address issues promptly.
- Establish a reporting system for cyclists to notify plant authorities of safety concerns or maintenance needs related to cycling infrastructure.

6.3.3.4 Traffic Operations

- Business Unit shall develop Standard Operating Procedures (SOPs) to address traffic operations, especially during peak periods, to enhance safety for cyclists.

7. SAFE VEHICLES

7.1 SELECTION AND ACCEPTANCE CRITERIA FOR VEHICLES

- Selection of the vehicles should be done as per the suitability of purpose, safety features, serviceability, operational cost, technology, comfort, and its resale value.
- Registration (All the hired vehicle for the passenger shall have registration as TAXI), Fitness, Insurance, Pollution Under Control (PUC), National Permit if applicable, Registration number shall be displayed relevant to the category as per the applicable national/ international motor vehicle legislation.
- The age of the vehicle shall not exceed the permissible limit assigned by the applicable national/ international motor vehicle legislation.
- All sites should have the criteria; to discard their vehicles operating inside controlled premises based on guidelines approved by Group Safety Council dated 10th November 2021, these guidelines are mandatory for all operation, maintenance, and construction activities. Compliance is required immediately.

Table-4: Vehicle Age Limit

Type	Age Limit
Trucks/Tippers/Trailers/Forklifts	15 Years (for internal movement under long-term contracts)
Bus	15 Years
Passenger Cars/Other Vehicles	10 Years

Exceptions and Approvals:

If any business unit requires modifications to these age limits, prior approval from the Group Safety Council (GSC) should be obtained.

7.2 VEHICLE MANAGEMENT – COMPULSORY FOR INTERNAL AND FOR EXTERNAL VEHICLES

All vehicles shall be equipped with the following safety features:

- **Three-Point Retractable Seatbelt:** For all seats.
- **Driver & Passenger Airbags:** Installed for added protection.
  Anti-Lock Braking System (ABS): To prevent wheel lock-up during braking.
- **Rubber Pads:** On all pedals for enhanced grip.
- **Laminated Windshields:** To prevent shattering.
- **Emergency Toolkit:** Includes a toolkit, suitable spare wheel and tire, wheel changing kit, and spare parts (e.g., bulbs, fuses, fan belts).
- **Safety Emergency Equipment:** First-aid kit, flashlight/torch, reflective vests, and at least two warning triangles or cones (one in front and one in back for two-lane roads).
- **Cargo Stowage Devices:** For securing loose equipment in the passenger compartment, cargo area, or on the vehicle body.
- **Driver Side Rear View Mirror:** Essential for visibility.
- **Passenger Side Rear View Mirror:** For additional visibility.
- **Ergonomically Designed Driver's Seat:** Cabin should also provide heat restraint.
- **Reversing Audible Alarm or Reverse Lighting System**: For safety during reverse manoeuvres.
- **Wheel Chock Blocks:** With handles for easy removal without putting the foot or hand under the truck wheel.

a. **In-Vehicle Management System (iVMS):** For tracking and monitoring.

- **Rear and Side Under-Run Crash Protection:** For Trucks, Trailers, Bulkers, Transit, and Dumpers.
- **Mudguards and Mud Flaps:** To minimize splashing.
- **Reflector Tapes:** Fitted on all vehicles for visibility.
- **Essential Vehicle Components:** Self-starter, headlights, rear lights, horn, brakes, wipers (mandatory during monsoon), brake lights, side indicators, hand brake, and tire management.

- **Cabin Door:** should have a proper locking arrangement.
- **Goods Drop Side and Tailgate:** should be properly locked with no spillages.
- **Heavy Vehicles:** fitted with a reverse horn and reverse camera.

External Vehicles:

The above requirements also apply to external vehicles through fresh contractual agreements with service providers and may be implemented in a phased manner.

Safety Features of HEMM:

Refer to Annexure -3 for detailed specifications.

Driver Ergonomics and Posture Guidelines:

To prevent musculoskeletal disorders and enhance comfort, drivers should follow these guidelines:

- **Avoid Beaded Seat Covers**: They can reduce the effectiveness of the seat belt.
- **Proper Hand/Wrist Positioning:** Avoid bent wrists by adjusting hand placement or the steering column tilt.
- **Avoid Excessive Gripping:** Minimize force on the steering wheel, especially in stressful situations.
- **Head Restraints:** Ensure the middle of the restraint aligns with the height of the ear and that the top edge is not lower than the top of the ears.
- **Seat Adjustment**: Position seats upright, adjust for personal body dimensions, and provide adequate lumbar support. Use a pillow if lumbar support is non-adjustable.
- **Leg Positioning:** Ensure knees are slightly higher than hips.
- **Frequent Breaks:** Avoid prolonged sedentary positions; stop for a walk or stretch.
- **Moderate Interior Temperature:** Maintain a comfortable temperature within the vehicle.
- **Safe Exiting:** Minimize torso or knee twisting when exiting the vehicle by swinging both legs to the side and stepping straight ahead.
- **Loading/Unloading:** Keep items close to the body to avoid extended reaches and bent backs.
- **Wallets:** Remove from back pockets before sitting for extended periods to avoid nerve irritation.

7.3 VEHICLE INSPECTION

All JSW Sites/ Locations should ensure that all vehicles are inspected prior to trip and at regular intervals and as a minimum following parameter but not limited to, should be inspected and documented as a part of their road and driving safety Management Program.

- Breaking system and components.
- Exhaust system.
- Smoke opacity (diesel).
- Gaseous emissions (petrol, natural gas or liquefied petroleum gas (LPG)).
- Steering linkages.
- Lamps, lighting and signalling devices.
- Wheels/ tyres.
- Suspension (visible defects).
- Chassis (visible defects).
- Tachograph (installation).
- Speed limiting device (installation).

Any vehicle considered to be defective should be clearly marked and disabled using a “lock-out, tag-out” system to ensure people are able to readily identify the vehicle as “out of service”. If any vehicle is permitted with minor deficiencies deviation should be approved by plant logistic head and documented.

Each unit or business should maintain a comprehensive inspection checklist, which should be used consistently to document the condition of the vehicle and the findings of each inspection.

7.4 MAINTENANCE REQUIREMENTS

JSW Business Unit/Site should ensure that all vehicles and associated equipment should be maintained to ensure they remain in efficient state, working order and good repair. All the receipts of such servicing

should be maintained in the logbook. No repair/ alternation in the vehicle should be performed by the driver or any unauthorized vendor.

Recognize or reputed service establishments should do the work and records to be maintained in the logbook. One copy of this maintenance record should be submitted on transporter's letterhead to JSW on a half yearly basis. The following guidelines outline the required procedure for vehicle maintenance and safety protocol:

Regular Preventive Maintenance:

Vehicles should undergo regular preventive (planned) maintenance inspections based on time or mileage, following the manufacturer's guidelines. Key maintenance areas include:

- **Braking system:** Ensure brakes are effective for both general service and parking, properly connected, and balanced if independent.
- **Steering system**
- **Tyres:** Check for correct inflation, good tread, and overall condition.
- **Visibility and hazard detection equipment**: Inspect CCTV cameras, sensing systems, windscreen washers, and wipers.
- **Warning devices:** Verify functionality of horns, reversing alarms, and lights.
- **Access and support equipment:** Examine ladders, steps, and walkways.
- **Moving parts and systems:** Inspect pipes, hoses, rams, outriggers, and lifting systems.
- **Lubricant and hydraulic fluid levels**, and pneumatic pressure levels.
- **Safety systems:** Check control interlocks and anchor points.

Inspection Documentation:

Business Unit should maintain a comprehensive inspection checklist and document all findings. Vehicles with minor deficiencies can operate only if deviations are approved by the Plant Logistic Head and are properly documented.

Reporting and Addressing Deficiencies

Problem Reporting System:

- Business Unit should implement a simple reporting system for drivers to report any issues. Vehicles that are deemed defective should be marked clearly and disabled using a "lock-out, tag-out" system to indicate they are "out of service."
- Ensure a process for deciding in a vehicle is safe to use or needs repair, including documentation of all decisions.

Safety During Maintenance

Safe Systems of Work:

Establish safe systems of work for vehicle maintenance and repair to minimize the risk of injury. This includes:

- Training for maintenance personnel
- Use of appropriate safety gear
- Adherence to safe work practices and procedures
- Thorough Examination of Lifting Equipment
- Lifting Equipment Inspection
- Use mechanical safety devices such as inflation cages or barriers to protect personnel from potential blowouts or tire bursts during inflation.



Figure-11 : Sample Example of Tyre Cage

8. SAFE DRIVERS

The single most critical element in road safety management is the driver. Health and safety considerations begin at the recruitment stage for new employees, as they may drive on company business from their first day. Drivers should be physically, mentally, and emotionally fit, competent, qualified, and insured to drive for JSW.

8.1 SELECTION OF DRIVERS

Business unit shall ensure that:

- Driver/ Operator age should be not less than 25 Years with at least 3 years of driving experience for heavy vehicles, not less than 22 years with at least 3 years of driving experience for light motor vehicle and not less than 25 years with at least 5 years of experience for HEMM.
- All employees who drive on business for JSW Operations shall have a valid national driving license appropriate to the vehicle driven and be knowledgeable of the rules of the road in the country in which they drive. Processes shall be in place to ensure licenses are checked upon recruitment and at regular intervals.
- All newly appointed drivers shall attend a driving induction course before being allowed to drive for JSW operations. The induction training shall be specific to the job requirement and task (Refer Annexure –1 Defensive Driving Training Program)
- Business units shall provide those that drive a company vehicle on company business with a suitable documented authorisation from the company e.g., internal driving license which specifies the type of vehicles they are permitted to drive. This shall only be issued after a driver has completed the requisites Unit training and associated competence assessment test and subject to a satisfactory medical. This information shall be kept on a central register.
- A health assessment should be conducted for all potential drivers as part of the recruitment process. An initial pre-employment health questionnaire could be completed for this purpose. This should be developed with the help of a qualified Occupational Health (OH) professional and handled according to the established rules of country-specific medical confidentiality and data protection legislation and employment law. Where results indicate there is or may be a problem, the employee can be referred to an OH specialist for further assessment before recruitment.

Health Assessment should include minimum:

- Eyesight/ vision – at least every two years or more frequently if advised by an optician or as per National/ International legislation.
- Physical mobility (ability to fully control and operate the vehicle).
- Hearing (for warning signs and spoken instructions); and
- Understanding of instructions and risks associated with duties.

8.2 SAFETY AND DRIVING REQUIREMENTS FOR DRIVERS

Business Unit shall ensure that:

- Drivers shall have a valid driving license for the type of the vehicle being driven.
- Drivers including passengers shall wear three-point retractable seat belt.
- No unauthorized pillion riders shall be allowed in the vehicle engaged in business purpose. Specific motorized / battery driven vehicle like tractor trolley, forklifts shall not allow any pillion ride.
- Two-wheeler drivers and the pillion rider travelling for JSW business purposes shall wear crash proof safety helmet as prescribed under the country specific Motor Vehicle Rules or by respective transport authorities such as IS 4151 in India; FMVSS 218, the Federal Motor Vehicle Safety Standard #218 in USA and BSI 6658 in U.K.
- Compliance with the organization’s Drugs and Alcohol Policy.
- Compliance with rest breaks prescribed by applicable legislation or by the concerned JSW Company.
- Mobile phones and cell broad cast or similar radio apparatus shall not be used when driving except for the following:
    - Using a 2-way "press to talk" radios, such as used by the emergency services and taxi drivers.

  - Using a hand-held phone for a genuine emergency call to police fire ambulance or other emergency services if it would be unsafe for the driver to stop.
- Persons other than the registered drivers shall not be permitted to drive the JSW vehicles at any time.
- Unauthorized person shall not be permitted to enter in the vehicle at any time before, during and after the trip.
- The impounding of a driving license by the government enforcement agency for any breach of applicable regulatory requirement shall be promptly informed to responsible person of the JSW site.
- The driver shall ensure that all legal valid documentation as obtained from the competent transport authority under the applicable legislation is maintained in the vehicle in always protected or on Govt. of India digilock site or Ministry of Inland Transport online vehicle record site and readily available manner. These shall include:
  - Shipping documents as prescribed by the Site.
  - Valid Driving License appropriate for the category of vehicle being driven.
  - Valid Vehicle Certificate of Registration.
  - Valid Road Transport Permit.
  - Valid Insurance certificates.
  - Road Tax Payment Documentation.
  - Pollution Control Certificates
  - Certificates of Fitness of transport vehicles, as applicable; and
  - Any other as per applicable legislation or transport condition.
- The service provider shall ensure that all necessary documentation as per applicable legislation is provided to all drivers for their respective vehicles.
- The service provider shall ensure that all the drivers are communicated and explained the core driving standards and other information in local language.
- All on-roll and hired vehicle drivers shall be trained and certified as per defensive driving guideline. (Annexure -1)

8.3 PROHIBITED BEHAVIORS FOR DRIVERS

- Operating Mobile Equipment in an unsafe manner, e.g. unsafe speed, reckless manoeuvres, reversing without observation, warning signal, horn, or lights as applicable.
- Driving Two-wheeler inside controlled premises. (Two-Wheeler usage is prohibited).
- Riding in Mobile Equipment that is not designed to carry passengers: i.e. no passenger seat and or seatbelt.
- Using Mobile Equipment for a purpose for which it was not designed.
- Doing something that distracts from proper concentration i.e.:
- Using mobile communications whilst operating Mobile Equipment
- Not keeping a cabin free of loose objects that could interfere with its controls.
- Leaving keys in the ignition of unattended Mobile Equipment.
- Leaving Mobile Equipment without applying park brake.
- Drivers should ensure safety by turning off the vehicle engine, putting it in park and setting the emergency brake, disabling any auxiliary ignition sources, avoiding smoking or using lighters, using only the refuelling latch on the nozzle without forcing it, not re-entering the vehicle during refuelling unless necessary (in which case they should discharge static buildup by touching metal away from the nozzle), and in case of a static-caused fire, leaving the nozzle in the fill pipe, backing away, and informing the relevant authorities, while using approved pumping equipment, hoses, and top fill nozzles.

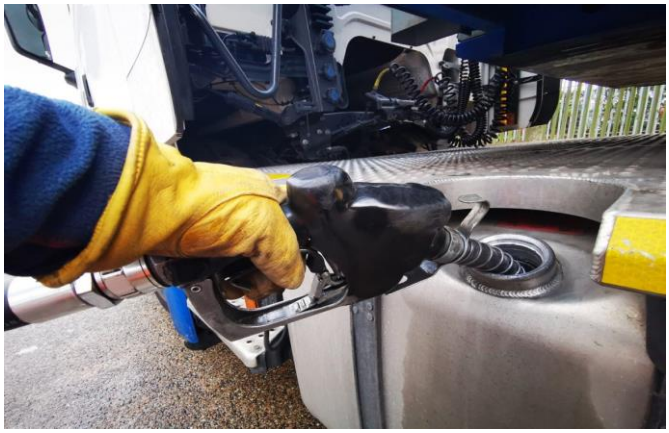


Figure-12 : Safe Refueling

- Knowingly overloading or operating Mobile Equipment with an insecure load.
- Knowingly using Mobile Equipment on unstable or unsuitable ground.
- Using mobile phones while walking in areas where it could reduce a person's ability to hear oncoming traffic.
- Not reporting Mobile Equipment or on-site Traffic incidents to a supervisor.



Operate mobile equipment in an unsafe manner; e.g. unsafe speed.



Use mobile phone or other device while operating mobile equipment or walking/standing near them.



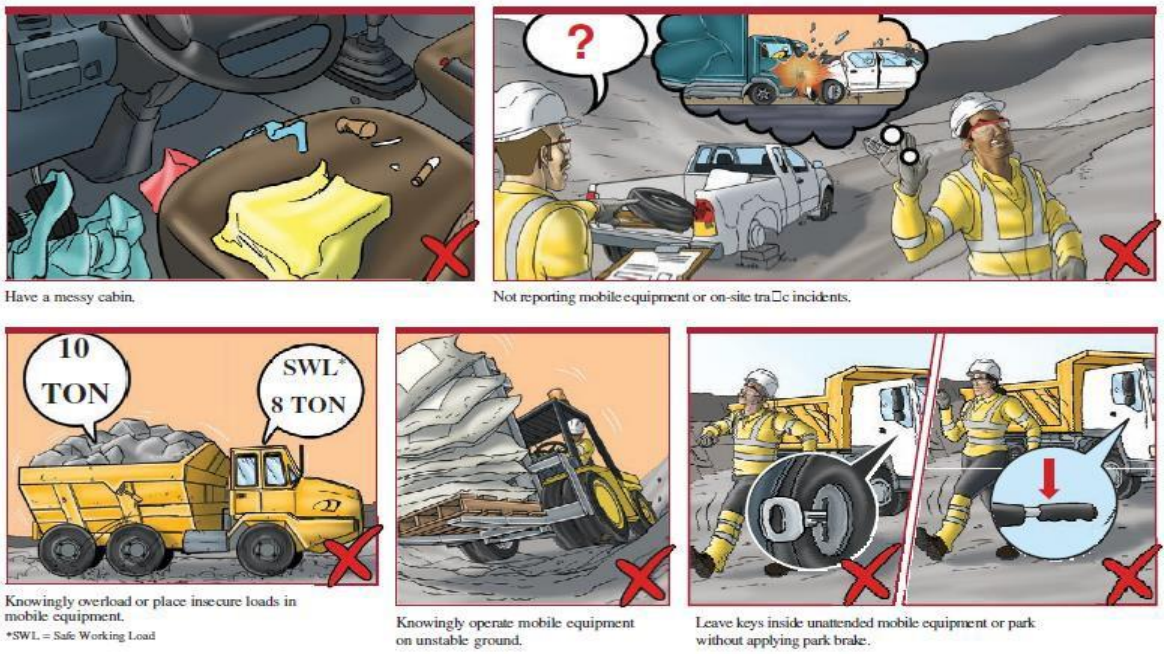
Reverse without looking.



Ride in mobile equipment if there is no passenger seat or seatbelt.



Use mobile equipment for a purpose for which it was not designed.



Have a messy cabin.

Not reporting mobile equipment or on-site tra□c incidents.

Knowingly overload or place insecure loads in mobile equipment.
*SWL = Safe Working Load

Knowingly operate mobile equipment on unstable ground.

Leave keys inside unattended mobile equipment or park without applying park brake.

Figure-13 : Prohibited Behaviors of Drivers

8.4 JOURNEY MANAGEMENT PLAN

The nature of road journeys varies widely from personal transport to delivery of goods, including extremely heavy and bulky items. Different types of journeys should be subject to formal risk assessment to identify the hazards, levels of risk and then to identify means of reducing the risks to minimum practicable levels.

Potential hazards of journeys include extreme weather, a route that passes through an area with a lot of crime and violence or an area that a breakdown service may find hard to reach. Long distance journeys are also potentially more hazardous because:

- The journey is more prone to delay, which extends the travel time even further.
- The driver is exposed to road and traffic hazards for longer.
- At least some of the roads are likely to be unfamiliar.
- Driving conditions may vary.
- The drive is likely to include rush hour or start early in the morning or end late in the evening; and
- The driver is likely to get more tired.

Every journey should therefore be a managed journey. Those responsible for journey planning (managers or drivers) should plan journeys carefully especially if they are complex, hazardous or cover a long distance. Travel and route planning tools are available from internet sources and should be used (e.g., Google Maps, AA route finder in the UK and Europe etc.). Although satellite navigation (satnav) devices can also be used, it is a good idea to have printed directions to hand, in case the satnav fails.

In planning routes, managers should take account of:

- **Road type -** accident rates tend to be higher on local roads and lower on motorways.
- **Hazards –** road works, accident hotspots.
- **Traffic densities –** time journeys to avoid peak traffic hours; and
- High risk features such as schools or busy town centres/shopping areas -employees should avoid driving in adverse conditions – operations should actively discourage driving at night (where practicable) and in adverse weather conditions, particularly fog, high winds, ice, snow or flooding or where there is danger of becoming stranded in remote locations.
- Ensure employees can postpone journeys or change routes if the police and travel organizations advise against road travel due to weather conditions and that they know the reporting procedure in such instances.

- When travelling into a remote or hostile environment, drivers should put emergency plans in place well in advance of the journey.
- For personal safety, drivers should be instructed that they should always let someone else know about their travel plans.
- Additionally, speed limits should be adhered to as per national highway regulations to ensure safe travel and compliance with the law.

Refer Annexure 2: Sample List of content for Journey Management Plan.

8.5 NIGHT TRAVEL OF COMPANY EMPLOYEES

All JSW businesses/ company shall formulate night travel policy for travel by road either self-driven or by hired taxi to prevent risk of night travel on highway. It is a good practice to ban business travel by road either self-driven or hired vehicle between 12 midnight to 05.00 Hours. In case of emergency travel between the banned hours, an approval process should be followed and approval should be taken from Head of the department.

8.6 DRIVER JOURNEY MONITORING SYSTEM

Business Units should ensure availability of In-Vehicle-Monitoring-System **(iVMS**) in all vehicles both In-bound & Out-bound as per recommendation of 12th National Safety Conference of Mines (i.e. for dedicated fleets only – 24 nos. trips in six months/ 18 nos. trips in a quarter) involved in material transportation (owned, contracted, rented or leased) so that journey data can be regularly analyzed, reviewed by management and periodic feedback given to drivers as a means of coaching for skills improvement and recognizing safe behavior. However, if serious unsafe behavior (such as speeding, freewheeling, several harsh braking and none-compliance to the journey plan) is found, feedback should be provided immediately, and appropriate measures should be taken.

Journey data should be recorded for each individual driver and, as a minimum, speed (average and top speed), harsh acceleration, harsh deceleration, distance driven and driving hours should be recorded. As a transition measure where **iVMS** device has not yet been fitted, the driver should complete the daily trip sheet.

8.6.1 Driver Performance Monitoring by iVMS

Based on the risk assessment of Business Operation, it is recommended to use of **iVMS. It should be deployed in phase manner** first for own, dedicated vehicles and hired vehicle, however location head should be authorized to take decision to deploy iVMS together for all kind of vehicles as per risk involved. All such vehicles should be equipped with functioning iVMS devices which meet the "**iVMS** and Driver Performance Monitoring Guidelines" (**Refer Annexure: 5**) in order to be approved to drive on public roads for JSW.

A) iVMS Functionality & Settings

- The following iVMS features are required functionalities that are to be available on all iVMS devices approved for use. The description of the functionalities can be found in **Refer Annexure:6**

B) Minimum Requirements

- Deceleration & acceleration – to measure harsh braking and harsh acceleration.
- Speed
- Driving hours
- Geo-fencing capability

C) Basic Requirements

- Driver identification
- Alarms & event recorder
- Crash Recorder
- Free-wheeling monitoring
- Accelerometer for harsh cornering
- Mounting and resiliency to environment

- IT functionalities: data storage, GPS tracking & data transmission, and critical event real time notification.
- Any new iVMS contract signed with this standard in effect should comply with both the minimum and basic iVMS requirements. The required IVMS settings are defined in **Annexure: 5 - iVMS and Driver Performance Monitoring Guidelines.**

8.6.2 Driver Evaluation

A) Driver Ranking, Recognition and Consequence Management

A scorecard for each driver should be produced at a minimum monthly. The score card will determine the driver's performance based on driving infractions and distance driven. Based on the evaluation, drivers are rated in 3 categories: green, yellow and red. However, this driver's score guard should be deployed first for internal drivers and then as per feasibility, can be applicable for others.

B) Driver Ranking, Recognition and Consequence Management

The policy for managing drivers based on driver's score cards should be included in the Business road safety SOP/ manual. Business will prepare a recognition policy linked to good driver performance (green drivers), to the driver training program and to a consequence management policy (yellow and red drivers).

In addition, contracted transporter companies should be ranked monthly based on the overall scoring of their drivers. This information should be used in transporter company selection and use.

The detailed description on the required use of iVMS data for driver monitoring is in

Refer: Annexure: 5- D, Ser. No.3 - iVMS and Driver Performance Monitoring Guidelines

C) Driver Feedback

Each driver is to be provided the following feedback:

- Monthly driver scorecard report
- Regular feedback on driving performance
  - When possible, after each trip
  - Coaching on required improvements.
- Immediate feedback in case of a serious unsafe behaviour
  - freewheeling
  - several harsh braking events.
  - excessive speeding
  - night driving & driving hours violations.
  - non-compliance with the approved journey plan (geo-fence)

Appropriate consequence management measures should be applied at the earliest for any violation to requirement.

Drivers should never be called and interrupted while driving. Any communication with the driver should be made when the driver's vehicle is stopped.

8.6.3 Driver Fatigue Management

Business Unit should ensure a systematic fatigue management plan to ensure their drivers are not at risk of falling asleep at the wheel.

Purpose of Fatigue Management Plan for Management, and for Drivers/Workers:

	Management	Drivers/ Operators
Educate/ Training	To ensure that employees/ stakeholders are informed of the risks associated with fatigue and how to participate in controlling these risks	

	Management	Drivers/ Operators
Identify	To identify the risks associated with fatigue, including establishing and monitoring an ongoing system for identifying problems	• To report problems with fatigue • To recognize and report their own fatigue symptoms. • To contribute to establishing and monitoring reporting systems
Assess	To assess the risks associated with fatigue	To contribute to the assessment of Risks
Control	To control the risks associated with fatigue, specifically:	To cooperate with control measures
	• Ensure that shift arrangements control the risks of fatigue. • Ensure that work arrangements do not contribute to fatigue problems or interfere unreasonably with employee capacity to meet family and social commitments • Provide training, information and supervision that supports effective management of fatigue. • Ensure that work systems are flexible enough to deal with factors influencing fatigue (e.g., allowing supervisors to reschedule tasks if fatigue becomes a problem) • Provide conditions that are conducive to sleep and where site accommodation is provided, supply a balanced diet	• To contribute to the design and implementation of control measures • To manage individual factors which affect fatigue (e.g., ensuring adequate rest between shifts)

The most important step in this process is implementing the Fatigue Management Plan, which may not be useful without adequate risk controls in place. Key issues to be considered in implementation are:

- **Timeframes:** Keeping to agreed timeframes is very important. The drivers/operators will become less supportive if the agreed actions being done cannot be seen. The action plan should be monitored regularly to make sure that the agreed timeframes are being met.
- **Testing:** The control measures need to be tested before they are permanently put in place. By testing, any unexpected problems will be identified. Such testing should take place within a set time.

- **Training:** Training is not a suitable control measure in itself but is essential for good risk control. Training gives the workforce the skills and knowledge they need to work with risk controls for fatigue and helps them identify and understand the fatigue hazards and risks in the workplace.
- **Roles and responsibilities:** The Fatigue Management Plan should name the people who are responsible for different actions, including high level support to oversee the plan's distribution and acceptance. It is the management's job to make sure that the Fatigue Management Plan is implemented.
- **Communication:** All drivers and operators within the group/ company need to know about the Fatigue Management Plan, including understanding their individual responsibilities, the timeline for implementation, and the monitoring of the plan's use.
- **Participation:** Everyone should be involved in implementing the Fatigue Management Plan. The more people who are directly involved, the more support for improvements there will be. Drivers/operators should have the information and skills to make the Fatigue Management Plan work. A participatory approach will help deal with any problems quickly.
- Evaluation effectiveness of controls All aspects of fatigue management should be reviewed at regular intervals to ensure continuing suitability, adequacy, and effectiveness of the controls for eliminating risk. Regular inspections and auditing of all aspects of the plan will help to ensure that the risk controls are working effectively.

Fatigue Management Plan: Recommended elements to include in a Fatigue Management Plan.

- A statement of the principles for managing fatigue
- Roles and responsibilities for all levels of the Business/ Site/ Location.
- The risk assessments that have been undertaken Identification and highlight of risks related to fatigue.
- The risk controls that are and will be in place along with an implementation plan.
- Driving duration suggested for rest pause (see below table no.:5)
- Awareness, education, and training that should be made available.
- Explanation of the support system that already exist and that will be set up along with an implementation plan (e.g., rest shelters, retiring/ waiting rooms, canteen, washrooms etc.)
- To prevent fatigue during driving, JSW Company/ site may consider the rest duration.

Table-5 : Duration Suggested for Rest Pause

No.	Description	Standards
1	Maximum daily driving time	12 hours
2	Maximum continuous driving time	3 hours or 200 Kms whichever is early
3	Minimum breaks time after 3 Hours continuous driving	20 minutes
4	Working week	Maximum Six Consecutive Days

9. MANAGEMENT OF RECORDS

Records to be maintained by the concerned department for effective implementation of the Road Safety Standard are as follows:

- A comprehensive register of all vehicles owned, leased, or operated on-site, including specifications, registration details, and operational status.
- Records of routine maintenance, inspections, and servicing of vehicles, including corrective actions for identified defects.
- Valid fitness certifications for all vehicles, as mandated by regulations.
- Copies of valid driver's licenses and certifications for all drivers.
- Documentation of road safety and defensive driving training provided to drivers.
- Records of periodic medical evaluations to ensure drivers are fit for duty.
- Logs of performance monitoring, including adherence to speed limits, safe driving practices, and incident-free records.

- Documentation of journey plans for vehicles traveling to off-site locations, including risk assessments and approved routes.
- Records of vehicle usage, travel routes, and trip completion times.
- Documentation of all road safety-related incidents or near misses, including root cause analysis and corrective actions.
- Detailed reports of any accidents involving vehicles, including contributing factors and preventive measures.
- Logs of any traffic violations or penalties incurred and corrective measures taken.
- Records of internal and external audits conducted on road safety compliance.
- All road safety-related records should be retained for a minimum of five years or as specified by organizational and regulatory requirements.

10. LEGAL AND OTHER REQUIREMENTS

JSW site should access, identify, evaluate, and keep up to date the Road Safety requirement as per prevailing law in operation.

11. EMERGENCY PREPAREDNESS AND RESPONSE

JSW Business shall develop, implement, and maintain a written emergency plan under the existing Emergency Preparedness and Response Plan (EPRP) that shall identify any foreseeable emergency (with or without any casualty). The EPRP shall cover remedial actions for the risks associated with road journey. Written emergency response procedure shall address the actions to be taken during an emergency including whom to call for local assistance. Emergency instructions and adequate training shall be provided to staff that shall include the following:

- Who to notify in the event of an accident or emergency.
- Actions to be taken in case of mitigating emergency.
- How to find out the hazards during material handling.
- Driver education on first aid procedures and correct transportation of crash victims.
- How to use and take care of the personal protective equipment; and
- Safe driving.

12. RACI MATRIX

Activity Description	Section In-charge	Executing Department HOD	Admin and Security	Safety
Risk assessment	R	A	C	I
Selection & Maintenance of vehicle	R	A	I	C
Inspection of driver permit to drive	R	A	C	I
Training and Certification	R	A	I	C
Audit/Inspection and monitoring for compliance	R	A	C	I
Incident reporting	R	A	C	I

R = Responsible expected to participate in the activity and contribute the best of his/her abilities
A = Accountable ultimately responsible for the results
C = Consulted contributes towards decision making
I = Informed kept informed but need not participate in the effort.

13. TRAINING

Each JSW Business/ site shall have a process in place for the training of persons involved in transportation of personnel and material. The training shall cover the general as well as specific aspects of road safety and defensive driving for employees, transporters, contractor, their workmen and suppliers. Training shall include:

- Fundamentals of defensive driving.
- Journey management plan.
- Properties and hazards of material.
- Packaging, equipment loading and securing.
- Transport equipment.
- Filling and delivering liquid products.
- Fire Fighting and First Aid.
- Regulations and on-board documents.
- Maintenance of vehicles; and
- Emergency Response Plan for accidental release of hazardous material or vehicle collision.

14. KEY PERFORMANCE INDICATOR

A road and driving safety management program with adequate resources and management oversight shall be developed and implemented to meet the objective/s of the monitoring program. A minimum of the following shall be monitored:

a. Number of Risk Assessments performed.

b. Percentage completion of inspections to schedule

c. Number of persons trained in Road and Driving Safety Management program.

d. Total training hours

e. Records of number of accidents resulted during road journey.

f. Number of Audits of Road and Driving Safety Management Program

g. Percentage completion of maintenance backlog

h. Implementation of audit recommendations

i. Vehicle Inspection Plan in line with manufacture guidelines

j. Provision of supervisory engineers specializing in vehicle inspection and testing; and

k. Control on competency requirements for inspection and testing of vehicles.

15. ASSURANCE

Each site shall conduct self-assurance program to ensure compliance with this STANDARD as part of its Safety assurance program. Third party system audit shall be conducted by Group Safety or external consultants to ensure compliance with the standard.

16. DEFINITIONS

Term	Definition
Continual Improvement	A recurring process of enhancing the sustainability governance system to achieve improvements in overall sustainability performance. consistent with JSW Mission, Values and Code of Conduct.
Emergency Response	The decisions and measures taken to contain and/or mitigate the effects of an emergency, to prevent any further impact and to regain control and restore order in its immediate aftermath, and then recover to a normal state. This process is facilitated by an Emergency Response Team and Emergency Preparedness and Response Plans, which should both exist. at the JSW Company and operation level.
Employee	An individual who is engaged to work directly for JSW on either a part-time or full-time basis and for a fixed period or on permanent basis and is salaried. By virtue of the individual's contract of employment, the employee is obliged to adhere to JSW's terms and conditions of employment (specific to Group or the subsidiary employing the individual) and is protected by national (where it exists) and international laws concerning labor and working conditions.
Hazard	An object, property or an activity that can cause adverse effects e.g., a high voltage electricity supply or a toxic chemical may present a hazard, meaning that they present the potential for harm.
Incident	An event or chain of events which caused or could have caused injury, illness, loss of assets or potential or actual damage to relationships or reputation.
Investigation	A systematic and structured analysis of an incident and the events and conditions leading up to it, with the aim of (i) identifying the root cause(s) that allowed that incident to occur, and (ii) proposing effective corrective and preventive actions to prevent any future recurrences.
Operation(s)	A location or activity that is operated by a JSW Company and is part of the JSW Group. Locations could include mines, refineries, ports or transportation activities, wind farms, oil and gas development Business Units, offices including corporate head offices, and research and development facilities.
Preventive action	An action from an audit, assessment or other evaluation that is identified and implemented to prevent the reoccurrence of an actual or potential non-conformance.
Procedure	Specified way to carry out an activity or a process.

Term	Definition
Record	Document stating results achieved or providing evidence of activities performed. A record is not a „live" or work in progress document but holds data and information of past events and therefore does not require. updating.
Risk	The effect of uncertainty on objectives (as defined by the ISO 31001 Standard). Uncertainties include events (which may or not happen) and uncertainties caused by a lack of information or ambiguity.
Risk assessment	The formal process of identifying, assessing, and evaluating the health and environmental risks that may be associated with a hazard.
Training	Recognized, accepted, and prescribed training with a set and replicable structure.
JSW Company	A subsidiary of JSW Group either fully or majority owned that has its own management structure (e.g., JSW energy, JSW steel, JSW paints etc.)
Fleet managers	Individuals who are given responsibility for the operation and management of JSW fleet vehicles
Goods vehicles	Vehicles used for moving heavy loads on-road or off-road
Leased or Hired vehicles	All leased or hired vehicles used by JSW Operations including short term vehicle hires, taxis, and chartered vehicles
Night driving	30 min after sun set until 30 min prior to sun rise
On-road vehicles	Includes company provided staff vehicles. Covers light vehicles (2WD or 4WD) that are primarily designed for transporting personnel on the general road network. This is generally a higher speed environment with significant amounts of traffic and constitutes a high risk, high consequence environment that justifies the provision of maximum safety. Features
Off-road vehicles	Light 4WD vehicles that are used in field circumstances for carrying equipment or personnel. As well as off-road conditions these vehicles may still be used in trafficked, high-speed environments. While off-road vehicles may not always be available with the safety options seen in on-road vehicles, effort shall be made to select safety features that reflect. their on-road use

Term	Definition
Fleet vehicles	All vehicles used by JSW operations including purchased vehicles and long-term leases
Special purpose vehicles	Include tracked or wheeled vehicles for extreme terrains
ICMM (International Council on Mining and Metals)	The International Council on Mining and Metals (ICMM) was established in 2001 and seeks to drive performance improvement through its members which comprise 20 mining and metals companies, as well as 30 national and regional mining associations and global commodity associations.
IFC (International Finance Corporation)	Member of the World Bank that finances and provides advice to private sector ventures and projects in developing countries.
Light Vehicle	Light vehicles can be registered for use on public roads and has four or more wheels, seats a maximum of 12 people (including the driver), and does not exceed 4.5 tons Gross Vehicle Mass (GVM), as specified by the manufacturer or an approved automotive engineer if the vehicle has been modified. They may be JSW owned or leased vehicles, hire vehicles, contractor or supplier vehicles and private vehicles used for work related activity. Examples of light vehicles covered by this standard are passenger cars, four-wheel drives, sports utility vehicles (SUVs), pickups (utilities, bakkies), minibuses, vans, and others). Reference to be taken from CMVR & MVACT for respective vehicle category
Stakeholder	Persons or groups that are directly or indirectly affected by a project as well as those that may have interests in a project and/or the ability to influence its outcome, either positively or negatively. This can refer to shareholders, lenders, employees, communities, industry, governments and interested third parties. Stakeholder engagement includes stake holder identification and analysis, information disclosure, problem/conflict anticipation and prevention, ongoing consultation, formation of partnerships, construction of grievance resolution mechanisms, negotiated problem solving, employee involvement in project monitoring, regular reposting forums and procedures and other related management activities
Surface Mobile Vehicles	Surface mobile vehicles include equipment such as rear dumps, belly dumps, water trucks, grazers, dozers, loaders, and tankers. It does not include draglines, shovels, excavators, forklift trucks, mobile cranes, backhoes, bobcats, and other trucks larger than light vehicles.

Term	Definition
Continual Improvement	A recurring process of enhancing the sustainability governance system to achieve improvements in overall sustainability performance. consistent with JSW Mission, Values and Code of Conduct.
Emergency Response	The decisions and measures taken to contain and/or mitigate the effects of an emergency, to prevent any further impact and to regain control and restore order in its immediate aftermath, and then recover to a normal state. This process is facilitated by an Emergency Response Team and Emergency Preparedness and Response Plans, which should both exist. at the JSW Company and operation level.

ANNEXURES

ANNEXURE 1: DEFENSIVE DRIVING GUIDELINE

i. Purpose

The purpose of this standard is to provide SOP guidelines for “Driver Training & Assessment” which is part of the “Vehicle & Driving Standard.

ii. Scope

a) In-cab assessment includes two key components:

I. Theoretical Driver Training

II. In-Vehicle Driver Training and Assessment.

b) These driver training program requirements apply to JSW on-roll and hired vehicles all drivers operating vehicle for the JSW Business Purpose.

** Abbreviations used.

DDT – Defensive Driving Training

SOP- Standard Operating Procedure

HTV – Heavy Transport Vehicle

PPE – Personal Protective Equipment

HSE- Health Safety and Environment

DMC- Driver Management Centre

iii) Driver Training Program Content

A. Theoretical Content:

a) Mandatory Driving Rules.

Review of the JSW LSSR that all drivers should respect including:

- No use of cell phones (no texting/no hands free)
- Mandatory use of seat belts for drivers and all passengers
- No unauthorized passengers
- No drugs/alcohol
- No freewheeling
- No tampering with the vehicle including iVMS devices.
- Maximum driving times are required rest periods according to Group Safety fatigue management rule.
- Possess a government driver’s license for the class of vehicle the driver will be using.
- Obey the local road traffic regulations.

b) Basic Defensive Driving Techniques

View your surroundings:

- Scan far ahead every second to identify potential hazards such as, other vehicles, pedestrians, road signs.
- Keep your eyes up to continuously scan the surroundings, and mirrors for potential risks including other vehicles and pedestrians.
- Check all mirrors at least every 7 seconds, and always before turning and starting to move.
- Check gauges and instruments regularly.
- Verify both left hand and right-hand side before entering an intersection.
- Scan for stopped/parked vehicles that may start to move.

c) Always have safe space around the vehicle

- Always maintain a safe following distance of at least 3 seconds.

- Adjust to at least 5 seconds in poor weather or visibility conditions.
- Always keep a 2-meter safety buffer around the vehicle
- Leave enough space between the vehicle ahead when stopped so that its tires can be seen.

Always make sure to been seen:

- Use signals, brake lights, turning indicators, 4-way hazard lights, headlights and horn when needed.
- Establishes eye contact – ensure that you are seen by others before turning and when starting to move the vehicle.

d) Journey Planning Techniques

- An explanation of the Group Safety fatigue management rules which define a set of maximum driving hours and minimum rest periods as per Group safety standard that should be respected.
- Training on the rules and risks of night driving
- Journey risk management including local journey hazards such as regulations, environment, and local journey management requirements.

e) Vehicle safety requirement & inspections

- Verification that all required vehicle equipment's are in working order including seat belts for driver and all passengers, headlights, turn-signals & brake lights, driver & passenger side mirrors.
- Vehicle pre-start inspection: present the vehicle inspection sheet & explain the driver's responsibilities.
- Procedures in place regarding what to do when a vehicle has failed a vehicle inspection or there is known maintenance problem.

f) Other Driver Safety Risks & Rules

- Training includes mandatory applicable safety rules including PPE, work at heights, energy isolation, roll over/tip-over, and loading/unloading & securing of loads.
- Risk to driver while outside the vehicle including use of safety equipment.
- Rewards and consequence management policy.

g) Pass/Fail Assessment

- At the end of the theoretical training, the driver will be evaluated with a Pass/ Fail assessment based on the training content.

Practical (In-Cab Content):

a) Vehicle pre-start check.

- Training the driver on the prestart required vehicle inspection and prestart checks. This includes filling out the vehicle inspection checklist.
- Inspect that all brakes & tires are in good working condition.
- Verify that all oil levels are in line with required level.

a) Driving Skills

- The instructor will coach the driver in the following skills: driving (including turning, reversing, and parking), braking (all types of braking systems including on downhill), changing gears, observing the surroundings and driver temperament.

b) Commentary Drive

- The driver will give a running commentary of what the driver is looking at, what the driver is doing and what the driver is thinking while driving the vehicle.
- The instructor will coach the driver to ensure that driver is commenting appropriately and will bring up any comments that were omitted.
- The in-cab assessment shall be undertaken for a minimum of 20 KMS.

c) Pass/Fail Assessment

- At the end of the in-vehicle training, the driver will be evaluated with a pass/fail assessment, a sample assessment form.
- It is a requirement to pass the assessment to be permitted to drive for JSW Group Business.
- Location/Site and Trainers should record and maintain "% driver Pass/Fail "of the in-vehicle driver assessment as a KPI.
- Those drivers who are unsuccessful in the assessment process will be provided one additional chance. The said candidate will need to review and make up the gaps identified and get reassessed within 15 working days.
- If a driver if unsuccessful after the second attempt he shall be banned for driving Business purpose.
- The assessors shall maintain records of the assessment undertaken.

iv) Driver Training Frequency & Duration

a) Requirements of Driver

- Attend and successfully complete the theoretical driver training.
- Accompany the driving instructor on a short "Commentary Drive" demonstration.
- Undergo a minimum of 2 hours of individual practical in-cab training in the same class and type of vehicle that the driver uses.
- Successfully pass the practical in-cab assessment.

b) When is the training required?

- All existing drivers permitted to drive for JSW Business
- Before expiration of the JSW Business permit to drive.
- For drivers who have failed the practical driver assessment
- For drivers who require retraining based on individual driving performance as determined by iVMS monitoring.
- Refresher training and assessment every 3 years.

v) Responsibilities of Trainer

- The trainer will conduct all the DDT training as per the SOP.
- The trainer will take the briefing and guidelines from the Site/Location safety team for execution of trainings.
- He will work in coordination with DMC and site/location logistic head for operational requirement to collect the driver data for execution.
- He will maintain proper documents and data base for records and share it with site/location logistic head.
- The trainer will take the feedback post training and submit to the team for action.
- Provide drivers with instruction, training, and supervision necessary to ensure their safety.
- Take steps to ensure drivers safety and the safety of others at road.
- Prepare a training timetable and make sure other trainers in department obtain a copy.
- Plan and prepare for assessments and make sure they take place at reasonable pace that reflects the training and its purpose.
- Send weekly and monthly MIS report of training to site/location logistic head and a copy to business safety head.

 # Please note that trainer is not responsible of any untoward incident or accident happens during behind the wheel training/evaluation

Duration of In-cab assessment

Type	Topics/Subject	Duration
Theoretical Training	Mandatory driving rules Basic DDT Journey planning technique Vehicle safety requirement & inspection Other Driver Safety Risks & Rules Pass/Fail Assessment	2 hrs.
Practical Training (Behind the wheel)	Vehicle pre-start check (15 min) Coaching on driver skills Commentary Driving Pass/Fail Assessment	2 hrs.

Sample Theoretical Pass/Fail Assessment Form (Unit/Business shall develop their own referring this)

Question #1
Which of the following is an unsafe behaviour of the driver?
a. Keeping a safe following distance
b. Checking your mirrors and blind spots before turning
c. Excessive speed
d. Tire blowout

Question #2
Which of the following is the behaviour of a defensive driver?
a. Talking on your cell phone
b. Tailgating
c. Speeding away from aggressive drivers
d. Checking your mirrors every 7 seconds

Question #3
What are the two driving conditions that we can control when we drive?
a. Ourselves and other drivers
b. Internal and external distractions
c. Our cushion of safety and our external environment
d. Ourselves and our vehicle

Question #4
How far ahead should we scan the road when we drive in a city?
a. 5 seconds ahead
b. 1 car length
c. 2 car lengths
d. 12-15 seconds ahead

Question #5
When should you avoid backing up your vehicle?
a. Only in dangerous situations.
b. When other passengers are in the car
c. Whenever possible
d. Never

Question #6
At 50kmph how far will you travel in the time it takes you to react to a hazard on the road?
a. 1 meter
b. 14 meters
c. 5 meters
d. 50 meters

Question #7
How much time should you leave between you and the car in front of you?

a. 1 second
b. 3 second
c. 0.5 seconds
d. 10 seconds

Question #8
What is the minimum distance before making a turn that you should use your turn signal?
a. 5 meters
b. 10 meters
c. 30 meters
d. 50 meters

Question #9
What should you do when stopped at a red light and it turns green?
a. Scan the intersection to see if it's clear.
b. Honk at the sleeping driver ahead of you
c. Immediately follow the diver ahead of you into the intersection
d. Press the gas pedal.

Question #10
Which of the following is a component that impacts the stopping distance of a vehicle?
a. Human perception time
b. Human reaction time
c. Vehicle reaction & braking time
d. All of the above

Question #11
What factor does NOT affect the total stopping distance of a vehicle?
a. Weather conditions
b. Road condition
c. weight of vehicle
d. None of the above

Question #12
Under optimal conditions, what is the minimum time that you should be behind the vehicle in front of you?
a. 1 second
b. 2 seconds
c. 3 seconds
d. 4 seconds

Question #13
When driving in the dark or in the rain, how many seconds should you be behind the vehicle in front?
a. 2 seconds
b. 3 seconds
c. 4 seconds
d. 5 seconds

Question #14
What is "Commentary Drive"?
a. The driver talks hands-free on a cell phone while driving.
b. The driver verbally explains the potential hazards, road signs, etc. that are seen ahead on the road while driving.
c. The instructor comments on the driver during the in-vehicle training session
d. The instructor comments and assesses a driver's performance white stopped and after the driving has been completed.

Question #15
Which of the following are JSW rules that should be always followed?
a. mandatory use of seat belt by the driver and all passengers
b. no unauthorized passengers
c. no use of cell phone-Including hands-free while driving
d. All of the above

Question #16
What are included in the JSW fatigue management rules?

a. Maximum allowed daily driving hours.
b. Night driving rules
c. Mandatory rest periods
d. All of the above

Question #17

Which of the following is NOT a method that should be used to be seen by others while driving?

a. Use of headlights and turning indicator.
b. Moving your vehicle closer to someone who has not seen you.
c. Creating eye contact with other road users
d. Using your horn when needed

Sample Practical Pass/ Fail Assessment Form

Driver Name		**Driver License Number**	
Company Name		**Vehicle class of license**	
Driver License Number		**License expiry date**	
Trainer Name		**Trainer Company**	
Date of assessment		**Duration of assessment**	
Vehicle registration #		**Type of vehicle**	

1. Verbal pre-start assessment

One Point for each correct answer	Is the answer appropriate? (Yes or no)
What is a safe following distance?	
What should you do if the weather is poor?	
What are possible distractions while driving?	
What should you do when it is dark or there is poor visibility?	
What is Commentary Drive?	
What can be done to make you more visible to others while on the road?	
What are some defensive driving techniques?	
Are you aware of other safety risks such as work at heights, moving outside the vehicle (risks as a pedestrian) and energy isolation?	
What are the fatigue management regulations?	
Are you aware of the rules regarding use of phone and other distractions?	
Instructor comments:	
	Score: /10

2. Vehicle & pre-start checks.

One Point for each area unless indicated differently	Demonstrates correctly (Yes or No)
Exterior vehicle inspection for any problems (fluid/air leak – tire pressure – vehicle	
Ensure that all windows are clean	

Ensure that all lights and indicators are working (2 points)	
Check seat position; adjust if necessary	
Check all mirrors; adjust if necessary	
Check warning lights when starting	
* Driver is wearing seatbelt and ensures that all passengers are as well	
Starts the vehicle properly	
Instructor comments:	
	Score: /10

ANNEXURE 2: SAMPLE LIST OF CONTENT FOR JOURNEY MANAGEMENT PLAN

This shall as a minimum include details of:

a. Preferred routes (up to date).

b. Hazard Map for all journeys.

c. Speed limits which may be less than the legal limit according to the journey.

d. Road conditions.

e. Weight of the load transported.

f. Information on approved safe rest areas.

g. Adverse weather conditions, if any.

h. Driver's name.

i. Travel duration, duty hours, driving hours, periodic interval of rest for driver break, rest place, safe eateries, communication requirements, etc.

j. Information on any abnormal or hazardous loads if relevant.

k. All statutory obligation met and relevant documentations.

l. Emergency contacts; and

m. Information about the Medical facilities.

ANNEXURE 3: SAFETY FEATURES OF HEAVY EARTH MOVING MACHINERY

1.0 General Requirements: The following Safety features and devices shall be provided in all Heavy Earth Moving Machinery (HEMM):

A. Access:

(i) Safe access to the Operator Station and to routine maintenance points of HEMM shall be provided. Proper placement of components of the access system shall permit and encourage a person to use three-point support while ascending, descending, or moving about the access system, when more than 1m above the ground. Two-point support is acceptable for stairs, stairways, ramps, walkways, and platforms. Three-point support should be used for all ladder systems. Track shoe and track pad surfaces are accepted as access steps if three-point support is provided when the HEMM is in 'OFF' condition.

(ii) On machines with articulated frames and in the fully articulated steering position, a minimum clearance of 150 mm shall be provided between firm structures and components with relative movement in the path of the access systems to the operator's station.

(iii) An alternative exit path shall be provided on a different location of the machine than the primary access path from the operator platform. If the alternative exit path is not obvious, it shall be identified. The alternative exit path is intended for emergency situations (e.g., machine tip-over) and therefore does not need to meet the primary access requirements.

B. Operator's Station (Cabin):

(i) The cabin shall protect the operator against foreseeable adverse climatic conditions, heat, dust, noise etc. Air-conditioning system shall be provided in the Operator's Station. A ventilation system, an adjustable heating system and a system for defrosting windows shall be provided wherever required.

(ii) Alternative opening (Emergency Exit): An alternative opening shall be provided on a side other than that of the primary opening. A window panel or another door is acceptable if they are easy to open or remove without the use of keys or tools. Latches may be used if they can be opened from the inside without the use of keys or tools. The breaking of a suitable size of glass pane is considered to represent a suitable alternative opening, provided that the necessary pane hammer, immediately accessible to the operator, is provided and stored in the cab. When the window panel is used as an emergency exit, it shall bear an appropriate marking.

(iii) Doors and Windows: Doors, Windows and flaps shall be securely held in their intended operating positions. Doors shall be retained at their intended operating positions by a positive engagement device. The front window shall be fitted with motorized windscreen wipers and washers. The tank of the window washers shall be easily accessible.

(iv) Pipes and hoses that contain fluids at pressures exceeding 5 MPa or temperatures above 60 °C located inside the cab shall be suitably guarded.

C. Operator's protective Structures:

(i) All HEMM with a seated operator shall be equipped with a roll-overprotective structure (ROPS). The ROPS shall comply with ISO 3471. Further, it shall also be fitted with FOPS, when they are intended for applications where there is a risk of falling objects. The fitted FOPS shall be in accordance with ISO 3449.

D. Seats:

(i) The Operator's Station shall be fitted with an ergonomically designed adjustable seat that supports the operator in a position that allows the operator to control the machine under the intended operating conditions. The seat and its suspension shall be so designed to reduce vibration transmitted to the operator to the lowest level that can be reasonably achieved.

(ii) If an additional seat for a trainer is installed in the Operator's Station, it shall be padded and shall provide adequate space for the trainer. The trainer shall also have available a conveniently placed handhold.

(iii) Seat Belt for Operator with reminder shall be provided.

E. Operator's Controls and Indicators:

(i) The controls shall be of suitable design and construction and arranged so that they are able to be operated with ease from the operator's seat and within the operator's force limits. Controls shall be laid out and designed to allow easy and safe operation based on the principle that a given direction of movement of any control produces a consistent and expected effect. The surfaces of frequently used pedals shall be fitted with skid resistant type materials.

(ii) Controls that can cause a hazard due to inadvertent activation shall be so arranged, deactivated, or guarded as to minimize the risk — particularly while the operator is getting into or out of the operator's station. The deactivation device shall either be self-acting or shall act by compulsory actuation of the relevant device.

(iii) A device/system shall be provided to release the residual pressure in each hydraulic and pneumatic circuits which can cause a risk.

F. Starting and Stopping System:
(i) All HEMM shall be equipped with a starting and stopping device (e.g., key). The starting system shall have a provision for protection against unauthorized use.

(ii) The starting and Stopping system shall be designed such that movement of the machine, working equipment and attachment, shall not be possible, while starting or stopping the engine, without activating the controls. (E.g., Transmission Neutral-Engine Start safety arrangement).

(iii) In case of Remote-control operated equipment, the Starting and Stopping system shall conform to any National/Internationally accepted standard.

G. Steering System:
(i) The steering system shall be such that the movement of the steering control corresponds to the intended direction of steering.

(ii) Hydraulic Steering circuits shall, if used, incorporate the following features:
(a) pressure control devices as required to avoid excessive pressures in the hydraulic circuit.
(b) hydraulic hoses, fittings and tubing with test burst pressures at least four times the working circuit pressure control device(s) for normal and emergency steering systems; (c) plumbing arrangements which avoid excessively tight hose bends, torsion in the installed hoses, or scrubbing and chafing of hoses.
(iii) An emergency steering system shall be provided which also function with reverse machine movement if the maximum rated speed in reverse exceeds 20 km/h.
(iv) A warning device indicating a normal steering power source shall be provided. This warning device shall be audible or visual and shall be activated by failure of the normal steering power source.
(v) Articulation safety lock shall be provided in articulated steering equipment. All articulated equipment shall be equipped with a safety bar or a device, which can readily be fitted without special tools, to prevent movement of the articulation joint during maintenance work in the vicinity of this joint.

H. Brake System:
All HEMM shall be equipped with the following brake systems and all these systems shall be effective under all conditions of service, load, speed, terrain, and slope, according to the intended use of the machine:
(i) Service brake: to be used as the primary braking system during normal operation of the equipment.
(ii) Emergency brake - to be applied by the operator in the event of a failure of the service brake.
(iii) Parking brake - used to prevent movement of stationary equipment. Provided that at least one of the brakes shall be "fail safe," i.e., the spring applied- hydraulically released (SAHR) or any other means. All HEMM shall have a brake system in accordance with ISO 3450 except for crawler machines with a travel speed less than 20 km/h, which shall have a brake system in accordance with ISO 10265.

I. Visibility:

(i) All HEMM shall be designed so that the operator has sufficient visibility from the operator's station in relation to the travel and work areas of the machine necessary for its intended use. The performance criteria shall be in accordance with ISO 5006.
(ii) Rear Vision Camera shall be provided in all HEMM.
(iii) Blind Spot Mirrors / Camera apart from rear side view mirror to enable operator to have clear visibility of blind spot shall be provided in all HEMM.

J. Stability:
(i) All HEMM with attachments, including optional equipment, shall be designed, and constructed so that stability is provided under all intended operating conditions including maintenance, assembling, dismantling, and transportation, as specified by the manufacturer in the operation manual.
(ii) Devices (e.g., outriggers, oscillating axle locking) intended to increase the stability of HEMM in working mode shall be fitted with interlocking devices or check valves which keep them in position in case of hose failure or in case of oil leakage.

K. Noise:
The operator and persons near to the HEMM shall not be exposed to noise level that exceeds an eight-hour equivalent continuous sound pressure level of 85 dB(A) and wherever it exceeds 85 dB(A), Personnel Protection Equipment (PPE) of adequate strength shall be used by the operators and the persons.

L. Warning devices and safety signs:
(i) All the HEMM shall be equipped with an audible warning device (horn) controlled from the operator's station
(ii) Warning system for Operator's fatigue shall be provided in all HEMM.
(iii) Audio Visual Alarm (AVA) system for reversing shall be provided in all HEMM.
(iv) Safety signs and hazard pictorials shall be displayed at conspicuous places.
(v) Retro- Reflective Reflectors shall be provided on all sides of the HEMM at suitable positions.

M. Protective measures and devices:
(i) All dangerously exposed moving parts of the equipment shall be provided with suitable guards of substantial construction to prevent injury to person(s).
(ii) Guards or shields shall be provided in the vicinity of exhaust and turbocharger to prevent fuel or oil spraying on hot surfaces.

N. **Electrical and Electronic Systems**:
(i) Electrical components and conductors shall be installed in such a way as to avoid damage from exposure to environmental conditions (corresponding to the intended use of the machine) that can cause deterioration. Electrical component insulation shall have flame-retardant properties.
(ii) Degree of protection:
Depending on the location/installation of electrical and electronic components, the following degrees of protection are required:
(a) All components installed exterior to the machine or directly exposed to the environment shall have a minimum degree of protection corresponding to according to IEC 60529, IP 55.
(b) All components installed in the operator's cab or protected against the environment, the protection shall be designed and executed to safeguard a correct function under expected and intended conditions.
(iii) Electronic controls, connectors in control circuits, multi-pin connectors and control switches external to the cab, shall have a minimum protection of IP 55.
(iv) All HEMM powered by electrical power source shall be provided with tripping device in Operator's Cabin to cut off Electric supply at Principal Switch Gear (PSG) end.

O. Fire Protection,
(i) All HEMM shall be equipped with suitable portable Fire Extinguisher(s) in addition to Automatically operated Fire Detection and Suppression device or System.
(ii) Hydraulic hoses, Electric Wires, sleeves, and conduits (where cable/wire is passed) of fire resistant quality shall be provided in all HEMM.

2.0 In addition to General requirement mentioned above, the following safety devices / features specific to machines shall be provided:

2.1 Dumper:
a) Mechanical steering locking to prevent untoward movement of steering wheel and tyres during work persons working below the cabin while engine is running.
(b) Mechanical type device to protect operator in case of head to tail collision of dumpers. (c) Limiting speed device to limit the speed as per working conditions.
d) Propeller shaft guard.
(e) Proximity warning device.
(f) Dump body raised position indicator with Warning.
(g) Retarder System in addition to Service, Parking and Dump Brakes.
(h) Rock ejectors for tandem tyres.
(i) Body raised position mechanical locking arrangement
(j) Engine cut off arrangement / Battery Cut-off switch on front lower portion of the Dumper.
(k) Cabin Guard Extension / Canopy fully covering operator's cabin.
(l) Load Indicator.
(m) Auto dipping System.

2.2 Tippers/Trucks:
(a) Cabin Guard Extension / Canopy fully covering operator's cabin.
(b) Exhaust/Retard Brake.
(c) Propeller shaft guard
(d) Tail gate protection
(e) Limiting speed device
(f) Dump Body lifted position locking arrangement.
(g) Dump Body raised position indicator with Warning.
(h) Dumb body stabilizers.
(i) Proximity warning device
(j) Auto dipping System
(k) Load Indicator.

2.3 Excavator:

2.3.1 Hydraulic Excavators:
(a) All functions cut off switch
(b) Swing Motor Brake and Swing lock
(c) Parking Brake.
(d) Vent valve on top of hydraulic tank (should be able to be removed without any tool).
(e) Provision for Limiting of hydraulic cylinders-Stoppers.
(f) Battery cut off switch outside cabin
(g) Two-way communication system other than mobile phone in Operator's Cabin.

2.3.2 Rope Shovels & Draglines
(a) All functions, such as Crowd, Hoist, Swing, Propel and Drag shall be provided with 'ON' type brake to automatically apply the brake in case of Electrical power failure.
(b) Travel limit switches for crowd, hoist and Drag functions as applicable.
(c) Limit switch for boom movement.
(d) Two-way communication system other than mobile phone in Operator's Cabin
(e) Boom crack monitoring system in Draglines.

2.4 DRILLS:
(a) Dust prevention or suppression system provided in the Drills shall confirm to DGMS circular no. DGMS(S&T)/ circular (Approval) No 1, dated 10.03.2017.
(b) Emergency 'Stop' push button in
(i) Operator's cabin
(ii) Main frame.
(iii) Propeller pendent

(iv) Rear end
(c) Over Temperature protection devices, in motor winding and other related parts.
(d) Explosive vent in transformer.
(e) Interlock between propel and drilling operations.
(f) High air discharge temperature trip switch
(g) Low lube oil pressure cut off switch (engine and compressor)
(h) Oil stops valve (electric solenoid valve in compressor lubrication line)
(i) No bump circuits
(j) Tower lock.
(k) Propel joystick-spring loaded type to return to neutral (dead man safety)
(l) Lock check valves for preventing creeping in drill
(m) Unloader valve
(n) Stabilizers
(o) Breakout wrench

3.0 All Heavy Earth Moving Machinery including dumpers and trucks shall be provided with Safety features and devices mentioned above before putting them into operation in a Mine.

ANNEXURE 4: SELF CERTIFICATION/ MINIMUM CHECKPOINTS – VEHICLE INSPECTION

MINIMUM CHECK POINTS - VEHICLE INSPECTION			
Checklist Serial No.			Date: / /
Name of Transporter:		Vehicle Regn. No.	
Driver Name /DL No:		Mobile no:	
Sr. N	Description	Site/ Location/ Plant:	
A	DRIVER	Yes/No	Comments
1	Driver has valid Original Driving License, Medical fitness & DDT Training		
2	Driver passed Alcohol Test		
3	Driver has PPE (Safety Helmet, Safety Shoes, and Reflective Jacket)		
B	VEHICLE	Yes/No	Comments
1	RC Book / Fitness Certificate/ Insurance/ Pollution documents available		
2	Availability of Rear-View Mirrors on both sides		
3	Horn in working order		
4	Reverse alarm & lights in working order		
5	Head Lights & Rear lights in working order		
6	Brakes in working order		
7	Hand brake in working order		
8	Windscreen wipers both side in working order		
9	All radial tyres (including spares) in roadworthy condition (treads not worn out)		
10	Three-point retractable Seat Belt, with ergonomic sheet and head rest for driver,		
11	Side Indicators and parking lights in working order		
12	No hazardous goods kept inside the Cabin (Stove / Kerosene etc.)		
13	First Aid Box and fire extinguisher available		
14	IVMS (In vehicle Monitoring System) fitted and operational		
Acceptable for operation ☐		Not acceptable☐	Acceptable after improvement ☐
Comments:			
Inspected by:			Transport contractor / Supervisor:
Signature			Signature
Date			Date

ANNEXURE 5: iVMS AND DRIVER PERFORMANCE MONITORING GUIDELINES

i) Requirements for iVMS[3] functionality

A. Minimum required iVMS features:

- Deceleration and acceleration:
  - Decelerating too fast (harsh braking) indicates poor anticipation and not sufficient distance between vehicles. It is the most important required criteria to monitor driver skills.
  - Accelerating too fast (harsh acceleration) indicates poor anticipation.
  - Harsh braking and harsh acceleration increase fuel consumption and vehicle repair costs.
- Speed and iVMS digital mapping:
  - Required to monitor speed against allowable speed limits.
- Driving Hours4:
  - Monitors compliance with driving hours requirements to avoid fatigue.
- Ability to perform geo-fencing5.
- Web based data transfer via cellular or satellite networks.
- Data transmission:
  - Data of all monitored variables to be sent at least once every minute,
  - In case of an infraction to harsh braking, speeding or harsh acceleration, second-by-second data is stored and transmitted for 30 seconds before and 30 seconds after the incident,
  - Device will continue to record data and store when out of network coverage.[6]
- iVMS device should be able to upload to different web services:
  - iVMS contract should allow upload of data to different web services,
  - iVMS device hardware should be compatible with different web services software.

Recommended iVMS features:

- Information storage:
  - iVMS stores five minutes of second-by-second data in case of an incident.
- Event alert notification (alarm):
  - To alert driver in the event of an infraction,
  - For events such as harsh braking, over-speeding, route deviation/entry in no-go areas, exceeding driving hours.
- Driver identification:
  - Ensure that iVMS data is linked to the specific driver of the vehicle.[7]
- Tamper resistant device.
- Hard cornering:
  - Driving at a speed too high when turning. It is also known as swerving,
- Monitoring vehicle movement while in neutral:
  - Known as “freewheeling,” it is when the vehicle is put in neutral and allowed to coast, it is often done to save fuel and is an extremely dangerous practice especially on downhill slopes.

[3] In vehicle monitoring system
[4] Either integrated into the iVMS package or measured with a separate device that captures the data electronically and acts as an additional OER (on board event recording).
[5] A geo fence is an electronic geographic boundary (longitude and latitude) that can be created to set specific rules around speed limits and allowed/prohibited driving zones.
[6] This feature is critical in areas with limited cellular/satellite coverage.
[7] Some possible technologies include radio frequency identification (RFID), identification key (Vehicle key linked to specific driver and biometric)

iVMS Settings

iVMS Settings[8]

Harsh Braking	• 2.8m/s2
Speeding[9]	• Light vehicles: tolerance of 5%[10] above posted speed limit. • Heavy vehicles: vs. posted speed limit
Harsh Acceleration	• Light vehicles: 2.8m/s2 • Heavy vehicles: 2.2m/s2
Exceeding Driving Hours (measured in minutes)	• Time above maximum driving hours • Time below minimum resting period

Driver Evaluation with iVMS

Driver Score Card:

- Points system that ranks driver's performance based on the number of infractions and distance driven.
- Each driver will have a score card for each calendar month11. A driver receives 1 point for each of the following infractions based on the iVMS settings in the table above:
  - Harsh braking,
  - Speeding: 1 point for every 60 seconds of cumulative time12 above the allowed speed,
  - Harsh acceleration,
  - Exceeding driving hours13:
  - 10 minutes more than allowed driving time,
  - 10 minutes less than required resting time.
- Driver scores are based on 100 kilometers driven.
- Drivers are ranked in 3 categories:

[8] For Business who wish to use more advanced monitoring systems that provide more stringent iVMS settings (i.e. real time driver camera technology – distance between vehicles) approval and validation by respective BU Head in consultation of BU Safety Head and Group safety Head is required.

[9]Allowed speed may be less than the posted speed limit.

[10] For light vehicles, cumulative speeding time is recorded when the vehicle is travelling 5% higher than the posted speed limit, for example, speeding is detected at 63 km/h when the posted limit is 60km/h. There is no such tolerance for heavy vehicles as posted speed limits are set for light vehicles and heavy vehicles should always be travelling below the speed limit

[11] Weekly driver scorecards and daily post-trip feedback to drivers are good practices that should be implemented when possible.

[12] For speeding, time is cumulative and starts to be counted immediately once the allowable speed is exceeded and ends once under the allowed speed. Total time speeding is calculated by adding the duration of each infraction together.

[13] This is a measure of violation against the fatigue management rules of each Business. The minimum required fatigue management rules are defined by Group Safety".

- Green, yellow, and red driver ratings[14] based on points per 100 kilometers,
- Best in class targets:
  - Green: 2 points or below per 100 kilometers,
  - Yellow: between 2 and 5 points per 100 kilometers,
- Red: above 5 points per 100 kilometers
- Minimum allowable targets Business could start with:
  - Green: 20 points or below per 100 kilometers,
  - Yellow: between 20 and 50 points per 100 kilometers,
  - Red: above 50 points per 100 kilometers

- Details of the driver score card and a sample calculation are found at the end of this annexure.

Ranking, Recognition and Consequence Management:

- Recognition policy linked to high standard of driver performance – Green drivers.
- Clear consequence policy for drivers with yellow or red rankings:
  - Yellow[15] drivers to be retrained.
  - Red drivers to be suspended/ blacklisted.
- Drivers are ranked monthly based on their driver scores.
- Monthly rankings of contracted transporter companies:
  - Based on driver score cards,
  - Used for transporter company selection/usage.

Policy based on Driver Score Card[16]

Driver Recognition & Consequence Policy	First Time	Second Time[17]
GREEN	Reward[18]	
YELLOW	Driver retraining	Driver pass/fail assessment
RED	suspension	blacklisted

Legal Assessment

- Each Business/ Site should consult with their local/ National legal in order to ensure that iVMS & driver monitoring are fully compliant with local legislation.
- All legal areas should be verified for compliance including:
  - Data privacy
  - Labor law (including risk of requalification)

[14] Each Business will determine their initial green-yellow-red scoring system which could be higher than best in class and tighten the points to reach best in class driver score cards target by end of 2025.

[15] A driver becomes red if he has a third yellow driver score card rating.

[16] Each Business should have a clear policy based on driver score card.

[17] If the driver is yellow or red twice within a 12-month period.

[18] Possible rewards would include 1) bronze badge for 3 months as green driver, silver badge for 6 months as green driver and gold badge for 12 month as green driver with reward ceremony. 2) Bonus linked to green driver (5% or 10% of salary).

- Competition / anti-trust law
- Other specific legislation (i.e., restrictions on data storage location)

Driver Score Card

Required Data Input	Rules for Scoring
# of harsh braking incidents	1 point for every incident
Speeding duration • Measured in cumulative time above allowed speed	1 point for every 60 seconds of cumulative time in violation of the allowed speed
# of harsh acceleration incidents	1 point for every incident
Exceeding driving hours • time measured when driving more hours or resting for less time than allowed	1 point for every 10 minutes in violation of fatigue management rules
Driving Distance • in kilometers	Driver Score is based on 100 kilometers driven[19]

Driver Ratings

GREEN = Driver Score 2 or below
YELLOW = Driver Score above 2 & below 5
RED = Driver Score above 5

Example of Driver Score Card

Driver Name	**Driver A**	
Distance Driven	**1200km**	
# of Harsh braking	5	0.42
Time above allowable speed	500 seconds	0.69
# of Harsh Acceleration	2	0.17
Time in violation of fatigue management rules	30 minutes	0.25
	Driver Score	**1.53**

[19] Driver Score is total of points, multiplied by 100 and divided by the number of kilometres.

ANNEXURE 6: DESCRIPTION OF IVMS FUNCTIONALITIES

Function	Description	Level
Acceleration	Monitors and records acceleration greater than a set threshold	Minimum
Deceleration	Monitors and records deceleration greater than a set threshold	Minimum
Speed	Monitors and records speeds greater than a set threshold: • Maximum speed against the defined speed limit of that roadway, • regardless of the vehicle's maximum configured speed value. • Time-over set speed	Minimum
Driving Hours	Capability to measure driving hours deviation against Group fatigue management rules and night driving policy. Deviations are to be measured and reported in "hh:mm: ss" format over defined threshold for resting time and driving time.	Minimum
Geo-Fencing	A geo-fence is a GPS-linked boundary that allows a user to apply different thresholds for that specified area with the ability to notify both the driver and a configured remote destination if thresholds are exceeded. Geo-fencing can be used as follows: • Create specific speed limits for an area where there is a high potential for an incident e.g., villages, near schools / markets. • Create specific areas where vehicles are not to be allowed access Create corridor zones for routes from which we do not want drivers to deviate	Minimum
Driver Identification	Ability to identify the driver of the vehicle before starting the trip. The driver is assigned to the vehicle until a new driver is assigned or ignition is switched off. This feature may not be required if monitor installed in vehicle only assigned to one driver.	Basic
Alarm & Event Recorder	Emits audible alarms in the vehicle and is able to record events greater than a set threshold such as: • Exceeding driving time or night driving rules • Speeding event • Harsh braking or harsh acceleration event • Warning a driver when arriving at a geo-fence location If drivers understand the parameters of when and why an alert will be activated, they will be able to monitor their own activities and educate themselves to be safer drivers by adjusting their driving style as feedback is. provided.	Basic
Crash Recorder	Record speed and location (second by second) for at least 30 seconds immediately before and after a harsh braking/deceleration or rollover event. The information is to be utilized for incident investigation.	Basic
Tamper Resistance	Monitor design to prevent driver tampering and/or records the tampering event Tampering can include disconnecting the battery/power supply, damaging GPS, or GSM antenna, disconnecting speed sensor source, etc.	Basic

Function	Description	Level
Free Wheeling Monitoring	Monitor, record and alert when exceed programmable thresholds for freewheel/coasting. • With Can Bus: detection of non-engagement of a gear during movement of the vehicle • Without Can Bus: detection of an engine rotational speed less than a threshold (e.g.: 500 rpm to adapt by vehicle type) associated with the movement of the vehicle. • Information: Start time and duration in hh:mm: ss, GPS position at start of event and end of event."	Basic
Accelerometer for Harsh Cornering	Measurement of acceleration forces with an accelerometer which measures forces in the Y-axis to monitor harsh cornering events and Z-axis to measure. orientation of vehicle to detect possible rollover	Basic
Mounting	Hardware should be able to be installed with a secure mounting in a position that does not distract the driver.	Basic
Environment Resiliency	Protected hardware (such as IP65 or IP67) to provide reliable performance in harsh environments. weatherproof heat and vibration resistant	Basic
Data Storage	The monitor should have adequate memory in case of no connectivity to store at least 1 months of operation data	Basic
GPS Tracking & Data Transmission	Data to be stored and transmitted in real time using data transition technologies such as (GPRS, 3G, 4G, etc.) Programmable interval starting at 30 seconds as minimum. At each GPS point the following is recorded/transmitted: vehicle and driver ID, date and time, latitude, longitude & altitude, heading, velocity etc. The system should store information when vehicle loses connectivity and transmit the information once the connection is restored.	Basic
Critical Event Real Time Notification	System should be able to send user-configurable alerts to notify selected users by SMS, email, or mobile push for events such as: harsh braking, freewheeling, device tampering, geo-fence violations, driving time violations, excessive. speed, etc.	Basic

ANNEXURE 7: SAFETY CONSIDERATIONS FOR ELECTRIC VEHICLES

Electric vehicles represent a completely different technology compared with internal combustion engines. This means that new safety hazards, mainly related to the characteristics of high-power electric equipment, may be present.

The electric vehicle system shall be designed to operate safely in all conditions; several specific problems will be treated, concentrating on aspects of vehicle behaviour which are typical for electric vehicles.
The electric vehicle represents a “new” technology, introducing electric power components on board road vehicles.

The different risks associated with this technology should be carefully assessed. The risk levels however should not be overestimated by fear of the unknown.
Different aspects of electric safety can be considered on electric vehicles:

- electric system safety
- functional system safety
- battery charging safety.
- vehicle maintenance, operation, and training

Electric system safety: Protection against electric shocks

Voltage levels on board electric vehicles

Typical voltage levels on electric vehicles are as follows:

48-120 V for cars and small vans

96-240 V for large vans

300-600 V for buses

For AC drives, which are gaining an increasing popularity, higher voltage levels are used; 200 V or more may be encountered even on small vehicles.

These voltage levels are to be compared with the safety voltage levels: in a typical electric vehicle environment, characterised by a low skin resistance (wet skin likely) (BB2) and a contact with conductive bodies (BC3), the security extra low voltage level is 25 V for AC and 60 V for DC.

The voltages used on electric vehicles are thus potentially dangerous and measures should be taken to prevent electrocution through direct or indirect contact.

Protection against direct contact

Live parts of the electric traction system should be protected against direct contact by persons in or outside the vehicle, through insulation or inaccessible position.

Insulation such as varnish, enamel, coatings, are not considered to be insulation as required for protection against direct contact.

Removal of protective devices and opening of doors, lids, and bonnets permitting access to live electrical equipment shall only be possible with tools or keys.

The conventional protection degrees (IPXXB or IPXXD) should be enforced.

Protection against indirect contact

The problem of indirect contacts is closely related to the problem of frame faults. Any spurious connection between the traction circuit and the vehicle frame is regarded as a fault. Frame faults can lead to several hazards:

- short circuits
- electrocution
- uncontrolled operation

Following measures should be taken to avoid these hazards:

- a fuse shall be built inside the battery pack, in the electrical centre of the battery.
- the vehicle frame shall be isolated from the traction circuit and shall not form any part of the power electrical circuit.
- all conductive parts of the vehicle, particularly accessible parts, or parts adjacent to electrical equipment shall relate to an equipotential connection.
- frame fault leakage detection shall be included in routine maintenance; permanent frame fault monitoring is mandatory for certain vehicles.

Functional system safety

The electric vehicle traction system should ensure a reliable and safe operation of the vehicle.

The topology of the traction system in an electric vehicle is fundamentally different from IC-engine vehicles and specific measures should be taken to avoid or prevent unsafe operations.

System activation warning

An electric vehicle standing still is in most cases completely silent. To prevent movement through unintentional actuating of the traction circuit, a warning device shall be present.

Power on procedure

To avoid possible damage through excessive torque, overcurrent or fierce accelerations, the power on procedure should be adequately organised: it shall be impossible to activate the controller with the accelerator depressed. Any unintentional movement of the vehicle during start-up shall be avoided.

Driving backwards - Prevention of fierce reverse braking

The change of driving direction in an electric vehicle can be done mechanically or electrically in the latter case, the actuation of the reversing shall be obtained by two different; consecutive movements or an electrical safety device which only allows reverse to be engaged when the vehicle speed is lower than 1 m/s, in which case actuation of the control unit shall be indicated obviously.

Emergency disconnect device

This problem is approached in a different way by car manufacturers and electricians:

- vehicle manufacturers do not consider emergency switches as a necessity and want to avoid them (they are in fact not present on thermal vehicles)
- electrical manufacturers consider emergency switches as essential (they are in fact present on any industrial electric device)

Emergency switches come in different versions:

- battery connectors
- direct-acting emergency buttons
- indirect-acting emergency buttons

It is recommendable that the disconnect action is direct. Furthermore, its operation shall not be detrimental to the controller.

Fail-safe operation- Power surge prevention

Unintentional acceleration due to failures in electronic traction controllers should be prevented using power surge control fail-safe circuitry. Any failure shall not cause more than 0,1 m movement of a standing, unbraked vehicle.

Fail-safe operation - Frame faults

Frame faults and stray currents can also cause uncontrolled operation: a fault current of a few µA in a controller can release hundreds of Amps in the motor!

Traction and auxiliary circuits shall be galvanically isolated. Infiltration and condensation of water shall be avoided.

Fail-safe operation - Electromagnetic compatibility

Electromagnetic interference, generated externally or by the controller itself, should not adversely affect controller operation.

The controller should be designed in conjunction with the rest of the vehicle in such a way that no unwanted radiations are generated.

The auxiliary network

The auxiliary network is used for lighting, windscreen wipers and other similar loads.

It is fed by the traction battery through a DC/DC converter; this should be designed with galvanic isolation.
In most vehicles, an auxiliary battery is also present. The auxiliary battery can be dispensed with if the DC/DC converter is powerful and reliable to ensure safe operation of the auxiliary loads (particularly lighting) in all conditions.

Electrical regenerative braking

Some safety considerations are to be put forward on this item:

- regenerative braking works through the drive train, on one axle only.
- regenerative braking does not work at very low speeds or at standstill.
- in most cases, the rate of deceleration is limited and not sufficient for an emergency stop.
- on slippery surfaces, high levels of regenerative braking may cause loss of adhesion.
- torque inversions add wear and tear to the mechanical drive system.
- the effect of regenerative braking may be impaired when the battery is fully charged; the latter may even be overcharged.

The primary friction brake system should be able to stop the vehicle in all circumstances.
To ensure safe operation and maximum efficiency, the braking torque should be controllable gradually and coasting should remain possible. This last feature is particularly important considering energy efficient driving.

Over speeding

Electric motors, particularly direct-current motors, can be liable to overseeding damage.

Over speeding is mostly caused by excessive downhill speed but can also be caused by excitation failure.

Battery safety

The battery is the most critical item on board the electric vehicle. It represents several potential hazards:

- electrical
- mechanical
- chemical
- explosion hazard

Electrical aspects

Protection against electrocution: the conventional enclosures shall be enforced as needed.

- Protection against short-circuits traction batteries have usually a very high short-circuit current. Protective devices (fuse links) shall be foreseen,at the electrical centre of the battery.
- When multiple battery packs are used, additional fuse links shall be provided. The type and location of these fuse links shall be carefully determined to avoid any risk of explosion.
- Furthermore, the layout of the battery compartment shall be sensibly designed to avoid any unintentional direct contact or short-circuit.
- To minimise leakage currents, particularly when vented batteries are used, creepage distances between live parts should be observed.

Mechanical aspects

The traction battery is a heavy item (particularly the Lead-Acid battery); its location on board the vehicle shall be determined to avoid instability of the vehicle. The battery should be constrained to avoid injury in case of an accident.

The battery location should be particularly observed when existing thermal vehicles are converted to electric traction; an adequate battery compartment is usually not available in this case.

Chemical aspects

Lead-Acid batteries. The main chemical hazard in the Lead-Acid battery is the electrolyte (sulphuric acid).
Precautions should be taken during maintenance.
In case of an accident, care should be taken to avoid electrolyte to be spilled on the vehicle's occupants or on third parties.
The lead metal in the battery is only released during the disposal and recycling process.

Nickel-Cadmium batteries. The electrolyte is a lye solution (potassium hydroxide). The same precautions apply as for sulphuric acid.

When Lead-Acid and Nickel-Cadmium batteries are used in one fleet, handling and maintenance tools shall be carefully separated.
The cadmium metal present in the battery is only released during the disposal and recycling process.

Sodium-Sulphur batteries. These are completely sealed batteries. The thermal envelope safely encloses the reagents (molten sodium and sulphur). Furthermore, the battery contains a multitude of small cells so that the amount of active material released in an accident is limited.

Early prototypes of this battery have faced problems of thermal runaway.

Sodium-Nickel Chloride batteries. These are similar to sodium-sulphur, but the nickel chloride is a salt which is less reactive than sulphur.

Zinc-Bromine batteries. The inherent safety of this battery is rather high; the bromine complex solution in the battery is toxic but shows a low reactivity.

The main hazard of this battery is the inhalation of bromine and bromine compounds which are released in case of fire.

Explosion hazards

Batteries with an aqueous electrolyte emit hydrogen due to the electrolysis of this electrolyte. This is particularly the case at the end of charge.

Measures should be taken to avoid explosion hazards:

- hydrogen concentration anywhere in the vehicle should never exceed 0,8 % in normal operation and 3,5 % in case of a failure (the explosion limit being 4 %).
- devices which are liable to produce heat or sparks (contactors, switches, connectors, lighting bulbs, brake paths etc.) shall not be located where potentially explosive air/gas mixtures can occur.

- battery fumes shall be ventilated and shall never be allowed to enter the passenger compartment.
- when valve-regulated lead-acid batteries are used (these are commonly known as “sealed” or “maintenance-free” batteries), one should take into account that in case of overcharging these batteries can also emit hydrogen gas.

Battery charging safety.

During the battery recharging process, the electric vehicle is connected to the mains distribution network and the necessary safety measures should be taken to avoid electrocution danger. Several cases can be observed:

Off-board battery chargers

Off-board battery chargers are mostly used with large vehicles and for rapid charging. With off-board chargers, it is essential to connect the vehicle body to the earth while charging. Otherwise, dangerous situations can occur in the case of a fault.

On-board battery chargers

With on-board battery chargers, the vehicle body should be connected to the earth during charging, except when using Class II (double insulated) equipment.
It is recommended to check the soundness of the earth using an earth-loop monitor. When the charger has no electrical separation, isolation monitoring is essential, and the traction battery should be isolated from the vehicle body.

Partially on-board battery chargers

Partially on-board chargers are based on inductive energy transfer. Since they involve no electrical contact between the vehicle and the mains network, their electrical safety is very high.
The absence of a cable also reduces the mechanical risks.

The characteristics of the electromagnetic environment of these chargers are under consideration.

Maintenance

First-line maintenance: by the user

Example: vehicle washing, windscreen top-up
The ordinary user is not a trained electrician and should be protected against all risks of direct contact.

Second-line maintenance: in the workshop

- Example: battery top-up, routine mechanical maintenance, controller replacement. The servicemen should be thoroughly trained for safe maintenance action when servicing electric vehicles, The battery should be disconnected before any intervention is done.

Third-line maintenance: in the manufacturer’s workshop

Example: major electrical repairs. This is to be done by trained personnel only.

Maintenance for safe operation

Besides the maintenance of mechanical parts, some electrical routine maintenance is necessary for safe operation and shall be done at regular service intervals:

test of insulation resistance and earth leakage

controller operation

battery condition, maintenance and cleaning

The verification of these points could become a part of legal vehicle testing.

Driver training

An electric vehicle is not petrol, not diesel, not even LPG or CNG. It's electric!

The electric motor has torque and power characteristics which are quite different from IC engines. Safe and energy-efficient driving of an electric requires proper.

skills. In the electric vehicle world, there is no place for the casual driving style so often encountered with petrol vehicles.

Battery charging should be done properly and with the necessary discipline.

Purchasers of electric vehicles shall be provided with the necessary information through the dealer network.

ANNEXURE 8: SELF-ASSESSMENT CHECKLIST FOR ROAD SAFETY AUDIT

Sr. No.	Performance Indicators	Status	Remarks
1	Has the Site established a Road Safety and Driving Program as suitable to needs?		
2	Whether roles and responsibilities are defined to implement and monitor the Program?		
3	Whether Site has communicated the JSW Core Road and Driving Safety standards to employees and transporters?		
4	Vehicles inspection procedures and checklists are followed, maintained, and reviewed by designated persons?		
5	Are Road Construction and Maintenance Procedures and quality assurance parameters are established including parking, drivers rest rooms etc.?		
6	Are Road and Driving Safety performance KPI are collected, documented, and reviewed effectively?		

Sr. No.	Performance Indicators	Status	Remarks
7	Are Road and Driving Safety Training incorporated in local training calendar?		
8	Road and Driving Safety Program Audits are conducted at defined frequency		

17. REFERENCE

Reference	Full Title, Brief Description and Web-links
International Organization for Standardization	ISO 39001: Management System Standard for Road Traffic Safety ISO 39001:2012 - Road traffic safety (RTS) management systems — Requirements with guidance for use
Health and Safety Executive UK	Guidelines for Driving at work. Vehicles and loads - Workplace transport - HSE
OSHA	Standard 1926.56 1926.56 - Illumination. | Occupational Safety and Health Administration (osha.gov)
DGMS Gazette Notifications	Gazette_notification_of_diferrent_Standards_and_Forms_under_CMR-2017.pdf (dgms.gov.in)
Evaluation of an In-Vehicle Monitoring System (IVMS) to Reduce Risky Driving Behaviours in Commercial Drivers: Comparison of In-Cab Warning Lights and Supervisory Coaching with Videos of Driving Behaviour	(PDF) Evaluation of an In-Vehicle Monitoring System (IVMS) to Reduce Risky Driving Behaviors in Commercial Drivers: Comparison of In-Cab Warning Lights and Supervisory Coaching with Videos of Driving Behavior (researchgate.net)
Safety Consideration of Electric Vehicle	Microsoft Word - Safety (EVS-12 1994) (vub.ac.be)
Recommendations of 12th National Safety Conference in Mines	llssa.pdf (dgms.gov.in)

JSW Group

MANAGEMENT STANDARD
PERSONAL PROTECTIVE EQUIPMENT
JSW/GHS/GS-05

MANAGEMENT STANDARD PERSONAL PROTECTIVE EQUIPMENT

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1. PURPOSE

The Personal Protective Equipment (PPE) Standard (hereinafter referred to as 'Standard') is intended to enforce organizational directives regarding personal protective measures. The Standard is aimed at protecting, the staff against incidents in technical safety and is largely intended to ensure the proper selection, use and maintenance of personal protective equipment to minimize the potential for personnel exposure to Occupational Health and Safety hazards across all divisions and group companies.

In this context, the principle remains that priority shall be given to the systematic identification of any hazards, and to the prevention of any hazards observed by means of technical and/or organizational changes. The selection of personal protective equipment is governed by the principle that the best possible protection shall be ensured with the least possible burdens for the employees concerned.

2. SCOPE

This Standard applies to all JSW Companies and subsidiaries, managed sites, corporate offices, research and development facilities, new projects, merged and acquired entities. The requirement outlined here applies to all JSW company employees, contractors and shall remain applicable for entire life cycle of an establishment, offices, manufacturing, and project sites wherein personnel will be required to undertake servicing and maintenance activities.

This Standard describes the basic requirements, applicability, minimum specifications of personal protective equipment (PPE) and defines the selection, use and maintenance of personal protective equipment (PPE) for all persons, who enter the operating areas/plants/offices in JSW controlled premises or project sites.

In the Standard, the following verbal forms are used to indicate requirements, recommendations, permissions, or capabilities:

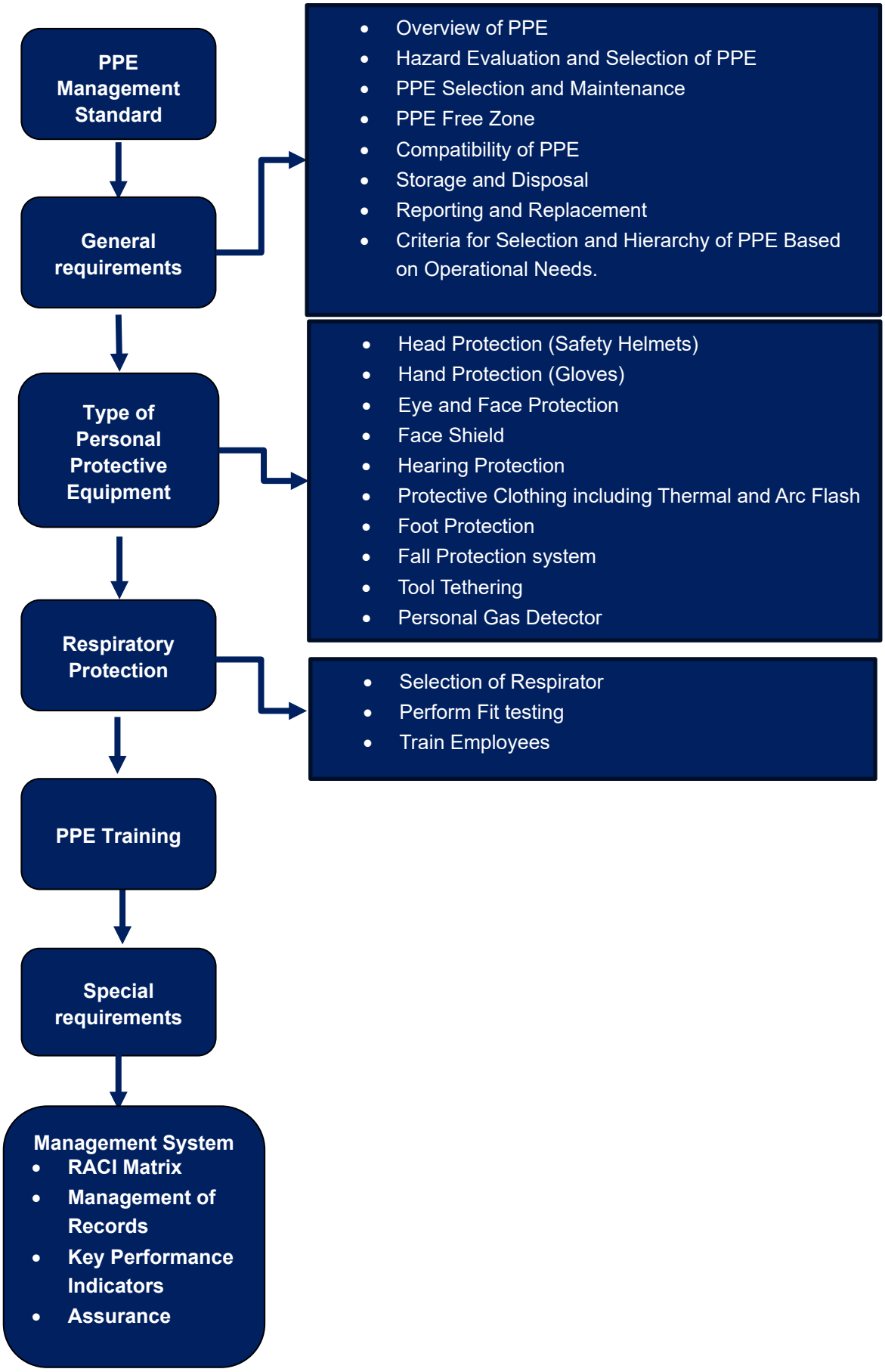
- "shall" indicates a requirement.
- "should" indicates a recommendation.
- "may" indicates a permission.
- "can" indicates a possibility or capability.

3. REVIEW

This standard shall be reviewed or revised at least every 5 years, or periodically as required to ensure continuous improvement. Reviews may be triggered by but are not limited to following cases.

- Installation and use of new equipment
- Adoption of new technology for equipment use.
- Changes to industry standards, laws, and regulations
- Introduction of new materials, chemicals, solvents, petroleum products, etc.
- Training records and feedback from training programs.
- Feedback from users.
- Inspection and audit findings.
- Review of accident and incident reports where PPE has been a factor.
- Recommendations from incident investigation reports.
- Findings from audits or inspections requiring corrective action.

4. PROCESS FLOW



5. GENERAL REQUIREMENTS

5.1 OVERVIEW OF PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal Protective Equipment (PPE) refers to equipment worn or held by an individual to protect against one or more hazards or residual risks that may compromise their health and safety at work. PPE shall be used when risks cannot be sufficiently eliminated or reduced by technical preventive measures, Collective Protective Equipment (CPE), administrative controls, or changes to work procedures.

Whenever possible, risks should be eliminated at the source. If this is not feasible, the risk should be minimized at the source, with Collective Protective Measures (CPE) prioritized over individual PPE. PPE should not be considered a substitute for technically viable preventive systems but should serve as supplementary protection against residual or occasional risks.

All PPE should be selected based on the specific hazards present in the work environment. Before each use, PPE should be carefully inspected to ensure it is in good working order and free from defects. Regular cleaning is essential to maintain hygiene and functionality, while proper maintenance is necessary to ensure the equipment remains effective in providing ongoing safety and protection.

The Business Unit shall ensure that all JSW employees, including those from external companies and visitors as applicable, are provided with the appropriate PPE. This equipment should be suitable, maintained in good condition, and used according to manufacturer guidelines. PPE exposed to hazards should be regularly assessed for its adequacy, including its proper use, care, maintenance, and disposal.

5.2 HAZARD EVALUATION AND PPE SELECTION

Each JSW Business Unit, Site, or Department is responsible for periodically reviewing the workplace environment to identify and evaluate potential health and safety hazards. These hazards may be safety-related, physical, or health-related. A comprehensive hazard assessment should address hazards in both categories to facilitate the selection of the most appropriate Personal Protective Equipment (PPE).

The hazard assessment process begins with a walkthrough survey of operations, jobs, and tasks, aiming to develop a list of potential hazards in the following key categories:

- Object fall hazards
- Operators fall hazards
- Abrasion
- Impact
- Penetration
- Vibration
- Compression (roll-over)
- Chemical hazards (various effects)
- Oxygen deficiency
- Heat exposure
- Cold and freezing risks
- Harmful dust
- Light (optical) radiation

PPE Program Review

JSW Business Units and Sites shall conduct a review of the PPE program based on the format outlined in Annexure-1, specific to each section or plant. This assessment will evaluate the workplace to identify existing or potential hazards requiring the use of PPE. Detailed guidance on activities across various JSW sites can be found in Annexure-8, which includes the PPE Grid according to specific activities.

The hazard evaluation and risk assessment shall be performed in accordance with JSW Standard (JSW/GHS/GS-17) and consider, but are not limited to, the following factors:

- The nature of work being performed
- Specific jobs and tasks
- Timing of work (day or night)
- Environmental conditions at the workplace
- Type of portable tools, machines, and plants involved
- Types of energy involved
- Training and competence of personnel
- Methods available for performing the work
- The hazards involved and their associated risks
- Methods selected for effective isolation
- Relevant documents and operating procedures

Control Measures and PPE Use

In addressing health and safety hazards, every effort should be made to control exposure using technically and economically feasible engineering and administrative controls. Until these controls are implemented, or when employee exposures cannot be avoided or effectively controlled, appropriate PPE should be used. PPE may also be used as precautionary protection for specific tasks. For further details, refer to Annexure-7, the PPE Health and Safety Hazard Evaluation Sheet.

While conducting this review, PPE requirements for each site, activity, job, and task should be selected based on specific hazards and the existing control measures in place at the site or location.

Approved PPE List and Usage

Each site should maintain an approved PPE list in line with this Standard. All employees, including contractors, should use only the PPE listed for that site. The recommended PPE grid, outlining the minimum mandatory PPE specifications for each section or plant, is provided in Annexure-3. This grid should be used as a guide to determine the minimum PPE requirements for each section or plant.

When potential hazards are identified, the permit recipient is responsible for ensuring that a competent person conducts a risk assessment. This assessment should determine the associated hazards and risks, and appropriate control measures should be applied to reduce the potential consequences to an acceptable level before work commences.

5.3 PERSONAL PROTECTIVE EQUIPMENT (PPE) SELECTION AND MAINTENANCE

The selection of the appropriate Personal Protective Equipment (PPE) should consider the following factors:

- **Nature and severity of the hazard**: Understanding the specific type of hazard (e.g., chemical, physical, biological) and its potential impact on health or safety.
- **Type of contaminant**: The specific contaminant involved, its concentration, and the location of the contaminated area relative to the source of respirable air.
- **Worker activity and duration**: The nature of the tasks being performed and how long workers are exposed to the hazard.
- **Comfort and usability**: The comfort of the worker while using the PPE, both when using a single type of PPE or multiple pieces of equipment in combination.
- **Operating characteristics and limitations**: The effectiveness of the PPE in preventing exposure, as well as any potential new hazards it may introduce during use (e.g., restricted mobility or visibility).
- **Ease of maintenance and cleaning**: The ability to properly maintain and clean the PPE to ensure continued effectiveness and hygiene.
- **Compliance with standards**: The conformity of PPE to relevant International and Local Standards (e.g., Bureau of Indian Standards (BIS), CE Mark (European Conformity), etc.).

PPE Selection Process

Business Units shall ensure that the selection of PPE is based on a thorough evaluation of the hazards present, the extent and frequency of exposure, and the individual characteristics of the users. PPE should not be selected randomly or as a generic solution but should be tailored to address specific hazards and user needs.

For detailed guidance on selecting appropriate PPE for various applications, refer to Annexure-6, the PPE Selection Guide, which provides a structured approach for choosing PPE based on the identified risks and operational requirements.

All plants: sections shall have clearly visible signage's, instructions defining the use of minimum mandatory PPE while entering in the respective plant areas, example - as indicated in Figure below.



Figure-5-1: Label Before Entering Mandatory Area

Personal protective equipment (PPE) shall be used, maintained, and stored in accordance with the manufacturer's instructions; in addition, PPE shall be visually inspected before each use and any damaged PPE shall not be used and stored in a dedicated location waiting for their disposal. Moreover, Sites shall develop procedures to document, schedule and monitor any necessary PPE maintenance or replacement.

5.4 PPE FREE ZONE

- The "PPE Free Zone" is an area where individuals are not expected to encounter hazardous conditions or substances, and where field work is not typically conducted. Since the zone is considered free from exposure to hazards, personnel working within it may wear regular work attire.
- The establishment of "PPE Free Zones" should be based on available site assessment data. These zones shall be permanently marked and communicated to personnel at the location.
- The PPE Zone should be clearly delineated to ensure that individuals standing on the PPE Free side of the boundary are not at risk from potential hazards or equipment located on the work environment side.
- The boundaries of the zone shall be updated and adjusted as needed if permanent conditions or changes occur (e.g., process modifications, implementation of engineering controls, introduction of new hazards). Any adjustments should be clearly identified, marked, and communicated.

If temporary or occasional work needs to be conducted within a marked PPE Free Zone, measures should be put in place to restrict access to the temporary work area (e.g., barricade tape, signage, communication) until the work is completed and the area can return to the PPE Free Zone.

5.5 COMPATIBILITY OF PPE

When multiple health risks require the use of more than one type of PPE, it is crucial to ensure that the selected PPE are compatible with each other and remain effective against the identified risks. For instance, if both a hard hat and a respirator are needed at the same time, verify that they can be worn together properly and continue to provide adequate protection against the intended risks.

5.6 STORAGE OF PPE

Business Units shall provide appropriate storage for PPE when it is not in use. This storage shall protect the equipment from contamination, loss, or damage caused by harmful substances, moisture, or sunlight. If PPE becomes contaminated during use, it shall be stored separately from uncontaminated PPE in a designated and clearly labelled area. If PPE contains hazardous materials, such as asbestos, it shall be sealed in an appropriate container and clearly marked.

PPE that is ready for use shall be distinctly separated in the storage area from equipment awaiting repair or maintenance. Once PPE is issued to an employee, the employee is responsible for ensuring proper storage throughout the PPE's service life.

5.7 DISPOSAL OF PPE

Business Units shall ensure that when PPE is no longer suitable for use, it is disposed of following the appropriate methods in accordance with relevant disposal procedures.

5.8 REPORTING LOSS OR DEFECT

Employees shall take reasonable care of the PPE provided to them and promptly report any loss or visible defects. If they have concerns about the PPE's condition, they shall consult their supervisor immediately.

Business Units shall establish procedures for employees (or contractors) to report any PPE loss or defects. These procedures shall ensure that defective PPE is repaired or replaced before employees return to work. Any replacement PPE reported as lost, damaged, or defective shall receive approval from the appropriate department.

5.9 MINIMUM MANDATORY CRITERIA PPE REQUIREMENTS

The following criteria should be considered when selecting Personal Protective Equipment (PPE):

- **Job and task-specific requirements**: The nature and scope of the specific work being performed.
- **Hazard identification**: The type of hazards present (e.g., physical, chemical, biological, radiation, electrical, stored energy, etc.).
- **Work environment**: Conditions such as temperature, humidity, ventilation, or the presence of contaminants that may affect PPE performance.
- **Risk and consequences of PPE failure**: The potential impact of PPE failure on worker safety and health.
- **Durability and service life**: The expected longevity of the PPE under typical use conditions and its ability to withstand wear and tear.
- **Regulatory compliance**: Adherence to applicable laws, regulations, and guidelines concerning PPE use and programs.
- **PPE standards and certification**: Compliance with relevant PPE standards and certifications (e.g., IS, ANSI, CE, ISO) based on the location and type of work.

- **Fit, comfort, and usability**: Ensuring PPE is properly fitted, comfortable for the wearer, and meets individual user needs for both single-use and multiple-use scenarios.

The PPE selection shall be performed following the below hierarchy:

Mandatory PPE	Safety Helmet and Safety Shoes are minimum PPEs for whosoever enter the operating areas/plants in JSW premises or project sites.
	Use of reflective Jackets while entering to any location/area in the plant.
Location based PPE	For example, when entering a chemical storage, the PPE required are Safety Shoe/Gumboot, Safety Helmet, Hand Gloves (Rubber), Safety Goggles, Rubber Apron/Suite For example, Thermal resistant and Arc flash suit are mandatory requirement while working in or near vicinity of Liquid metal or hot material and Electrical panels/ substation etc. respectively.
Activity Based PPE	For example, when doing an electrical job, the PPE required are Safety Helmet, Electrical resistant Safety Shoes, Electrical resistant/ insulation (or Arc resistant) Rubber hand gloves, Electrical Arc Flash Protective Suit (for high voltage or as per Risk)

6. TYPE OF PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment (PPE) shall be used to protect person from hazards a residual risk as per local legal requirements of state/country. All PPE shall, at minimum, meet regulatory and JSW defined standards.



Figure-6-1: Personal Protective Equipment (PPE)

The PPE listed below are the minimum mandatory PPE required to be worn while entering the factory premises through all gates with also reference to visitors and drivers:

- Safety Helmet
- Safety Shoes
- High Visibility Marking Jacket

Table-1: Requirement of PPE at Sites

	Safety Helmet	Safety Shoes	Safety Glasses	High Visibility Jacket	Seat Belt
Pedestrian	✓	✓	✓	✓	
All Vehicles	✓	✓	✓	✓	✓

All areas and tasks for which PPE is needed under expected routine or non-routine operating conditions shall be clearly displayed in each facility (by sign boards) and should be documented in respective Safe Work Procedure (SWP).

PPE shall be visually inspected before each use and any damaged PPE should not be used.

PPE shall be discarded on completion of shelf-life or when they are not in usable condition to serve intended purpose due to prolong use or wear & tear. Shelf-life of PPE shall be related to their effective use (based on risk assessment) and shall be as per respective IS Code, International Standards, and manufacturer's recommendations.

Potentially contaminated PPE shall not be worn in designated clean areas (for example offices, control rooms, lunchrooms, and clean change rooms). Those PPE shall be cleaned or disposed of as deemed appropriately by each facility. Site shall establish schedule for replacement of PPE.

All PPE which have been affected during an incident/ accident shall be inspected prior to reuse.

Following requirements apply to the various types of PPE listed below.

6.1 HEAD PROTECTION

Mandatory Use: Safety helmets should be worn at all times upon entering the plant site to protect against potential head injuries from falls, falling objects, or hazardous equipment.

Material and Standards: Glass fibre reinforced plastic (FRP) helmets are required to provide impact, penetration, electrical shock, and burn protection. Helmets should conform to BIS Standard 2925 or local legislation (e.g., Mine Act 1952, Factories Act 1948, Section 35), as well as international standards such as the CE Mark.

Types of Helmets:

- Class A: Provides protection against impact, penetration, and electrical voltages up to 2,200 volts.
- Class B: Used protection from impact, penetration, and flying objects, with electrical voltage resistance up to 20,000 volts.
- Class C: Lightweight helmets used impact protection but no electrical resistance.

Maintenance and Inspection:

- Helmets should be thoroughly inspected before each use for cracks, damage, or alterations.
- Ensure helmets are free from holes, cracks, or frayed materials.
- Helmets should not be used to carry objects, as this can compromise their protective capabilities.
- Clean helmets regularly and store them in a cool, dry place away from heat or potential damage to maintain their effectiveness.

Prohibited Practices: Modifications to helmets (such as drilling holes) or wearing caps inside helmets are strictly prohibited.

Sikh Turban and Other Requirements: The use of a Sikh turban shall be permitted and respected according to traditional practices on the JSW site, in accordance with the relevant policies and safety standards.

JSW Helmets should have company logo, Contractor Employees should have their company name and may have logo, visitors helmet will have visitor label and shall follow the following colour codes.



Figure-3: Head Protection

Colour	Application
White	All JSW Employees, except Safety, Security and Fire
Yellow	Associates / Apprentices
Orange with Company name and logo	Contractors
Green	Safety Professionals
Red	Security and Firemen
White	Medical Employees
White with Visitor & Vocational Trainee label	Visitors & Vocational Trainee

Table-2: Safety Helmets Colors

6.2 HAND PROTECTION

Hand injuries, constituting a significant portion of workplace accidents, often result from handling sharp objects, hot metals, chemicals, and electrical equipment. Effective use of Personal Protective Equipment (PPE), specifically gloves, is essential due to the vulnerability of hands and fingers to these hazards.

Selection of appropriate hand protection is based on a thorough risk assessment, considering factors like the specific hazards involved, performance characteristics needed, duration of use, and the tasks performed. Gloves come in various materials such as cotton, rubber, PVC, Kevlar, stainless steel mesh, and leather, chosen based on the type of protection required.

Types of Hand Protection:

Mechanical Hazards:

Protection against potential crushing, impact, vibration, and cuts from machinery parts or falling objects.

Temperature Extremes:

Gloves shield against heat or cold, including protection from flames and welding sparks.

Chemical Exposure:

Different glove materials resist various chemicals like acids, alkalis, solvents, and oils. Selection depends on the specific substances encountered.

Electrical Hazards:

Rubber gloves with defined voltage ratings provide insulation against electric shocks as per specified classes.

Table-3: Class of gloves and Voltage Ratings

Class	Maximum Use Voltage (AC)	Proof Test Voltage (AC)
00	Up to 500 volts	2,500 volts
0	Up to 1,000 volts	5,000 volts
1	Up to 7,500 volts	10,000 volts
2	Up to 17,000 volts	20,000 volts
3	Up to 26,500 volts	30,000 volts
4	Up to 36,000 volts	40,000 volts

Radioactive Materials:

Impervious gloves act as a barrier against radioactive substances, preventing skin contamination or ingestion.

Key Features and Properties of Safety Gloves:

Impact and Compression: Anti-impact gloves feature padding for cushioning against impacts while allowing movement.



Figure-4: Impact Gloves, Electrical Gloves Chemical-Resistant, Radiation-Resistant

Vibration: Anti-vibration gloves reduce exposure to vibrations from tools, preventing conditions like hand-arm vibration syndrome.

Penetration and Abrasion: Materials like Kevlar and leather offer protection against punctures and abrasions.

Thermal Protection: Gloves made from materials like terrycloth, Kevlar, glass Fiber, and leather protect against extreme temperatures and cryogenic liquids.

Fire Resistance: Chromed leather gloves are resistant to flames and heat.

Chemical Protection: Various materials such as natural rubber, neoprene, nitrile, butyl, PVC, and Viton provide resistance to different chemicals.

Table-4: Chemical Agent Glove Material Suitability

Chemical Agent	Glove Material & Suitability					
	Natural Rubber	Nitrile Rubber	Neoprene	PVC	Butyl Rubber	Viton
Water soluble substances; weak acids, and alkali	✓	✓	✓	✓	-	-
Oils	-	✓	-	-	-	-
Chlorinated solvents	-	-	-	-	-	✓
Aromatic solvents	-	-	-	-	-	✓
Aliphatic solvents	-	✓	-	-	-	✓
Strong acids	-	-	-	-	✓	-
Strong alkali	-	-	✓	-	-	-

General Use: Flexible gloves like rubber or knit fabric provide good grip and are suitable for low-risk tasks.

Guidelines for Use:

- Gloves should cover the entire exposed portion of the hand and be of appropriate size to ensure a snug fit.
- Regular inspection and maintenance of gloves are crucial to ensure they remain effective. Damaged and expiry date gloves should be replaced promptly.
- Gloves should be stored in a clean, dry area to prevent contamination and degradation.
- Effective use of gloves not only protects workers from immediate injuries but also safeguards against long-term health issues associated with repeated exposure to hazards. Compliance with standards such as EN388, EN-407, and IS 4770-1968 ensures that gloves meet necessary safety requirements for specific hazards.

6.3 EYE AND FACE PROTECTION

Suitable eye protection shall be provided for all employees, including consultants and employees of contractors and visitors, where there are hazards of flying objects, glare, liquids, injurious light radiation, dust, or molten metal splashes.

Types of Eye Protection

There are several types of eye protection, some of which provide protection for the wearer's face as well. Some typical examples are:

- Safety spectacles
- Safety goggles
- Face-shields such as full face-shields, visors, or balaclavas

Protection against impact, particles, chemical splash, molten material, or flash shall be provided for face, neck, and eyes. There are several types of eyes and face protection equipment available, but it is important that employees use the proper type for the work.



Figure-5: Goggles, Safety Spectacles

All employees performing work that requires eye protection shall wear safety spectacles with side shields. Safety goggles should meet the minimum requirements of BIS Standard 14352:1996 or Section 35 of the Factories Act, as well as welding face shields conforming to BIS Standard 1179:1967, or equivalent international standards such as CE Marked products, providing a comparable level of protection. Additional types of eye protection may be required depending on the specific hazards involved.

Employees who wear prescription spectacles should use suitable over-glasses or spectacles with side protection. Although the standard does not prohibit the use of contact lenses, JSW Group does not recommend them. Contact lenses can present potential issues under certain conditions, such as:

- Extremely dusty environments where particles may get under the lens and cause irritation.
- Extremely hot and/or dry environments, such as near boilers, furnaces, or heaters, where the eyes may be exposed to intense radiated energy.

Appropriate eye protection should be worn whenever eye protection is required. The selection of suitable eye protection is essential for ensuring safety and compliance with JSW PPE specifications. The primary

consideration should be the specific hazard, but factors such as comfort, fit, style, and durability should also be taken into account. Eye protection should fit securely and not easily slip off, and it should be assigned on a personal basis. In certain cases, double eye protection may be necessary.

The intense light emitted by an arc or flame can cause serious eye damage, making proper eye protection essential. Workers should wear safety glasses, goggles, welding helmets, or welding face shields with appropriate filter lenses. This requirement applies to both the workers performing the task and any observers, such as supervisors or assistants.

The filter lenses should have the correct shade number for adequate protection. The shade number indicates the amount of light radiation allowed to pass through the lens; a higher shade number means a darker lens, which permits less light to pass through.

The tables below outline the minimum protective lens shade numbers for common welding and cutting processes.

Table-5: Filter Lenses for Protection During Shielded Metal Arc Welding

Operation	Electrode Size – inch (mm)	Arc Current (Amperes)	OSHA Minimum Protective Shade Number	ANSI & AWS Shade Number Recommendations
Shielded Metal Arc Welding (SMAW)	Less than 3/32 (2.4)	Fewer than 60	7	-
	3/32-5/32	60-160	8	10
	(2.4-4.0)	More than 160-250	10	12
	More than 5/32-1/4	More than 250-550	11	14

Table-6: Filter Lenses for Gas Welding and Oxygen Cutting Operations

Operation	Plate Thickness (Inches)	Plate Thickness (mm)	OSHA Minimum Protective Shade Number	ANSI & AWS Shade Number Recommendations
Gas Welding	Under 1/8	Under 3.2	4	5
	1/4 to ½	3.2 to 12.7	5	6
	Over ½	Over 12.7	6	8
Oxygen Welding	Under 1	Under 25	3	4
	1 to 6	25 to 150	4	5
	Over 6	Over 150	5	6

The main classes of eye and face protection equipment required for industrial operations are as follows:

Eye Protection Equipment

- **Safety Glasses**: These are similar to safety goggles but provide a lower level of protection. They feature shatterproof lenses made from materials such as polycarbonate or propionate plastic and often include side shields. Safety glasses are designed to protect the eyes from large physical objects like wood chips. They are also used to filter laser light and prevent laser reflections from causing retinal burns. However, safety glasses do not protect against liquids or vapours.
- **Safety Goggles**: These offer full, all-around eye protection. They fit snugly to the face, enclosing the optical area, and are held in place with a headband. Goggles come in various designs, such as eyecups, flexible or cushioned, plastic eye shields, and splash goggles. Some goggles are designed for wide vision, and some include ventilation systems to reduce fogging.

- **Safety Spectacles**: These are mounted in a durable metal or plastic frame, with or without side shields. The lenses are made from materials like toughened glass, cellulose acetate, acrylic, or polycarbonate. Side shields are included when lateral protection is necessary.
- **Safety Clip-ons**: These are protective lenses designed to clip onto the front of non-safety spectacles. They are typically cut-type goggles made to fit over corrective spectacles.
- **Hand-held Face Shields**: These are used in welding operations or for observing the welding process, providing additional protection from sparks and debris. Hand-held face-shields are also used in welding operations or for observing the welding process.

Maintenance and Care: Eye protector lenses should be kept clean to maintain clear vision, prevent eye fatigue, and avoid accidents. Typically, eye protection is issued to individuals personally and should only be used by the person it is assigned to. If eye protection is reassigned, it should be thoroughly cleaned and disinfected.

When not in use, eye protectors should be stored in appropriate cases to avoid damage. Replace worn-out or damaged headbands and replace scratched or pitted lenses to ensure proper vision and maintain impact resistance. Similarly, replace transparent face shields that are warped, scratched, or have become brittle over time to ensure ongoing safety.

6.4 FACE SHIELD

Face Shields are designed to provide protection for the face and neck from flying particles and sprays of hazardous liquids / fumes; the selection shall be made based on protection needed. Always wear face shields during activities such as, grinding, welding, lancing, and gunning and handling chemicals and corrosive liquids, power chipping, removing, or installing ceiling panels and drilling above smaller height. Face shields are considered additional protection for high temperatures, high density / impact particles or against chemical splashes and are not an alternative to goggles.

Though heavier and bulkier than other eye protectors, face shields can be comfortable when equipped with an adjustable head harness. They protect the face but don't fully enclose the eyes, so they don't offer protection against dust, mist, or gases. Visors on brow guards or helmets are replaceable and can be worn over standard prescription glasses without fogging issues. Face shields with reflective metal screens maintain good visibility while effectively deflecting heat.

The window or transparent section of face shield shall be made of suitable plastic. It may be supported in a frame hood, as an addition to headgear, or any manner suitable for the purpose. Face shields shall be worn over suitable safety spectacles. Splash goggles are recommended under face shields when protection from hazardous liquid splashes is required.

Proper face shields (arc flash hood and thermal resistant hood as shown below) are compulsory for electric works presenting risks according to risk assessment results and whenever an electric work is performed with potential arc-flash.

Consider the task and potential use of goggles as well as face shields for added protection.



Figure 6-2: Face Shield

Figure 6-4: Arc Flash Hood **Figure 6-3: Thermal Resistant Hood**





6.5 PROTECTIVE CLOTHING

The work clothing shall provide basic protection for individual work environments. The normal dress shall be either protective clothing or long tight trousers with full sleeve shirts / jackets. Loose clothing shall not be worn, and long hair should be covered when work is performed around machinery with exposed moving parts.

Selecting Suitable Body Protection

Choosing appropriate body protection is essential to safeguard against various hazards. The selected body protection shall address the following risks:

- **Low-Risk Chemicals**: For exposure to mild chemicals, chemical-resistant clothing such as aprons or coveralls is usually sufficient to provide protection.
- **Strong Solvents, Oils, and Greases**: When dealing with more hazardous substances, protective garments such as coats, coveralls, and aprons made from materials like neoprene, polyurethane-coated nylon, Terylene, or rubber offer enhanced protection.
- **Chemical Suits**: For protection against potent chemicals, chemical suits provide full encapsulation and are available in vapor-proof or splash-proof designs. These suits are typically equipped with breathable air systems. Chemical suits should be inspected every three months, even if not in use, to check for airtightness, seam integrity, and other potential issues. When handling hazardous substances like triethylaluminium (TEAL), specialized aluminized clothing should be used to protect against TEAL fires.

- **Vapor Suits**: Vapor suits are designed to protect against hazardous vapours and should be air-tested with the manufacturer's test kit before storage in a protective case. Manufacturers often provide testing and repair services for these suits to ensure continued efficacy.
- **Splash-Resistant Clothing**: Splash-resistant clothing is made from materials designed to protect against liquid splashes, preventing exposure to harmful liquids.
- **Fibers and Dust**: For protection against fibers and particulate matter, suits made from bonded olefin are used to provide a barrier to airborne particles.
- **Radiant Heat and Flame**: Fire-resistant garments are designed to protect against radiant heat and open flames, offering a level of safety for workers exposed to high-temperature environments.

6.5.1 Fire Retarding / Flash / Radiant Heat Protection Clothing

Fire retarding clothing shall be worn by all persons working in an area where a process malfunction, electrical flash, welding, cutting, or burning is likely to occur and expose them to burn hazards. Heat



Figure-7: Fire Retarding/Flash/Radiant Protection

resistant work clothing shall be worn in areas where exposure to high temperature or radiant heat.

Fire/Heat-protecting clothes may follow NFPA 2112 or equivalent standards. The outer layer of heat and fire protection wear should be made of materials like Nomex®, Kevlar®, PBI (Polybenzimidazole), or Basofil® or any suitable tested fabric to the recognized standard. These materials provide excellent flame resistance and durability, ensuring maximum protection. The inner lining should consist of flame-resistant cotton blends or aramid blends, enhancing comfort and moisture-wicking properties while maintaining fire resistance.

A moisture barrier is crucial for keeping the wearer dry and comfortable. This barrier is typically made from PTFE (Polytetrafluoroethylene) laminates, often used in combination with Nomex® or other materials, or from polyurethane (PU) coated fabrics, which offer waterproofing and flexibility while maintaining some breathability.

The thermal barrier, responsible for providing insulation, is usually made from aramid batting or non-woven flame-resistant fabrics. These materials ensure effective thermal protection, keeping the wearer safe from extreme heat. Additionally, reflective trim made from 3M™ Scotchlite™ Reflective Material is used to enhance visibility in low-light conditions, which is essential for the safety of firefighters and other emergency responders.

6.5.2 Electrical Protection

Electrical Arc Resistant Suit conforming to IEC-61482-2 or equivalent standard shall be worn by person when working on electrical equipment and exposed to hazard of flash over. Rating of such suit shall be as per its application based upon the voltage exposed and risk assessment. Where there are potential electrical hazards, electrical protective equipment appropriates for the specific parts of the body including electric safety shoes as applicable. Refer **Annexure-2** for guidelines on additional PPE.

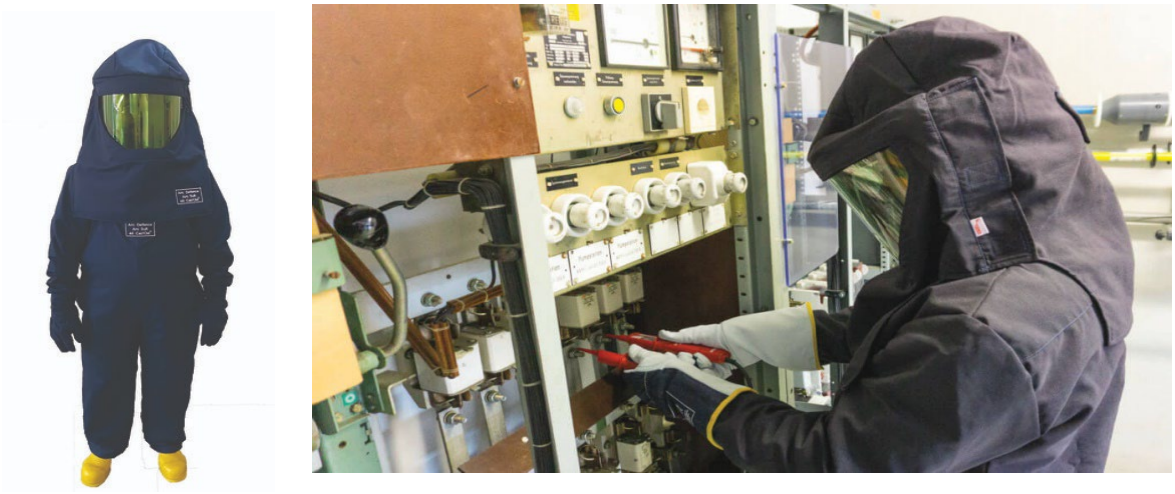


Figure-8: Electric Arc Flash Protection

6.5.3 Heat and Cold Stress Protection

Proper protective equipment shall be provided to protect against high and low temperature extremes. Low temperatures include source of freezing hazards, as liquid Nitrogen.



Figure-9: Heat/Cold Stress Protection

6.5.4 Chemical Protective Clothing

Specific Work clothing for chemical handling shall be of natural latex rubber gloves, neoprene synthetic rubber and vinyl shall be worn by personnel for protection against various chemicals, as recommended by related SDS and chemical risk assessment. It protects the whole body except face, hands and feet from chemicals and should be used while handling of liquids that can splash and can damage skin.



Figure-10: Chemical Protecting Clothing

6.5.5 High Visibility Clothing

This material is made from PVC infused with fluorescent pigments. Personnel shall wear it when working on roadsides or other areas where high visibility is essential for safety. JSW Employees shall wear uniform with full sleeves having reflective tapes.

Colour Coding for High Visibility Clothing within JSW Premises

- **JSW Employees, Associates, and Apprentices**: Green, as specified below.
- **Contract Workers**: Orange.
- **Visitors**: Blue.

Note: If Shirt provided to employees with reflective tapes then continue the same.



Table-7: High-Visibility Clothing

Types of PPE

Types of PPE	Specifications	Applications
Chemical Protective Clothing	Material – Natural Latex Rubber, Neoprene, Vinyl	Handling of Corrosive Chemcials
	Coverage: Full body coverage except face, hands, feet	Splash protection
Thermal Protective Clothing	Material: Fire-resistant fabrics, aluminized materials	Welding, cutting, exposure to radiant heat
	Performance: Protects against radiant heat and flames	
Arc Flash Protective Clothing	Standard: IEC 61482-2 or equivalent	Working on electrical equipment, arc flash hazards
	Rating: Suitable for specific voltage levels based on risk assessment	
High Visibility Clothing	Material: PVC with fluorescent pigments infused	Roadside work, low visibility environments

6.6 FOOT PROTECTION

All employees of the JSW, consultants, employees of the contractors and visitors shall use appropriate safety shoes while performing their duties during job or while inside JSW premises. Safety shoes/boots with closed metal toes (or non-metallic toes giving same protection as metal) shall be worn in areas.

Types of Foot Protection:



Figure-11: Foot Protection

- **Safety Boots or Shoes**: The most common type of safety footwear, often equipped with steel or composite toecaps for added protection. They may also include features such as slip-resistant soles, steel midsoles, oil resistance, and insulation against extreme temperatures.
- **Rubber Boots**: Ideal for wet conditions, rubber boots are useful in situations where the footwear needs to be washed frequently. Typically made from rubber, these boots are also available in polyurethane and Polyvinyl Chloride (PVC), which offer greater chemical resistance. Rubber boots may also include corrosion-resistant steel toecaps, rot-proof insoles, steel midsoles, anklebone padding, and cotton linings.
- **Anti-Static Footwear**: Designed to prevent the accumulation of static electricity on the wearer, anti-static footwear reduces the risk of igniting flammable atmospheres and provides some protection against electric shock. For example, these can be used in coal section area, HSD area etc.
- **Conductive Footwear**: Similar to anti-static footwear, conductive footwear prevents the build-up of static electricity, making it suitable for handling sensitive components or substances. However, it does not offer protection against electric shock.

Selecting Suitable Foot Protection

Choosing the right foot protection primarily depends on the specific hazard involved, but comfort, style, and durability are also important factors to consider. The selection shall be based on the compatibility with the work, the level of protection required, and the user's needs.

Foot protection shall generally be flexible, water-resistant, equipped with oil-resistant soles, and able to absorb perspiration. Boots are necessary when ankle protection is required. Consideration shall also be given to the footwear's ability to resist corrosion, abrasion, and industrial wear and tear. Always follow the manufacturer's instructions and markings for the proper use and level of protection.

Key features of safety footwear to consider when selecting include:

- **Soles**: Work shoes and boots shall have threaded soles for slip resistance. Soles shall also be heat and oil-resistant and can be shock-resistant, anti-static, or conductive.
- **Protective Toecaps**: Toecaps made of steel or composite material provide protection from heavy, sharp objects falling from height.
- **Heat Resistance**: Safety footwear made with leather or other heat-resistant materials can offer protection from heat, sparks, and molten metal complying with EN ISO 20345, ASTM F2413, ISO 13287 or specific national standards as applicable to heat resistant footwear.
- **Waterproofing**: Those working in wet environments shall wear safety footwear that is impervious to water. Rubber and PVC are suitable waterproof materials because they are impermeable. There are also breathable materials that are water-resistant and allow air to pass through, improving comfort and hygiene.

The Safety Shoes of non-metallic toes tested for high voltage shall be provided for Electrical Workforce. The shoes shall conform to BIS Standard 15298 - 2: 2011 or safety international standards providing an equivalent level of protection, like CE Marked. Test certificate from a reputed laboratory shall be supplied with the shoes.

Foot protection shall be lace up and not elastic sided, it shall be ankle boots for plant areas. Employees shall maintain footwear in good state of repair, or the shoes should be replaced with authorization of management.

All persons entering site by driving whole type of vehicles are required to use safely shoes while driving. Safet footwear shall be well constructed of suitable material for the exposure it is intended to receive and shall provide wearability and comfort.

Full- bridged metatarsal protection is recommended for concrete breaking, construction rigging and other heavy work. Safety footwear shall comply with the requirements of IS 3737: 1966- Leather safety boots for workers in heavy metal industries or equivalent EN standard.

Safety footwear shall be kept in good condition by regularly inspecting and discarding any worn or deteriorated pairs. Check and replace laces as needed. Remove any debris lodged in the tread and inspect stitching for signs of looseness, wear, or damage.

High heels are not considered safety shoes regardless of their labelling.

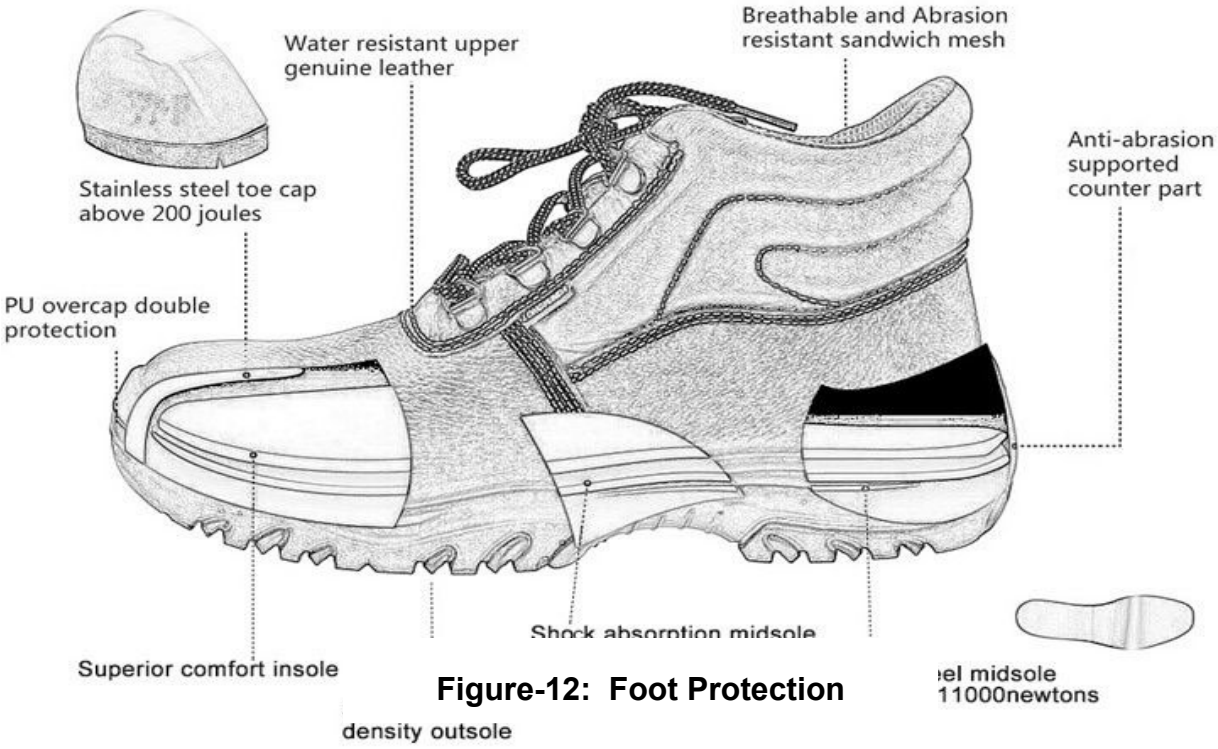


Figure-12: Foot Protection

6.7 FALL PROTECTION SYSTEM

Positive fall protection systems, including full-body harnesses, fall arrestors, rope grabs, etc., are mandatory for all elevated work areas from where a fall could occur.

Potential fall distance should be calculated to determine how to rig the system, and selection of the appropriate type of connecting device. For example, when using a 1.8-meter lanyard, the illustration below shows a typical calculation of total estimated fall distance:

- When fall clearance is under 6 meters (18.5 feet), an alternative solution such as shorter lanyard length, or a different connecting device such as self-retracting lanyard or fall limiter, is needed to reduce the total fall distance.
- When fall clearance is over 6 meters (18.5 feet)there is sufficient total fall distance available, and the 1.8-meter lanyard is acceptable to use.
- Never tie a knot in any lanyard to make it shorter, as it reduces the strength by more than 50%. Instead purchase an adjustable lanyard and adjust it to proper working length.

Please Refer JSW Work at Height Standard JSW/GHS/GS-12.

Selecting Suitable Personal Fall Protection

When choosing an appropriate Personal Fall Protection system, consider the following factors:

- Type of work: The nature of the task being performed.
- Mobility requirements: The level of movement needed during the task.
-
    - Fall distance and clearance limits: The maximum distance and clearances allowed in case of a fall.
    - Maximum descent height and load: The highest allowable descent and the weight limit for the equipment.
    - Length, type, and quantity of ropes, lanyards, and harnesses: The specific equipment needed for the job.
    - Post-fall recovery: How to safely recover from a fall.

All safely harness shall comply to Indian standard or provide an equivalent level of protection like CE Marked indicating compliance with European standard and shall be equipped with two shock- absorbing lanyards.

Group Companies should guarantee the inspection and maintenance of all Personal Fall Protection equipment and its components. Any faulty items shall not be used until they are either repaired, tested, or replaced. Only qualified individuals shall carry out repairs.

Everyone should inspect their harnesses, lanyards, connectors, ropes, slings, and other components of the Personal Fall Protection system both before and after each use.



Figure-13: Fall Protection System

6.8 PERSONAL GAS DETECTORS

In environments where exposure to carbon monoxide (CO), lower explosive limit (LEL), and hydrogen sulphide (H_2S) is a concern, personal gas detectors are essential for ensuring worker safety. These devices should be selected based on their ability to detect specific gases and meet the following specifications:

Types of Gas Detectors:

Combustible Gas Detectors (LEL): Gas detectors should detect gases from 0 to 100% LEL, with high sensitivity for low levels of combustible gases. The response time should be within 15-30 seconds. Alarms should be set at predefined LEL levels (e.g., 10% for low alarm and 20% for high alarm). Regular calibration is required to maintain accuracy. Refer to the Confined Space Entry standard (JSW/GHS/GS-06) for more details on limit values of various types of gases.

Toxic Gas Detectors:

Carbon Monoxide (CO): CO detectors should measure levels from 0 to 500 ppm or higher, with high sensitivity to detect low concentrations. The response time should ideally be within 15-30 seconds, with alarm thresholds set at 35 ppm for a low alarm and 200 ppm for a high alarm. Regular calibration is essential to maintain accuracy.

Hydrogen Sulphide (H_2S): H_2S detectors should measure from 0 to 100 ppm or higher, with high sensitivity for detecting even low concentrations. They should respond within 15-30 seconds, with alarms configured at 10 ppm for a low alarm and 50 ppm for a high alarm. Consistent calibration is required.

Combination Gas Detectors: These detectors are designed to detect multiple gases simultaneously, such as CO, H_2S, and lower explosive limit (LEL) gases. They should be capable of covering the required range for each gas and allow configurable alarm settings. Key features include long battery life, rugged construction, and a clear display for real-time monitoring. Regular calibration and maintenance are critical to ensure continued accuracy.

Operational and Maintenance Considerations:

- **Bump Test:** A bump test should be performed safely before use to verify functionality, following the manufacturer's recommendations. This ensures the detector's battery is charged and the device is functioning properly.
- **Servicing:** Personnel should note the service schedule for the gas detector. Disposable detectors that have reached the end of their life should be disposed of properly.
- **Calibration:** Instrumentation for measuring atmospheric concentrations should be calibrated every six months, with the calibration date recorded on the instrument. For specific and long-term activities, calibration should be performed according to the risk assessment.

General Features:

Self-Test: Detectors should perform self-tests and calibration checks to verify proper functionality.

Data Logging: The ability to log data for accurate record-keeping and post-event analysis.

User-Friendly Interface: Easy-to-use controls and a readable display for quick interpretation of readings and alarms.

Safety and Compliance: Ensure detectors meet relevant safety standards, such as ATEX, IECEx, or ANSI/ISA, and are certified for use in specific hazardous environments.

6.9 BUOYANCY AIDS

A lifejacket is a personal safety device which shall be selected so that, when fully inflated (if an inflatable type). It provides sufficient buoyancy to turn and support an unconscious person face upwards within five seconds (ten seconds if automatically inflated). The person's head shall be supported with the mouth and nose well clear of the water. Life jackets in India are subject to the approval by the Government of

India under relevant Acts and Rules. They are classified based on type (adult size, child size) and buoyant material (unicellular plastics, kapok, cork). The life jackets should not unduly restrict vision, hearing, or breathing. The Maxima Life Jacket for Adults is a Type III Personal Flotation Device (PFD) designed to support a user weight of up to 120 kg.

Lifejackets should be worn where any work or activity is done near a water body and there is a foreseeable risk of falling into the water. They should also be worn during movement or transportation via boats or helicopter.

Lifejackets shall be selected by specifying compact types that allows a full range of movement, such as automatically inflatable type or a type that is inflated by manual pull cord.

Automatically inflated life jackets shall be carefully maintained since the automatic inflation mechanism can fail to operate if the unit has been subject to rough handling or incorrect storage.

6.10 HORTICULTURE

PPE for horticulture workers shall include a helmet, appropriate gloves, safety glasses, safety boots or gumboots, a high-visibility jacket, and form-fitting clothing.

6.11 PEOPLE WORKING ON ROADWAYS

People such as traffic coordinators, security, road sweepers, street light maintainers need to consider helmet, glasses, high visibility jacket, safety shoes, dust mask and barrier protection if exposed to traffic.

6.12 OTHER PPES

The need for other PPE shall be assessed at each location for any categories which have not already been covered in this document. Other potential workplace hazards which may require the use of specialized PPE include biological agents, and radiation.

7. RESPIRATORY PROTECTION

7.1 RESPIRATORY PROTECTION

- The site should implement this respiratory protection program with required work-specific procedures for required use of respiratory protection.
- The respiratory protection program includes the following provisions:
  - Procedures for selecting respirators.
  - Medical evaluations of employees required to use respirators.
  - Fit testing procedures
  - Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations.
  - Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators.
  - Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators.
  - Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations.
  - Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance
  - Procedures for regularly evaluating the effectiveness of the program.

a) Only respirators approved by National or international standard shall be purchased and used at site. Information to be considered in selecting the type of respirator to be used includes:

- Estimated or actual contaminant concentration where the respirator will be used.
- Characteristics and limitations of available respirators.
- Factories Act and state factories rules Permissible Exposure Limit, Threshold Limit Value, Recommended Exposure Limit.
- Nature of contaminant: gas, vapor, or particulate.
- Could the contaminant concentration become immediately dangerous to life or health.
- If the contaminant is flammable, does the estimated or actual concentration approach the lower explosive limit.
- Does the contaminant have adequate warning properties (i.e. Odor).
- Is the contaminant an eye irritant.
- If the contaminant is a gas or vapor, is there an available cartridge that traps it efficiently and safely; and
- Can the contaminant be absorbed through the skin?

b) The Respirator Specification Form shall be utilized to document the type of respiratory protection required to be worn for the specific hazard present and employee performing the task. Refer Annexure-4.

c) Respirator Requirements for Routine Tasks

- For protection against gases and vapours, a full or half-face atmosphere supplying or air-purifying respirator (cartridge or canister type) should be utilized.
- A separate respirator should be purchased, issued, and maintained by the site for each site employee that uses a respirator on a routine basis.
- Air-purifying respirators (cartridge or canister type) have limitations to the concentration for which a particular cartridge/canister can be used. Therefore, where possible the respirator shall be equipped with an end-of-service-life indicator (ESLI) certified by authority for the contaminant.
- If there is no ESLI appropriate for conditions at the site, a change- out schedule for canisters and cartridges shall be implemented that is based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life. The site shall describe the information and data relied upon, the basis for the canister and cartridge change-out schedule and the basis for reliance on the data. For more information on establishing a Site cartridge change-out schedule, see Annexure- 6, Guidance on the Development of a Cartridge Change-Out Schedule and Respirator Cartridge Selection Chart.

- For protection against particulates, an atmosphere supplying (supplied Air) respirator or an air purifying respirator equipped with a filter certified by NIOSH, as a high efficiency particulate air (HEPA) filter, shall be utilized.
- An employee may leave the work area to wash his respirator to prevent skin irritation or to change cartridges.

d) Respirator Requirements for IDLH Atmosphere

JSW site does not allow site employees to enter IDLH atmospheres except when necessary for response to emergency situations. If entry to an IDLH atmosphere is necessary Confined Space Entry, should be adhered to and the following requirements should be met:

- Employees entering an IDLH (Immediately Dangerous to Life or Health) atmosphere should use a full-face, pressure-demand SCBA (self-contained breathing apparatus) certified by a recognized national or international standard with a minimum service life of 30 minutes. Alternatively, they may use a combination full-face, pressure-demand supplied-air respirator (SAR) with an auxiliary self-contained air supply.
- At least one employee (or more, as necessary) should remain outside the IDLH atmosphere whenever entry into an IDLH atmosphere is required.
- Continuous communication (visual, voice, or signal line) should be maintained at all times between employees inside the IDLH atmosphere and the employee(s) located outside.
- Employees positioned outside the IDLH atmosphere should be equipped with pressure-demand or other positive-pressure SCBAs or SARs with an auxiliary SCBA. Additionally, they should have appropriate retrieval equipment on hand to assist in safely removing employee(s) from the IDLH atmosphere if needed.

e) Respirator Requirements for Emergency Situation

- When responding to emergency situations, air supplying-type respirators [i.e. Self-Contained Breathing Apparatus (SCBA)] should be used. For those Facilities that have the potential requirement for use of respirators during an “Emergency Response”, a minimum of two SCBAs should be purchased and maintained on-site for emergency response situations.
- Respirators provided for escape only shall be certified of standard for escape from the atmosphere in which they will be used.
- If the Site provides supplied-air and/or SCBA type respirators, the Site should confirm with the manufacturer of the compressed air, compressed oxygen, liquid air, and/or liquid oxygen that the breathing gas meets all requirements.
- Refer Anexure-4 for Respirator Specification form.
- Emergency Life Support Breathing Apparatus - ELBA systems are designed to provide breathable air to workers in emergency situations where immediate evacuation from a confined space is necessary due to hazardous conditions.

Specifications:

- **Duration:** The ELBA should provide a minimum of **15 minutes** of breathable air. This duration allows sufficient time for safe exit or rescue.
- **Air Supply:** ELBA systems typically use compressed air or oxygen to supply breathable air. Ensure that the air supply meets the required safety standards and is free from contaminants.
- **Facepiece:** The ELBA should include a full-facepiece that provides a secure seal to protect the eyes, nose, and mouth from hazardous atmospheres. It should be comfortable and fit properly to ensure effective protection.
- **Regulator:** The ELBA should be equipped with a high-quality regulator that controls the flow of air to the facepiece and maintains a consistent supply of breathable air.
- **Visual Indicators:** The ELBA should have clear visual indicators (such as gauges or indicators) that display the remaining air supply. This helps users monitor the duration of their air supply during an emergency.
- **Harness and Carrying Case:** The ELBA should include a harness or carrying system for ease of use and rapid deployment. It should also come with a durable carrying case to protect the equipment when not in use.

- **Maintenance:** ELBA systems should be regularly inspected, tested, and maintained in accordance with the manufacturer's recommendations. This includes checking for leaks, ensuring the air supply is clean, and replacing any worn or damaged components.

7.2 EMPLOYEE MEDICAL EVALUATION

- Employees shall not be assigned to tasks requiring the use of respirators unless they have been medically evaluated, fit tested, and trained on the use and care of their respirator.
- Annually, a FMO, physician or licensed health care professional will perform a medical evaluation to determine that all employees required to wear respirators are medically fit to wear the respirator. Pulmonary function tests will be included in the employee's medical evaluation.
- The Site should provide the FMO, physician or licensed health care professional with a copy of this procedure, the following information prior to the employee's medical exam:
  - Type and weight of the respirator to be used.
  - Duration and frequency of respirator use.
  - Expected physical work effort.
  - Additional PPE and equipment to be worn; and
  - Temperature and humidity extremes that may be encountered.
- If an employee refuses a medical evaluation/exam, they cannot work in an atmosphere that requires the use of a respirator.

7.3 RESPIRATOR FIT TESTING

- Each employee who should wear a respirator should undergo either qualitative or quantitative fit testing with the same make, model, style, and size of respirator that they will use.
- Whenever possible, the respirator manufacturer or supplier shall conduct initial and annual fit testing for employees. Employees trained by the manufacturer or supplier are also qualified to fit test site personnel.
- Fit testing for all employees required to wear a respirator shall be done in a controlled environment during the initial fitting, when using a different respirator facepiece, and at least annually thereafter.
- The isoamyl acetate procedure is the preferred method for qualitative fit testing, with irritant smoke as an alternative option.
- Fit test results should be documented, including the date, tester's name, type of test, test results, employee name, and name and model number of the respirator that fits properly. These records shall be stored in the employee's fit test record form.
- Employees should conduct field qualitative fit checks and field inspections before entering a contaminated atmosphere. Field qualitative fit checks include:
  - Positive pressure check: Close the exhalation valve with the palm and breathe into the mask. A satisfactory fit is achieved if pressure can be built up inside the mask without leakage.
  - Negative pressure check: Close off the inlet openings of the cartridge with palms and inhale gently to create a vacuum within the facepiece. Hold breath for 10 seconds; if no inward leakage is detected, the respirator seal is good.
- The site should not permit employees to wear a respirator when conditions prevent a good seal of the respirator facepiece to the face. This may include:
  - Facial hair that interferes with the sealing surface of the facepiece or valve function.
  - Temple pieces on glasses, goggles, or other PPE.
  - The absence of one or more dentures.
- Employees should inform their immediate manager if they believe the fit of their respirator may be compromised. An additional fit test shall be performed whenever an employee reports or a manager, supervisor, or colleague observes changes in an employee's physical condition that could affect respirator fit, such as facial scarring, dental changes, cosmetic surgery, or significant changes in body weight.

7.4 RESPIRATOR CLEANING AND DISINFECTION

- Employees should clean and disinfect their respirators regularly to keep them sanitary. They shall use the Respirator Cleaning and Disinfection Procedure or an equally effective method.
- Disposable respirators may be reused if they still offer the same level of protection to employees.
- If respirators are shared between individuals, they should be disinfected before each use.

7.5 RESPIRATOR INSPECTION

- Respirator inspection shall include checking various components such as the tightness of connections, the condition of the face piece, head straps, gaskets, diaphragms, valves, connecting

tubes, cartridges, canisters, filters, and rubber parts for signs of pliability and deterioration, as applicable.

- Employees should inspect respirators used routinely before each use and during the cleaning process.
- Respirators kept for emergency use should be inspected monthly and checked for proper functioning both before and after each use.
- Emergency escape-only respirators shall be inspected before they are brought into the workplace.
- Self-contained breathing apparatus (SCBA) shall be inspected monthly. Breathing air cylinders should remain fully charged and shall be recharged when the pressure falls to 90% of the manufacturer's recommended level. Any issues found during the monthly inspection should be immediately addressed, or the SCBA shall be removed from service.
- Monthly inspection records for SCBAs and respirators maintained for emergency use shall include the inspection date, the inspector's name, findings, or deficiencies, required corrective actions, and a unique identifier such as a serial number. This information can be recorded on a tag attached to the respirator, its storage compartment, or as part of a paper or electronic inspection report.

7.6 RESPIRATOR STORAGE & REPAIR

- Once cleaned and inspected, respirators shall be stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, high moisture, and harmful chemicals. They shall also be stored in a way that prevents deformation of the face-piece and exhalation valve.
- Emergency and rescue respirators shall be stored in a clearly marked container for quick access.
- When not in use, respirators shall be sealed in plastic bags for protection.
- Respirators shall be stored in a manner that keeps the face-piece and exhalation valve free from bending or distortion.
- Respirators that fail inspection or are found to be defective should be taken out of service. They shall be discarded or repaired following these guidelines:
  - Repairs shall only be carried out by trained personnel or the supplier.
  - Replacements and repairs shall comply with the manufacturer's recommendations.
  - Only replacement parts designed for the specific respirator shall be used.
- Maintain a stock of replacement parts.
- Discard disposable respirators when they need repair.

7.7 CONTRACTORS

- All contractors and their employees should adhere to this procedure or an equivalent one. The site shall review and adjust the terms of contracts with all contractors according to the type of work they are assigned and outsourced.
- In accordance with the contract terms and if other conditions of this procedure are met, the site may permit the use of respiratory PPE for tasks with respiratory hazards, provided the following criteria are met:
  - The respiratory protection equipment is approved and certified.
  - Employees are fit tested for the type, make, model, and size of the RPE being used, with records kept on file.
  - Employee medical fitness records for RPE use are available.
  - The RPE is properly maintained and inspected.
  - Employees are trained and authorized to use RPE.
- If the contractor does not meet the requirements, the site may, depending on the contract terms, provide necessary support to the contractor and its employees by offering services, training, or RPE at an additional cost to the contractor.

8. EMERGENCY RESPONSE

JSW sites should develop a comprehensive Emergency Response Plan (ERP) specifically related to Personal Protective Equipment (PPE) to ensure a swift and coordinated approach during emergency situations. This plan should address both the immediate and long-term requirements for PPE during emergencies, ensuring that the workforce is adequately protected, and the response is both effective and efficient.

9. PERSONAL PROTECTIVE EQUIPMENT TRAINING

Training on the proper use of PPE is essential and will be integrated into safety induction programs and periodically refreshed during safety training sessions. Work-specific PPE training shall be covered in specific safety certification courses. Supervisors are responsible for ensuring that employees receive adequate instruction and training before using PPE, encompassing its correct use, maintenance, storage, disposal, and limitations.

Training sessions will be conducted by individuals with a comprehensive understanding of the topics outlined in the PPE Standard. Training for both PPE users and supervisory personnel will include:

- Identification of workplace hazards and risks.
- Rationale behind the selection of specific PPE for each hazard.
- Capabilities and limitations of the chosen PPE, including both routine and emergency use scenarios.
- Proper procedures for donning and doffing PPE.
- Guidelines for maintenance, inspection, cleaning, and disposal procedures.

Two types of training will be conducted:

Formal Training: Led by approved trainers, covering theoretical aspects and standard procedures.

Field Advice and Demonstration: Provided by trained work supervisors, offering practical guidance and demonstrations in real work environments.

Documentation of all training activities and competency assessments will be maintained at each site, including:

- Employee's name and job role.
- Site health and safety organization.
- Date of training.
- Training content details.
- Trainer's name.
- Methods used to verify understanding (e.g., test scores or practical assessments).
- Frequency of refresher training required.

Documentation may be maintained in a computer-based system but shall be made available in hard copy form on request, ensuring accessibility for all relevant parties, including employees, management, and safety auditors. Retention periods for training and competency records shall be defined, adhering to legal requirements and industry best practice standards.

Refresher training shall be organized at regular intervals, such as annually, or in the event of significant changes to the process, equipment, working practices, or if workplace inspections, post-accident investigations, or risk assessment activity identifies shortcomings in the existing level of competency. Local legislation requirements shall also be considered.

10. SPECIAL REQUIREMENTS

10.1 VISITORS AND CONTRACTORS

Visitors are required to wear the same quality PPE as employees. They are required to enter plant with Safety helmet, safety shoes and high visibility vest unless picked up and escorted by vehicle to

administration offices only. Visitors should undergo plant safety induction al security gate before entering the plant. Visitor's safety induction communicates basic minimum PPE requirements for visitors.

Contractors are required to wear the same level of PPE as employees when performing the same work within the site. Contractor will provide all required personal protective equipment (PPE) free of charge to all of their employees, including but not· limited to the following - Eye/face protection safety footwear, proper gloves, full body safety harnesses, hearing protection, high visibility jacket, mask s and safety helmet and Job specific PPEs.

In normal conditions any persons entering the project area shall wear Safety Helmet, and safety shoes without any reservation. In case he plans to perform any specific work then he shall wear specific safety gears lo protect himself from hazard arising out of the work being performed.

10.2 PERSONAL PROTECTIVE EQUIPMENT SITE PROGRAM

Each Sites with employees and visitors using PPE shall adopt this standard and shall develop and periodically review the Site-specific procedure document addressing the following:

- The health and safety hazards evaluation.
- Types of PPE selected for use.
- PPE types & Storage locations.
- Use situations/ limitations.
- PPE maintenance procedures, including decontamination, laundering and authorized laundry service.
- Disposal of PPE.
- Training records.
- Applicable inspection records.

The Site PPE procedure document shall include a PPE grid for each department, detailing specific PPE requirements based on job tasks, hazards identified, and regulatory guidelines. This grid serves as a practical guide for selecting and using appropriate PPE across different operational areas.

11. MANAGEMENT OF RECORDS

Records to be maintained by the concerned department for PPE management are as follows:

- A detailed register of all PPE, including type, quantity, specifications, and storage location.
- Documentation of PPE issued to employees, including the type, date of issue, and employee acknowledgment.
- Logs of regular inspections, testing, cleaning, and maintenance of PPE, along with any corrective actions taken.
- Documentation of training provided to employees on proper PPE usage, care, and maintenance.
- All PPE-related records should be retained for a minimum of five years or as per organizational and regulatory requirements.

12. LEGAL AND OTHER REQUIREMENTS

JSW site shall access, identify, evaluate, and keep up to date the PPE requirement as per prevailing law in operation.

13. RACI MATRIX

Activity	Section In-charge	Head Maintenance	Operations Head	Safety
PPE Monitoring & improvement in operational discipline	R	A	I	C
PPE Technical Queries Solution	C	A	I	R
PPE Ariba Requisition	R	A	I	C
Vendor Management	C	R	A	I

R	=Responsible	People who are expected to actively participate in the activity and contribute to the best of their abilities
A	=Accountable	The person who is ultimately responsible for the results
C	=Consulted	People who have the specific expertise and can contribute to decision making
I	=Informed	People who are kept informed, but do not necessarily participate in the effort

14. TRAINING

JSW sites should develop a comprehensive Personal Protective Equipment (PPE) Training Program to ensure the safety and well-being of all employees and contractors working in potentially hazardous environments. This program should be designed to meet regulatory requirements, align with JSW's Health & Safety Policy, and be tailored to the specific risks present at each site.

15. KEY PERFORMANCE INDICATORS

JSW sites should develop their own Key Performance Indicators (KPIs) for the PPE Standard based on specific safety requirements and operational needs. These KPIs should be designed to monitor, evaluate, and continuously improve the effectiveness of PPE usage, compliance, and maintenance.

16. ASSURANCE

Each site shall conduct self-assurance program to ensure compliance with this STANDARD as part of its Safety assurance program. Third party system audit shall be conducted by Group Safety or external consultants to ensure compliance with the standard.

17. DEFINITION

Term	Definition
Adequately Trained	Providing communication to employees (including contractors) on the harmful effects of working environment and as to how wearing appropriate type of PPE protects them. Training should be provided in the proper application and use of the PPE provided for the task. Training includes the ability to demonstrate competence in the use of the PPE. Employees and Contractors should be able to identify that they have been trained. Approved Manufacturers of PPE will specify the appropriate level of training required when performing work (maintenance) on their Personal Protective Equipment. All personnel should meet these criteria before performing maintenance on personal protective equipment. Also, internally defined level of training may exist, and personnel should also meet these criteria as well.
Approved PPE list	A list of personal protective equipment specified for use at the operating site. Provisions for ordering equipment from this list shall be available.
Decontamination of PPE	The process of removing contamination from all surfaces of Personal Protective Equipment in a manner that does not contaminate the individual performing the task and protects the subsequent user in case of shared PPE.
Hazardous task	Hazardous tasks are those tasks which by the nature of the exposure can cause immediate or long-term harm to the individual or group performing the task is left unprotected.
Line Management	Managers and supervisors who are in the line of command of a primary function of their organization, business, location, or site such as the Site / Unit Head or President or the Head of an operations department or Sectional Head or front-line supervisors at a manufacturing site or a Manager / Engineer in the maintenance department at a manufacturing site
Personal protective equipment (PPE)	PPEs are the devices worn by the worker to protect against hazards of the work or the environment. PPEs are Equipment that provide barrier between personnel and hazards and help prevent accidents and personal injuries. Respirators, gloves, hearing protectors, work clothing, fire resistant clothing, chemical protective clothing, welding clothing, fall protection, safety glasses are some examples of PPE.
PPE Grid	A PPE grid is a document that tells employees which PPE a minimum mandatory requirement is to be worn while entering inside section or department
Respirator	Approved personal protective equipment for protecting the respiratory system of workers from respiratory hazards.
Fit test	means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual.
Hood	means a respiratory inlet covering that completely covers the head and neck and may also cover portions of the torso.
Immediately dangerous to life or health (IDLH)	means an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.
Self-contained breathing apparatus (SCBA)	means an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

18. ANNEXURE

18.1 ANNEXURE 1: CHECKLIST FOR ESTABLISHING A PPE PROGRAM

The following checklist aimed at support of PPE Program has been developed based on OSHA Standard 29 CFR 1910.132.

CHECKLIST ON NEED FOR PPE			
SUGGESTED QUESTIONS	TYPICAL OPERATIONS OF CONCERN	YES	NO
EYES			
Do your employees perform tasks, or work near employees who perform tasks, that might produce airborne dust or flying particles?	Sawing, cutting, drilling, sanding, grinding, hammering, chopping, abrasive blasting, punch press operations, etc.		
Do your employees handle, or work near employees who handle, hazardous liquid chemicals or encounter blood splashes?	Pouring, mixing, painting, cleaning, syphoning, dip tank operations, dental and health care services, etc.		
Are your employees' eyes exposed to other potential physical or chemical irritants?	Battery charging, installing fiberglass insulation, compressed air, or gas operations, etc.		
Are your employees exposed to intense light or lasers?	Welding, cutting, laser operations, etc.		
FACE			
Do your employees handle, or work near employees who handle, hazardous liquid chemicals?	Pouring, mixing, painting, cleaning, syphoning, dip tank operations, etc.		
Are your employees' faces exposed to extreme heat?	Welding, pouring molten metal, smithing, baking, cooking, drying, etc.		
Are your employees' faces exposed to other potential irritants?	Cutting, sanding, grinding, hammering, chopping, pouring, mixing, painting, cleaning, syphoning, etc.		
HEAD			
Might tools or other objects fall from above and strike your employees on the head?	Workstations or traffic routes located under catwalks or conveyor belts, construction, trenching, utility work, etc.		
Are your employees' heads, when they stand or bend, near exposed beams, machine parts, pipes, etc.?	Construction, confined space operations, building maintenance, etc.		
Do your employees work with or near exposed electrical wiring or components?	Building maintenance; utility work; construction; wiring; work on or near communications, computer, or other high tech equipment; arc or resistance welding; etc.		
FEET			

CHECKLIST ON NEED FOR PPE			
SUGGESTED QUESTIONS	TYPICAL OPERATIONS OF CONCERN	YES	NO
Might tools, heavy equipment, or other objects roll, fall onto, or strike your employees' feet?	Construction, plumbing, smithing, building maintenance, trenching, utility work, grass cutting, etc.		
Do your employees work with or near exposed electrical wiring or components?	Building maintenance; utility work; construction; wiring; work on or near communications, computer, or other high-tech equipment; arc or resistance welding; etc.		
Do your employees handle, or work near employees who handle, molten metal?	Welding, foundry work, casting, smithing, etc.		
Do your employees work with explosives or in explosive atmospheres?	Demolition, explosives manufacturing, grain milling, spray painting, abrasive blasting, work with highly flammable materials, etc.		
HANDS			
Do your employees' hands come into contact with tools or materials that might scrape, bruise, or cut?	Grinding, sanding, sawing, hammering, material handling, etc.		
Do your employees handle chemicals that might irritate skin, or come into contact with blood?	Pouring, mixing, painting, cleaning, syphoning, dip tank operations, health care and dental services, etc.		
Do work procedures require your employees to place their hands and arms near extreme heat?	Welding, pouring molten metal, smithing, baking, cooking, drying, etc.		
Are your employees' hands and arms placed near exposed electrical wiring or components?	Building maintenance; utility work; construction; wiring; work on or near communications, computer, or other high-tech equipment; arc or resistance welding; etc.		
BODY			
Are your employees' bodies exposed to irritating dust or chemical splashes?	Pouring, mixing, painting, cleaning, syphoning, dip tank operations, machining, sawing, battery charging, installing fiberglass insulation, compressed air, or gas operations, etc.		
Are your employees' bodies exposed to sharp or rough surfaces?	Cutting, grinding, sanding, sawing, glazing, material handling, etc.		
Are your employees' bodies exposed to extreme heat?	Welding, pouring molten metal, smithing, baking, cooking, drying, etc.		
Are your employees' bodies exposed to acids or other hazardous substances?	Pouring, mixing, painting, cleaning, syphoning, dip tank operations, etc.		
HEARING			

CHECKLIST ON NEED FOR PPE			
SUGGESTED QUESTIONS	TYPICAL OPERATIONS OF CONCERN	YES	NO
Are your employees exposed to loud noise from machines, tools, music systems, etc.?	Machining, grinding, sanding, work near conveyors, pneumatic equipment, generators, ventilation fans, motors, punch, and brake presses, etc.		

18.2 ANNEXURE 2: ADDITIONAL INFORMATION ON PPE

A. Body protection

Electric Arc Flash Protection

Arc Flash Suit: As per NFPA-70E, clause 3-3.9.5, arc flash suits and closure designs should allow for quick and easy removal. The suit, including the visor/window, should have energy-absorbing properties suitable for the specific arc-flash exposure risk.

Arc Thermal Performance Value (ATPV): ATPV represents the minimum energy level (cal/cm²) at which a garment provides adequate thermal protection, effectively preventing second-degree burns.

Breakdown Threshold Energy (EBT): EBT is the average of the five highest incident energy exposure values below the Stoll curve, indicating where the flame-resistant fabric remains intact. EBT is measured when ATPV cannot be determined due to the flame-resistant fabric breaking open.

Factors Influencing Worker Injury in Arc Flash Events: Key factors affecting injury severity in arc flash exposures include the intensity of the electric arc, determined by fault current, system voltage, electrode gap, phase involvement, open-arc or enclosed configuration, arc duration, and the worker's distance from the arc. Additional considerations include clothing type and fit, as well as individual factors like age and health conditions.

Guideline for High Voltage Arc Flash Suit (above 600 volts) suitable for hazard risk category-4 as specified in NFPA-70E:

- The arc flash suit should include flame-resistant (FR) pants and an FR shirt, along with a double-layered switching coat. It is recommended that the operator wears cotton undergarments beneath the arc flash suit.
- Combined protection should meet the requirements for Hazard Risk Category 4 as specified in NFPA-70E.
- The complete arc flash suit should weigh between 24 and 30 oz/yd².
- The minimum Arc Thermal Performance Value (ATPV) or Energy Break Threshold (EBT) rating for the full suit shall be 40 cal/cm², according to NFPA-70E guidelines.
- The suit kit should include inner and outer hand gloves, as well as a hard hat, all compliant with NFPA 70E standards.

Guideline for Low Voltage (LV) Arc Flash Jacket / Flame Resistant (FR) Jacket (8.5 ~ 9 Cal/cm²) for use in systems >260V <=690V:

- The LV Arc Flash Jacket / FR Jacket, rated at 8.5 ~ 9 cal/cm², should be worn by anyone entering the substation or working on any electrical equipment within the substation or on the shop floor.
- The jacket is mandatory even for individuals standing in front of an LV panel (indoor or outdoor) without actively performing work.
- The LV Arc Flash Jacket / FR Jacket should be worn with full sleeves, and all buttons should be fastened securely.

Guidelines for Use of Arc Face Shield and Electrical Safety Hand Gloves in System Voltage >260V <=690V:

Mandatory Arc Face Shield Use (12 Cal/cm²): A 12 cal/cm² Arc Face Shield is required for specific tasks listed in Note-1 when working with system voltages >260V and ≤690V.

- *Note-1*: The tasks listed here are not exhaustive; the supervising engineer may add additional tasks as needed but cannot remove any of the specified tasks.
- **Tasks Requiring 12 Cal/cm² Arc Face Shield**:
    - Rack-in and rack-out of modules, including ACB, MCCB, and SFU.
    - Inspection of power rails (such as DSL for cranes, power lines for coke oven machines, etc.).
- The use of 12 Cal/cm² Safety Hand Gloves is mandatory for tasks listed in Note-2 when isolation of power with positive isolation at two levels has not been achieved.

- The list provided in Note-2 is not exhaustive; the engineer in charge may add additional tasks as necessary but cannot remove any of the listed tasks.
- Note-2: Tasks requiring the use of 12 Cal/cm² Safety Hand Gloves include:
- Rack in and rack out of modules such as ACB, MCCB, SFU, etc.
- Inspection of power rail (DSL for cranes, power lines for coke oven machines, etc.).
- Working on bus bar, conductor, power line, motor terminal block, etc.
- Switching on and off SFU and isolators.
- Power testing.
- Earthing.
- (Full form: ACB - Air Circuit Breaker, MCCB - Moulded Case Circuit Breaker, SFU - Switch Fuse Unit, DSL - Direct Supply Line)



Figure-14: Arc Flash PPE Categorisation

18.3 ANNEXURE 3: SITE SPECIFIC ARRANGEMENT FOR RESPIRATORY PROTECTION EQUIPMENT

(To be filled in, updated once in a year by Element Owner, and kept along with procedure)

Part-A

1	Name of Business Site & Location:	
2	Name of Site Head:	
3	Name of Site Safety Head / Representative:	
4	Name of Element / Component Owner:	

5. List of Authorized Person to use RPE:

Sr. No.	Name of employee	Department	Type of RPE	Make/ model	Size
1					
2					
3					
4					
5					

Part-B		
A	Site Specific improvement record (describe)	
B	Site Specific Changes- Deviation, Exclusion record (describe)	

18.4 ANNEXURE 4: RESPIRATOR SPECIFICATION FORM

Site Name:			
Employee's Name:		**Date:**	
Job Description:			
Contaminant			
Estimated or Actual Contaminant(s):		Concentration Level: (ppm or mg/m^3)	
Nature of Contaminant: Gas, Vapor, or Particulate (circle one)		Warning Properties: (i.e. odor)	
If a gas or vapor, is there any absorbent that traps it?			Explain:
Could Contaminant(s) become			Explain:
If flammable, does concentration approach LEL?			Explain:
Is contaminant(s) an eye irritant?			Explain:
Can contaminant(s) be absorbed through the skin?			Explain:
Factory act, OSHA Permissible Exposure Level, ACGIH TLV or NIOSH REL:			
Respirator:			
Recommended Respiratory Protection			
First Choice: Make:	Model #:		Type:
Second Choice: Make:	Model #:		Type:
Characteristics of respirator:			
Limitations of respirator:			
Approval Numbers:	Respirator Identification:		

18.5 ANNEXURE 5: GUIDANCE ON DEVELOPMENT OF CARTRIDGE CHANGE OUT SCHEDULES

GUIDANCE ON DEVELOPMENT OF CARTRIDGE CHANGE-OUT SCHEDULES

OSHA regulation 29 CFR 1910.134 no longer allows a contaminant's warning properties (smell, taste, or irritation) to be used to determine cartridge breakthrough. The user should have a respirator equipped with a NIOSH approved end-of-service-life indicator (ESLI) for the specific contaminant or should use a cartridge change-out schedule for the specific cartridge and contaminant. Currently, there are limited cartridges equipped with an ESLI. Therefore, at this time a cartridge change-out schedule is the only viable option for those cartridges that will be used at JSW facilities.

This document is intended to provide guidance to JSW facilities in establishing their site-specific change-out schedules. This guidance is only a starting point for developing such a program. Each site's program will be different due to individual site characteristics that should be included in any change-out schedule determinations.

Manufacturer Consultation

The best course of action in establishing a cartridge change-out schedule is to consult the manufacturer of the cartridge. The following information has been obtained for commonly used safety product providers.

The following information is provided to assist you in understanding the various issues surrounding the establishment of a cartridge change-out schedule, to provide recommendations for establishing a change-out program and to provide resources for obtaining further detailed information.

- **Precautions When Using Data to Establish Your Change Schedule**

The following is a partial list of factors which may affect the usable cartridge service life and/or the degree of respiratory protection attainable under actual workplace conditions. These factors should be considered when developing a cartridge change- out schedule.

- Type of contaminant(s)
- Contaminant concentration
- Relative humidity
- Breathing rate
- Temperature
- Changes in contaminant concentration, humidity, breathing rate and temperature.
- Mixtures of contaminants: (1) multiple contaminants present simultaneously versus (2) alternate usage of the same cartridges against different contaminants on different occasions.
- Accuracy in the determination of the conditions
- The contaminant concentration in the workplace can vary greatly. Consideration should be given to the quality of the estimate of the workplace concentration.
- Cartridge storage conditions (exposure to trace levels of contaminants and humidity and elevated temperatures)

RESPIRATOR CARTRIDGE SELECTION CHART

Cartridges manufactured for each type of contaminant are identified by colour coding. The following chart is provided to aid in selecting the proper cartridge.

ATMOSPHERIC CONTAMINANT	COLOR ASSIGNED
Acid Gas	**White**
Acid Gas & Organic Vapor	**Yellow**
Ammonia Gas	**Green**
Dust, Fumes & Mists (Other than radioactive materials)	**Orange**
Organic Vapours (Except tritium & Noble gases)	**Black**
Other Vapours & Gases not listed above	**Olive**

References: Information for this chart is taken from ANSI K13.1-1973, Identification of Air Purifying Respirator Canisters and Cartridges.

The user shall refer to the wording of the label to determine the type and degree of protection the canister or cartridge will afford.

The user shall refer to the wording of the label to determine the type and degree of protection the canister or cartridge will afford.

18.6 ANNEXURE 6: PPE SELECTION GUIDE

Note: This table is a guide for the selection of PPE. The safety review, SWP and Health and Safety Hazard analysis will provide more information which should be used in the decision-making process.

Issue:

P = Personal issue which is not share.

S = Shared

S* = Shared but cleaned, checked, and sanitized after each person has used equipment.

PPE	Application	Limitations	PPE Requirement	Where/When to Use	Issue
Apron	Protects the front of the body from splashes	Won't protect the back of the body, the lower legs or the arms.	Should be suitable for the chemical being handled - Refer MSDS	• Open handling of liquids that can splash and can quickly damage your skin (materials the MSDS says can cause "skin corrosion", "skin burns"). • Open handling of powders where there is potential for high exposure and the powder can quickly damage your skin (materials the MSDS says can cause "skin corrosion", "skin • burns" and/or are "harmful if absorbed through intact skin"). • When handling very hot materials.	**S**
Raincoat or waterproof overalls	Protects the body in wet areas	Suitable for normal water and rain at cool temperatures	Check compatibility with any chemicals in water	In situations of exposure to wet work or working in external environments in wet weather	**S**
Chemical suit	Protects the whole body except face, hands, and feet from chemicals.	Chemical suits are made of different materials. They do not all protect the	Check Compatibility with chemicals handled	In situations where a hazardous material can come in contact with the body in	**S**

PPE	Application	Limitations	PPE Requirement	Where/When to Use	Issue
		body from the same chemicals.		quantities too large for other PPE to protect. Normally used for emergency response.	
Dust mask[2]	Protects the lungs, nose, throat from dusts by filtering the air you breathe.	Will not protect you from vapours and gases	Use correct dust masks for toxic dusts. Make sure mask fits the face properly.	In situations where dust (nuisance or hazardous) can be above exposure limits	**P**
Face shield	Protects your face from liquid splashes and from flying particles and objects.	Will not protect eyes, since particles or liquids can come around the shield if it does not form a tight seal around the eyes. Will not protect the face from powders or dusts.	Compatibility with head protection and chemicals used. Should meet IS standard or equivalent.	Use (with goggles) in any situation where u can potentially see a liquid that can quickly damage the skin (liquids the MSDS says can cause 'skin corrosion" or "skin burns").	
Gloves[3]	Protects hands and fingers from chemicals, hot materials, rough or sharp materials and live electrical equipment. Available in different sizes so a good fit can be obtained. Long gloves also protect the lower arms.	There are gloves made from many different materials. They don't all protect hands from the same chemicals. All gloves can be permeated and should not be used indefinitely. Used for electrical high voltage work, gloves need to be tested for performance in accordance with standards	Should protect from the chemicals handled (refer to Approved PPE List"). Then used for electrical work should be appropriately rated electrical working gloves	Use each time you handle a material that is hazardous to the skin (materials the MSDS) says "severe irritation", "can be absorbed by the skin", 'skin sensitizer"). Use when repeatedly handling a material that the MSDS says can "irritate the skin" (mild effects). Use to protect hands from handling objects with sharp edges. Use to protect hands from coming into contact with live electrical terminals	**P**
Safety Helmet	Protect your head from (for example from falling objects and low obstructions).	Won't work when a large object or very heavy weight falls on your head. Safety helmets are certified with a 3.0	Safety helmet should meet local standard or IS standard	Use when working in an area where there is potential for falling objects or obstructions.	**P**

PPE	Application	Limitations	PPE Requirement	Where/When to Use	Issue
	Also protect against liquids falling from above.	kg weight dropped from 1.5m (5 feet).			
Motorcycle Helmet	Protect the head in case of fall or accident Visor protects the eyes from foreign particle	Should be worn securely and visor placed over face May limit but not fully protect in serious accident	Motorcycle helmet as per approved IS Standards	Whenever riding motorcycle but is always mandatory on the JSW Site including the townships	**P**
Hearing protection	Ear plugs or muffs protect the ears from noise by reducing the amount of noise the ear receives.	Ear plugs should be correctly inserted into cars to work.	Should provide correct protection for the noise levels encountered.	Use in any noisy areas. Some areas will specify earmuffs in preference to ear plugs Due to the specific type of noise. Use when exposed to noise levels more than the 85 dB exposure limit for 8 hours.	**P**
Metatarsal guard	Protects the metatarsus. (between toes and ankle) from impact and high-pressure water et.	Does not protect toes. Should be worn in combination with safety shoes or boots.	Should withstand at least 75-foot Pounds of impact.	Use when manually using high pressure water blaster (with Pressure above 3000 psi).	**S**
Respiratory protection	Many types available (canister, air supply, full, face, half mask).	Refer to Approved PPE List	No beards, employee should be clean shaven See "Respiratory Protection" guidelines from manufacturer.	Use when handling materials that can produce air mixture concentrations above exposure limits TLV. Use when air monitoring data is not available for the open handling of materials. Full face respirator also provides eye protection	**S***
Rubber Shoes	Protect the feet from chemicals.	Will not protect against impacts or crush — some gum boots and rubber shoes also have	Should be compatible the chemicals handled.	Use when working with liquids on the floor, for example spill clean-up.	**P**

PPE	Application	Limitations	PPE Requirement	Where/When to Use	Issue
		steel ca toe protection		Use bool type for construction work in muddy environments	
Safety glasses	Protect your eyes from impacts with flying particles. Provides limited protection from chemical lashes.	Won't protect eyes from splashes of hazardous materials.	Should have side shields. Should meet standard or equivalent.	Wear in areas where liquids are handled (unless goggles arc specified). Wear in areas where flying particles can be present.	**P**
Safety shoes	Protect your foot & toes from objects that can crush, penetrate, or injure them on impact.	Most safely shoes only provide protection over your toes (not the whole foot),	Should have steel toe for impact protection, should be made of leather or other tough material. Should have ankle protection and be laced up.	Wear when handling equipment or load, object that can damage the fool if dropped, or can roll over the feet. Mandatory inside the Plant	**P**
Splash goggles	Protect your eyes from dusts and chemical splashes.	Will fog if not kept clean and coated with anti-fog.	Should form a seal all around the face. Should fil different shaped faces. Should be capable of fitting over prescription lenses for those people who wear them. Should meet IS8520-1977 standard or equivalent.	• In any operation where you can potentially see* a liquid the MSDS says can cause 'severe eye irritation "corrosion to eyes 'injury to eyes". Open handling of powders where there is potential for dust (for example no local exhaust ventilation) and the MSDS says can cause "severe eye irritation' or "injury to eyes'.	**P**
Welding goggles	Protects the eyes from UV radiation, and sparks.	Should be of correct tint to protect the eyes.	Should meet a local standard. Should select correct lens tint based on type of welding. Should meet IS 1967, IS 8181968 standard or equivalent	Wear when welding or using a gas torch.	**S**
Heat Protective Clothing	Protect the body and limbs from radiant heat and special cases such as molten metal splashes	Should wear the correct protection for the application so that heat or metal does not burn through the protective clothing Need to consider the potential for hot	Arm length gloves, aprons, suits, and leg guards for radiant heat protection as defined in IS standards. Aluminium full suits, gloves, head protection for lancing and similar work such	Consider the appropriate level of protection when conducting hot work, welding, gas cutting, fighting fires, lancing, dealing with hot metal	**S**

PPE	Application	Limitations	PPE Requirement	Where/When to Use	Issue
		metal to enter shoes	as fighting fires as approved in IS standards		
Welding helmet	Protects the eyes and face from UV radiation, sparks, and metal chips.	Does not protect the lungs or eyes from fumes. Should be of correct tint to protect the eyes.	Should meet local standard. Should select the correct lens tint based on type of welding. Should meet IS standard or equivalent.	Wear when welding.	**S**
High Visibility Jacket-Synthetic	Easy Identification by others	Do not use in Heat Zone Area Hot Work.	Reflective Strips on front and rear side of jacket.	During course of employment.	**P**
Jean Jacket with reflective. Strips	To protect the body,		Reflective Strips on front and rear side of jacket. Full Sleeve jacket. Heat / Fire Resistance.	During course of employment.	**P**

- [1] For example, PVC
- [2] For example 3M #8710 Disposable dust mask
- [3] For example PVC

18.7 ANNEXURE 7: PPE HEALTH AND SAFETY HAZARD EVALUATION SHEET

	Hazard type	Severity of Risk	Head, Face, Eyes, Ears						Respiratory				Body				Feet		Hands				
Location/Activity	Physical / Chemical Hazards	Degree of Exposure (Low, medium, High)	Safety Glasses	Welding or cutting Goggles	Chemical Splash goggles	Face shield	Safety helmet	Hearing protection	Half-face (Mouth, nose	Full-face (air purifying via cartridge)	Dust mask	SCBA (Self-contained breathing apparatus)	Full body protection (Jacket/apron (rubber,	Fire-retardant clothing	Arc Flash Suit with Hood	Fall protection – safety harness	Safety shoes	Di-electric rubber shoes	Cut resistant gloves	Chemical resistant gloves	High voltage gloves	Fire retardant gloves	Other

18.8 ANNEXURE 8: PPE GRID SAMPLE

Recommended PPE Grid Samples (Section/ Activity wise)-Generalized/Indicative. (Business/ site should develop the PPE Grid as per the Activity in the procedure)

MANAGEMENT STANDARD: PERSONAL PROTECTIVE EQUIPMENT

	Recommended PPE Grid as per job requirements																							Availability of PPE at the location																						
	Head, Face, Eyes, Ears						Respiratory				Body						Feet		Hands						Other	Head, Face, Eyes, Ears						Respiratory				Body						Feet		Hands						Other
Location/ Activity	Safety Glasses	Welding or cutting Goggles	Chemical Splash Goggles	Face shield	Safety helmet	Hearing Protection	Half-face (mouth, nose)	Full-Face (air purifying via cartridge)	Dust Mask	SCBA (Self-contained breathing apparatus)	Full Body protection (Jacket / apron (rubber,	Special purpose Apron	Fire —Retardant Clothing	Arc Flash Suit with Hood	Fall protection — Safety harness	Gum Boots	Safety shoes	Di-electric rubber shoes	Cut resistance gloves	Chemical resistant gloves	High voltage gloves	Cotton Gloves with or w/o PVC Dots	Fire Retardant Gloves	Other	Safety Glasses	Welding or cutting Goggles	Chemical Splash Goggles	Face shield	Safety helmet	Hearing Protection	Half-face (mouth, nose)	Full-Face (air purifying via cartridge)	Dust Mask	SCBA (Self-contained breathing apparatus)	Full Body protection (Jacket / apron (rubber,	Special purpose Apron	Fire —Retardant Clothing	Arc Flash Suit with Hood	Fall protection — Safety harness	Gum Boots	Safety shoes	Di-electric r9ubber shoes	Cut resistance gloves	Chemical resistant gloves	High voltage gloves	Cotton Gloves with or w/o PVC Dots	Fire Retardant Gloves	Other
CGL-1 Entry																																														
CGL-1 Zinc Pot																																														
CGL-1 Exit																																														
CGL-1 Exit-Finishing																																														
CGL-1 Exit-Dispatch																																														
Embosing line																																														
Rewinding line																																														
CRM-4																																														
CR Slitter																																														
Dispatch-Point																																														
Finishing - CCL1&2																																														

| | | |

Department	Safety Helmet	Safety Shoe	Safety Goggle	Fluorescent Jacket	Nose Mask	Ear Plug	Ear Muffler	Safety Belt	Fall Arrestor	Cut Resistant Hand Gloves	, Cotton Hand Gloves	Electrical Hand Gloves	Nitrile Hand Gloves	Nose Mask	Voltage Detector	Arc Flash Suit	Gumboot	Face Shield	Respiratory Protection
HOP	√	√	√	√	√														
Project Manager	√	√	√	√	√														
Site Engineer / Supervisor	√	√	√	√	√	√				√	√			√					
Mechanical Engineer	√	√	√	√	√	√		√	√	√	√			√					
Logistic Engineer	√	√	√	√	√									√					
Civil Engineer	√	√	√	√	√									√					
Electrical Engineer	√	√	√	√	√						√	√		√	√	√			
Storekeeper	√	√	√	√	√														
Visitor / Guests	√	√	√	√	√														
Security Staff	√	√			√														
Labour	√	√	√	√	√	√		√	√	√	√			√			√	√	
Others																			

Table: JSW Energy

Department	Safety helmet	Safety Shoes	Safety Goggles	Hi-Vis-Reflective Vest	Nose Mask	Ear Plug	Ear Muffler	Safety Belt	Fall Arrestor	Cut Resistant Hand Gloves	, Cotton Hand Gloves	Electrical Hand Gloves	Nitrile Hand Gloves	Nose Mask	Voltage Detector	Arc Flash Suit	Gumboot	Face Shield	Respiratory Protection
HOP	√	√	√	√	√														
Project Manager	√	√	√	√	√														
Site Engineer / Supervisor	√	√	√	√	√	√				√	√			√					
Mechanical Engineer	√	√	√	√	√	√		√	√	√	√			√					
Logistic Engineer	√	√	√	√	√									√					
Civil Engineer	√	√	√	√	√									√					
Electrical Engineer	√	√	√	√	√						√	√		√	√	√			
Storekeeper	√	√	√	√	√														
Visitor / Guests	√	√	√	√	√														
Security Staff	√	√			√														
Labour	√	√	√	√	√	√		√	√	√	√			√			√	√	
Others																			

Table: JSW Sandur Wind Power Project

Sl No	Material Long Text	DIC Agglomeration	DIC Iron	DIC Steel	DIC RMHS	DIC Coke	DIC Mill	DIC Projects	DIC Logistic	DIC Utility	DIC General Services
1	ASSY/PARTS- OEM GENERAL-ALUMINIUM BRACKET	√	√	√	√	√	√	√	×	×	×
2	ASSY/PARTS-ACID GAS FILTER	√	√	√	×	√	√	√	×	×	×
3	EARMUFF	√	√	√	√	√	√	√	√	√	√
4	EARPLUG	√	√	√	√	√	√	√	√	√	√
5	GLASS-FACE SHIELD- POLYCARBONATE	√	√	√	√	√	√	√	√	√	√
6	GLASS-FACE SHIELD-ACRYLIC	√	√	√	√	√	√	√	√	√	√
7	GLASS, SAFETY, TYPE: SIGHT GLASS; SIZE:19X9.75 INCH; THICKNESS:0.06 IN; MATERIAL: POLYCARBO×TE WITH GOLD COATING; MOUNTING: WITH HELMET BRACKET	√	√	√	×	√	√	√	×	×	×
8	GLASS, SAFETY, TYPE: SIGHT GLASS; SIZE:4.5x2.5 INCH; THICKNESS:0.118 IN; MATERIAL: COBALT; MOUNTING: ON HELMET BRACKET; STANDARD: EN 171;COLOUR:BLUE;SPECIAL FEATURE:INFRARED FILTER-4 SHADE-5	√	√	√	×	√	√	√	×	×	×
9	GLOVES, -HEAT RESISTANT-PARA ARAMID-FLEECE	×	√	√	×	√	√	√	×	×	×
10	GLOVES, SAFETY-CUT RESISTANT KNITTED FIBRE-HIGH PERFORMANCE POLYETHYLENE WITH PU COATING	√	√	√	√	√	√	√	√	√	√
11	GLOVES-ALUMINIUM MITTEN-ARAMID FABRIC	×	√	√	×	√	√	√	×	×	×
19	GLOVES-HEAT RESISTANT-CHROME LEATHER-WOOLEN	√	√	√	√	√	√	√	√	√	√
20	GLOVES-PVC-COTTON KNIT	√	√	√	√	√	√	√	×	√	×
22	GOGGLE	×	√	√	×	√	√	√	×	×	×
23	FULL BODY HARNESS	√	√	√	√	√	√	√	√	√	√
24	HELMET-INDUSTRIAL-V SHAPE ADJUSTABLE CHIN STRAP	√	√	√	√	√	√	√	√	√	√
25	LEGGING	√	√	√	√	√	√	√	√	√	√
26	MASK-FR POLYPROPYLENE-MODEL: V-40-V	√	√	√	√	√	√	√	×	×	×
27	MASK-POLYPROPYLENE WITH ACTIVATED CARBON-MODEL:3M 8577	√	√	√	√	√	√	√	√	√	√

28	MASK, -RESPIRATORY HALF FACE-MODEL:6000 SERIES	√	√	√	√	√	√	√	×	×	×
29	MASK, SAFETY-BRAIDED TEXTILE-MODEL: V-410 SLV	√	√	√	√	√	√	√	√	√	√
30	MASK-DISPOSABLE DUST MASK; SIZE-MODEL: V-44+	√	√	√	√	√	√	√	√	√	√
31	MASK-ELASTOMER-MODEL:3M 9004IN	√	√	√	√	√	√	√	√	√	√
32	PROTECTIVE WARE- CHEMICAL SUIT	√	√	√	×	√	√	√	×	√	×
33	PROTECTIVE WARE-SAFETY JACKET-HIGH VISIBILITY REFLECTIVE	√	√	√	√	√	√	√	√	√	√
34	PROTECTIVE WARE-SUIT-HEAT RESISTANT	×	√	√	×	√	√	√	×	×	×
35	PROTECTIVE WARE-APRON	×	√	√	×	√	√	√	×	×	×
36	PROTECTIVE WARE-SUIT-RAIN COAT	√	√	√	√	√	√	√	√	√	√
37	LEG GUARD	×	√	√	×	√	√	√	×	×	×
38	SKULL NECK CAP	×	√	√	×	√	√	√	×	×	×
39	SAFETY SHOES/BOOT- GUM BOOT- LEATHER	√	√	√	√	√	√	√	√	√	√
40	SAFETY SHOES/BOOT- HIGH ANKLE- LEATHER	√	√	√	√	√	√	√	√	√	√
41	SAFETY SHOES/BOOT-HALF KNEE BOOT-LEATHER	√	√	√	√	√	√	√	√	√	√
42	SAFETY SHOES/BOOT-LOW ANKLE-LEATHER-PU-SINGLE DENSITY	√	√	√	√	√	√	√	√	√	√
43	SAFETY SHOES/BOOT-HIGH ANKLE-LEATHER -PU-SINGLE DENSITY	√	√	√	√	√	√	√	√	√	√
44	SAFETY SHOES/BOOT-LEATHER -PU-RUBBER	√	√	√	√	√	√	√	√	√	√

Table: JSW Steel

19.REFERENCE

References Document	Full Title, Brief Description and Web Links
1. Occupational Safety and Health Administration (OSHA)	OSHA is a part of the United States department of labour to ensure safe and healthful working conditions for workers by setting and enforcing standards by providing training, outreach, education, and assistance. Personal Protective Equipment - Overview | Occupational Safety and Health Administration (osha.gov) Personal Protective Equipment (osha.gov)
2. International Organization for Standardization (ISO)	ISO is an independent non-government membership organization and the world's largest developer of voluntary international standards. They give world class specifications for products, services, and systems to ensure quality, safety, and efficiency. ISO/TS 20141:2022 - Personal safety - Personal protective equipment Guidelines on compatibility testing of PPE ISO/TS 20141:2022 - Personal safety — Personal protective equipment — Guidelines on compatibility testing of PPE
3. Health and Safety Executive	The health and safety executive are Britain's National regulator for workplace health and safety dedicated to protecting and prevent people and places. Personal protective equipment (PPE) at work (hse.gov.uk) Using the right type of PPE - Using personal protective equipment (PPE) to control risks at work - HSE
4. Imperial College London	Example from literature of documents regarding PPE Personal Protective Equipment | Administration and support services | Imperial College London
5. American National Standards Institute	As the voice of the US standards and conformity assessment system, the American National Standards Institute empowers its members and constituents to strengthen the US marketplace position in the global economy while helping to assure safety and health of consumers and the protection of the environment. Examples: • Eye and Face Protection ANSI A87.1-1989 • Head Protection ANSI Z89.1-1986. • Foot Protection ANSI Z41.1-1991 PPE - Personal Protection Equipment (ansi.org)
6. World Health Organization	Health products policy and standards (who.int)

References Document	Full Title, Brief Description and Web Links
7. European Standards ▪ Regulation (EU) 2016/425 of 9 March 2016 on personal protective equipment ▪ EN 397 Industrial safety helmets ▪ EN 50365 Electrically insulating helmets for use in low voltage installations ▪ EN 166 Personal eye-protection – specifications ▪ EN 167 Personal eye-protection – optical test methods ▪ EN 168 Personal eye-protection – non-optical test methods ▪ EN 1731 Personal eye-protection – mesh eye and face protectors	Regulation - 2016/425 - EN - EUR-Lex (europa.eu) EN 397:1995 - Industrial safety helmets (iteh.ai) EN 50365:2002 - Electrically insulating helmets for use on low voltage installations (iteh.ai) EN 166:2001 - Personal eye-protection - Specifications (iteh.ai) EN 167:2001 - Personal eye-protection - Optical test methods (iteh.ai) EN 168:2001 - Personal eye-protection - non-optical test methods (iteh.ai) EN 1731:2006 - Personal eye protection - Mesh eye and face protectors (iteh.ai)

19.1 BIS CODE FOR PERSONAL PROTECTIVE EQUIPMENT (PPE)

Body	
IS 3521	Industrial safety belts and harnesses – Specification
IS 4501	Specification for aprons, rubberized, acid and alkali resistant
IS 6153	Specification for protective leather clothing
IS 7352	Specification for X-ray lead rubber protective aprons
IS 8519	Guide for selection of industrial safety equipment for body protection
IS 8990	Code of practice for maintenance and care of industrial safety clothing
Ears	
IS 6229	Method for measurement of real ear protection of hearing protectors and physical attenuation of earmuffs
IS 8520	Guide for selection of industrial safety equipment for eye, face and ear protection
IS 9167	Specification for ear protectors
Eye and Face	
IS 1179	Equipment for eye and face protection during welding
IS 5983	Eye protectors
IS 7524 Part 1	Method of test for eye protectors: - non-optical tests
IS 8521: Part 1	Industrial safety face shields – with plastic visor
IS 8521: Part 2	Industrial safety face shields – with wire mesh visor
IS 8940: 1978	Code of practice for maintenance and care of industrial safety equipment for eyes and face protection
IS 9995: 1981	Specification for visor for non-metal police and firemen's helmets
IS 14352: 1996	Miners' safety goggles – Specification
Feet and Legs	
IS 1989: Part 1	Specification for leather safety boots and shoes – for miners
IS 1989: Part 2	Specification for leather safety boots and shoes – for heavy metal industries
IS 3737: 1966	Leather safety boots for workers in heavy metal industries
IS 3738: 1998	Rubber boots – Specification
IS 3976: 2003	Protective rubber canvas boots for miners – Specification
IS 4128: 1980	Specification for fireman's leather boots
IS 5557: 1999	Safety Rubber boots – Specification
IS 5852: 1996	Protective steel toe caps for footwear – Specification
IS 6519: 1971	Code of practice for selection, care and repair of safety footwear
IS 7329: 1974	Metal last for safety rubber canvas ankle boots
IS 10348: 1982	Safety footwear for steel plant
IS 10665: 1982	Safety rubber ankle boots for miners
IS 10667: 1983	Guide for selection for industrial safety equipment for protection of foot and leg
IS 11225 1985	Leather safety shoes for women workers in mines and steel plants
IS 11226: 1993	Leather safety footwear having direct moulded rubber sole – Specification
IS 11264 1985	Code of practice for manufacture of safety rubber footwear for miners
IS 13295: 1992	Code of practice for manufacture of leather safety boots and shoes for workers in mines and heavy metal industry
IS 14544: 1998	Leather safety footwear with direct moulded PVC soles – Specification
IS 15298: Part 2	Safety, protective and occupational footwear for professional use – Specification for safety footwear

Hands	
IS 2573	Specification for leather gauntlets and mittens
IS 4770	Rubber Gloves – electrical purposes – specification
IS 6994 Part 1	Specification for safety gloves – leather and cotton gloves
IS 8807	Guide for selection of industrial safety equipment for protection of arms and hands
Head	
IS 2745	Specification for non-metal helmet for firemen and civil defence personnel
IS 2925	Specification for industrial safety helmets
IS 4151	Specification for protective helmets for scooter and motorcycle riders
Respiratory	
IS 8318	Colour identification markings for air purifying canisters and cartridges
IS 8347	Glossary of terms relating to respiratory protective devices
IS 8522	Respirators, chemical cartridge
IS 8523	Respirators, canister type (gas masks)
IS 9473	Respiratory protective devices – Filtering half masks to protect against particles – specification
IS 9563	Carbon monoxide filter self-rescuers
IS 9623	Recommendations for the selection, use and maintenance of respiratory protective devices
IS 10245: Part 1 to 46	Breathing apparatus
IS 15322	Particle filters used in respiratory protective equipment – Specification
IS 15323	Gas filters and combined filters used in respiratory protective equipment – Specification
Other	
IS 6685	Specification for life jackets
IS 11057	Specification for industrial safety nets
IS 12078	Recommendations for personal protection of workers engaged in handling asbestos Personal Protective Equipment

Other international standards are added here.

International Standards on specific PPE Programs are the followings:

1. **General Requirements:**
   - EN ISO 13688:2013 - This standard specifies general performance requirements for ergonomics, innocuousness, size designation, aging, compatibility, and marking of protective clothing and the information to be supplied by the manufacturer with the protective clothing.
2. **Eye and Face Protection:**
   - EN 166:2001 - This standard specifies the requirements for protective eyewear, including safety glasses and goggles.
   - EN 170:2002 - This standard specifies the requirements for filters used in eye protection against ultraviolet radiation.
3. **Respiratory Protection:**
   - EN 149:2001+A1:2009 - Respiratory protective devices. Filtering half masks to protect against particles.
   - EN 405:2002 - Respiratory protective devices. Valved filtering half masks to protect against gases or gases and particles.
4. **Hand Protection:**

- EN 388:2016 - Protective gloves against mechanical risks.
- EN 374:2016 - Protective gloves against chemicals and micro-organisms.
- EN 407:2004 - Protective gloves against thermal risks (heat and/or fire).

5. **Foot Protection:**
   - EN ISO 20345:2011 - Personal protective equipment – Safety footwear.
   - EN ISO 20346:2014 - Personal protective equipment – Protective footwear.
   - EN ISO 20347:2012 - Personal protective equipment – Occupational footwear.
6. **Head Protection:**
   - EN 397:2012+A1:2012 - Industrial safety helmets.
   - EN 14052:2012 - Protective helmets for industry.
   - EN 12492:2012 - Mountaineering equipment. Helmets for mountaineers. Safety requirements and test methods.
7. **Hearing Protection:**
   - EN 352 Series - Hearing protectors.

Specific PPEs are also ruled by standards, as:

EN 149:2001+A1:2009: Respiratory protective devices - Filtering half masks to protect against particles. These standard covers filtering facepieces (FFP) that protect against particles.

EN 166:2001: Personal eye protection - Specifications. This standard specifies general requirements for safety goggles, face shields, and other eye protectors.

EN 352: Hearing protection - Ear muffs, ear plugs, and other hearing protection devices.

EN 420:2003+A1:2009: Protective gloves - General requirements and test methods. This standard sets requirements for gloves regarding comfort, efficiency, and ergonomics.

EN 381: Protective clothing for chainsaw users. This standard specifies requirements for protective clothing when using chainsaws.

EN 388:2016: Protective gloves against mechanical risks. This standard assesses protection against abrasion, blade cut, tear, and puncture resistance.

EN 407: Protective gloves against thermal risks (heat and/or fire). This standard specifies requirements for gloves protecting against heat and fire.

EN 1149: Protective clothing - Electrostatic properties. It sets requirements for clothing that protects against electrostatic phenomena.

EN 1150: Protective clothing - Visibility clothing for non-professional use. These standard covers high-visibility clothing for non-professional use.

EN 14605: Protective clothing against liquid chemicals - Performance requirements for clothing with liquid-tight (Type 3) or spray-tight (Type 4) connections.

EN 14683: Medical face masks - Requirements and test methods. This standard specifies requirements and test methods for medical face masks to limit the transmission of infective agents.

JSW Group

MANAGEMENT STANDARD

CONFINED SPACE ENTRY

JSW/GHS/GS-06

MANAGEMENT STANDARD:CONFINED SPACE ENTRY

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1. PURPOSE

The purpose of this Standard is to establish procedures that support a comprehensive health and safety program in alignment with JSW Health and Safety policy. Its primary aim is to ensure the implementation of preventive and mitigating measures for all risks associated with safeguarding employees from the hazards of confined spaces within the JSW Group.

This Standard outline the requirements and guidance for:

- Identification of confined spaces within JSW Group facilities, including a systematic process for locating and labelling these spaces.
- Safe entry into confined spaces and execution of confined space work, such as inspecting, cleaning, testing, and repairing.
- Preventive and protective measures to ensure the safety of confined spaces.
- Training processes and frequency, as well as evaluation of competencies and abilities relevant to confined spaces.

By adopting a systematic approach, this Standard aims to safeguard employees from potential hazards associated with confined space entry, work, and processes. These hazards include oxygen deficiency, exposure to hazardous materials, engulfment risks, drowning, power-driven equipment dangers, electrical shock, heat-related stress, and challenges during emergency escape. The systematic approach ensures these risks are identified, assessed, and controlled to ALARP (As Low as Reasonably Practicable) levels or eliminated entirely. This is achieved through preventive measures, comprehensive training, and adherence to established safe work practices, effectively mitigating health, physical, and safety hazards.

2. SCOPE

This Standard applies to all companies and subsidiaries within the JSW Group, including managed business units, sites/locations, corporate and regional offices, research and development facilities, new projects, as well as merged and acquired entities. It is relevant to all JSW employees and contractors across these entities.

Compliance with this Standard is required throughout the entire lifecycle of a project, business, or site/location, including the planning, assessment, exploration, evaluation, design, development, operation, and closure phases.

Each business unit within the JSW Group should develop and publish its own specific requirements as supplementary documents to this Confined Space Entry Group Standard, ensuring alignment with the Group's overarching policy.

National and local legislation shall be adhered to, and where the requirements of national or local regulations concerning confined spaces are more stringent than those outlined in this Standard, the more stringent requirements will take precedence.

In the Standard, the following verbal forms are used to indicate requirements, recommendations, permissions, or capabilities:

- "shall" indicates a requirement.
- "should" indicates a recommendation.
- "may" indicates a permission.
- "can" indicates a possibility or capability.

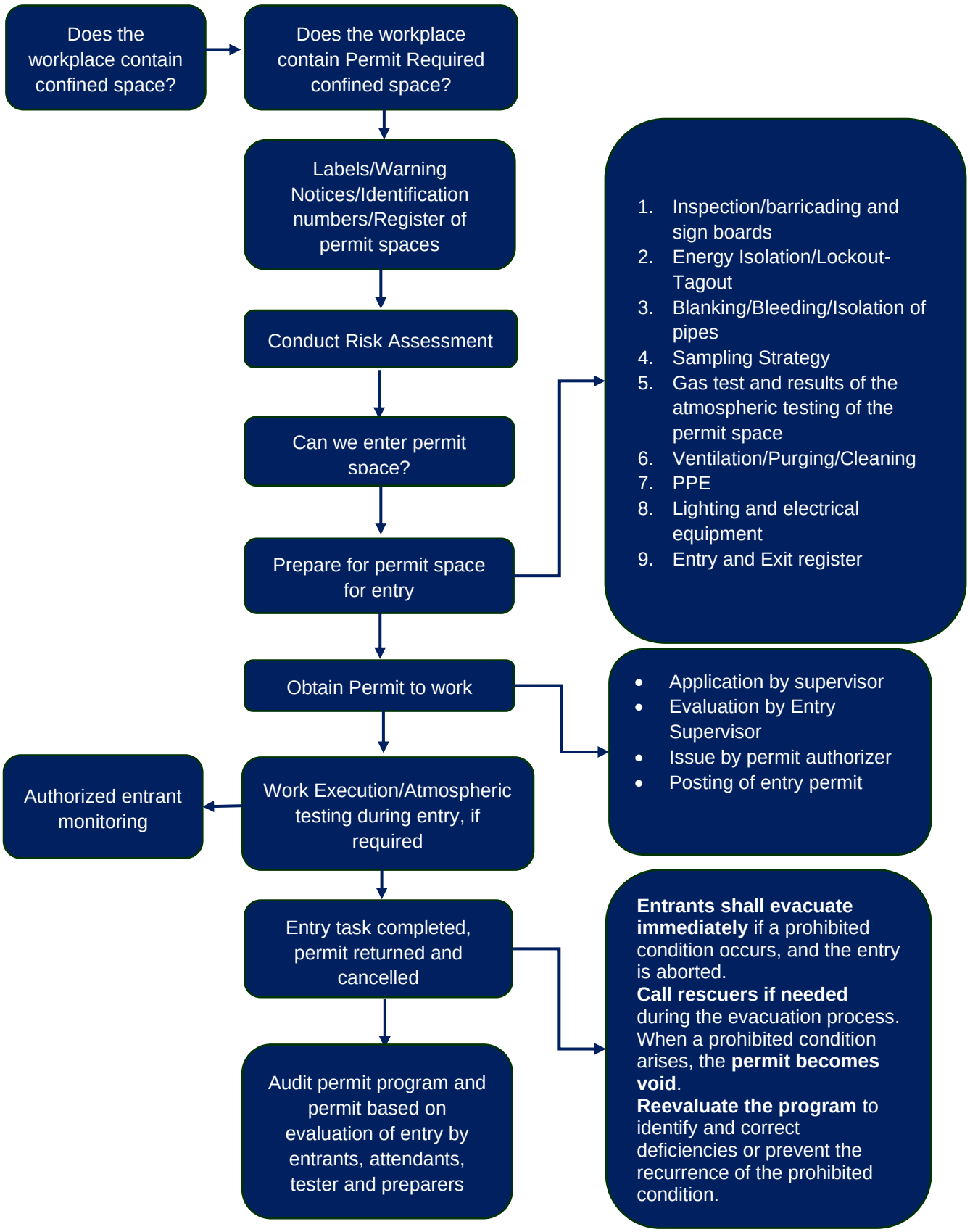
3. REVIEW

The Standard should be reviewed at least every five years or when a serious incident or high potential near miss is recorded. The review should include the evaluation of the following:

- Confined Space procedure, including confined space risk assessments.
- Training records and programs for employees.

- Learning from incidents and high potential near misses related to confined spaces.
- Confined space equipment inspection records, including personal protective equipment and rescue equipment.
- Survey of confined spaces within JSW Group facilities, including a systematic process for locating and labelling these spaces.
- Specifications of confined spaces, including their characteristics and associated hazards.
- Changes to industry standards, laws, and regulations affecting confined space operations.

4. PROCESS FLOW



5. CONFINED SPACE MANAGEMENT

5.1 WHAT IS A CONFINED SPACE?

Confined spaces pose hazards because they are usually not designed for the continuous presence of employees or for regular work activities. Confined spaces often have poor ventilation, which allows hazardous atmospheres or hazardous physical conditions to quickly develop, especially if the space is small. The hazards are not always obvious and may change from one entry into the confined space to the next, as entry and exit routes may be limited or difficult.

The main characteristics of a confined space are:

- **Bodily entry possible** – A space large enough and configured so that an employee can bodily enter and perform assigned work.
- **Limited or restricted means of entry and exit** – Typically, the way out is the same as the way in.
- **Not designed for continuous employee occupancy**.

Additionally:

Has been identified as such in a risk assessment, and may:

- Contain potentially harmful levels of toxic or explosive substances.
- Lack a safe level of oxygen (e.g., after a nitrogen purge).
- Pose risks of entrapment or engulfment.
- Present any other recognized serious safety or health hazards.

Entry into a confined space occurs when any part of a person's body enters the space, including when the upper body or head crosses the entry threshold.

A confined space does not always have to be fully enclosed. Open-top structures such as vats, storage units, and floating roofs of large tanks are also considered confined spaces. Excavations that are 1.2 meters (4 feet) or deeper, such as trenches, pits, culverts, and sumps, are considered confined spaces. Other examples of confined spaces include tunnels, silos, hoppers, utility vaults, tanks, water supply towers, sewers, pipes, access shafts, truck or rail tank cars, aircraft wings, boilers, manholes, pump stations, digesters, manure pits, and storage bins.



Figure-1: Confined Space



Figure-2: Confined Space

5.2 IDENTIFYING HAZARDS

Confined spaces may pose various risks, but by proactively identifying hazards and putting suitable control measures in place, these risks can be substantially reduced.

Following are the hazards which are essential to recognize but are not limited to:

- **Previous Contents and Residues:** Potential for contamination and hazardous residues.

- **Toxic Gases or Vapours:** Inhalation risks leading to respiratory harm or poisoning.
- **Oxygen-Deficient or Oxygen-Rich Atmospheres:** Heightened risk of asphyxiation or combustion.
- **Flammable or Explosive Atmospheres:** Danger of fire or explosions due to combustible materials.
- **Physical Hazards:** Risks from moving machinery, electrical hazards, and sharp edges.
- **Space Constraints:** Limited Access and Restricted Space: Challenges related to the confined dimensions that affect movement, access, and egress.
- **Biological Hazards:** Presence of pathogens like bacteria and Mold, posing health risks.
- **Entrapment, Engulfment, or Drowning:** Threats from confined space configurations leading to entrapment or drowning.
- **Ingress and Egress Risks:** Difficulties in entering and exiting the space, increasing accident potential.
- **Liquid Hazards:** Liquids capable of causing slips, chemical burns, or drowning hazards.
- **Solid Material Risks:** Risks associated with the movement or collapse of materials within the confined space.
- **High Temperatures:** Exposure to extreme heat or environmental stress, leading to heat-related illnesses.

5.3 RISK ASSESSMENT

The Business Unit shall ensure that a competent person (with the appropriate training and qualifications) undertakes a risk assessment before carrying out work involving entry into a confined space. As far as practicable, the assessment should be in writing and consider at least the following:

- The nature of the confined space and the environment in which the work is carried out.
- The work required, including whether entry into the confined space is necessary.
- The range of methods by which the work can be performed.
- The hazards involved and associated risks.
- The task risk assessment.
- The assessment of risks associated with concurrent operations in neighboring areas that may impact confined space work.
- The actual method selected, and the plant proposed.
- The competency of staff involved.
- Arrangements for rescue and emergency procedures.

5.4 RISK CONTROL

Risk control in confined spaces involves eliminating or reducing risk factors to ALARP (As Low as Reasonably Practicable). This is achieved through the implementation of appropriate control measures, including:

- Mechanical and electrical isolation of equipment.
- Line breaking to ensure system integrity.
- Purging to remove hazardous substances.
- Ventilation, either forced or natural, to maintain a safe atmosphere.

Adequate resources should be allocated, and clear responsibilities shall be assigned to ensure safety. Employees involved in confined space work shall receive proper training on safe working procedures, including communication methods between the confined space work executor and the attendant.

Additionally, a Job Safety Analysis (JSA) should be conducted at the site in accordance with existing systems to enhance safety practices and identify task-specific hazards.

JSW locations that choose to:

- Prohibit entry into permit-required confined spaces, or
- Allow entry only under strict safety measures (e.g., additional monitoring, emergency response plans, enhanced PPE),

Site shall implement effective access control measures. These measures should be approved by multiple site organizational functions and designed to prevent unauthorized entry. Examples include:

- Using padlocks and a strict control system for keys.
- Installing bolted flanges or other physical barriers.
- Any other controls identified in the risk assessment.

6. PRINCIPLES OF CONFINED SPACE ENTRY

The following principles form the foundation for managing confined spaces at JSW locations:

- **Written Confined Space Entry Program:** Each Business Unit where employees may enter confined spaces shall establish and implement a written confined space entry program.
- **Feasibility of Entry:** Confined spaces shall only be entered when no other method of completing the task is feasible. Before entry, all necessary measures shall be taken to eliminate or minimize exposure to potential hazards.
- **Development of Entry Procedures:** When entry into confined spaces is necessary, a written entry procedure shall be developed for each identified confined space. This procedure shall be specific to the confined space location or category of work. The system should include the following actions:
  - **Hazard Assessment:** Assess each confined space to identify potential hazards before and during entry.
  - **Hazard Control:** Create procedures to eliminate, control, or isolate hazards prior to and during entry.
  - **Preparation:** Prepare confined spaces for entry by ensuring all necessary measures are in place.
  - **Atmosphere Monitoring:** Continuously monitor the space's atmosphere before and during entry to ensure safety.
  - **Safe Conditions:** Maintain safe conditions throughout the entry process and the duration of the work.
  - **Internal Hazards:** Consider potential hazards that may arise from activities within the confined space.
  - **External Hazards:** Evaluate how activities outside the space could affect conditions within it.
- **Rescue Plans and Authorization:** Before beginning work in a confined space, ensure that suitable rescue plans and necessary resources are in place. Authorization is required for entry into a confined space. Warning signs related to associated permanent dangers should be conspicuously posted and permanently displayed at each entrance to a confined space.

6.1 APPLYING THE PRINCIPLES

6.1.1 Developing and Implementing Program

JSW Business/Site should develop and implement a comprehensive written confined space entry program that adheres to the principles outlined in this standard. This program shall also incorporate mandatory requirements and comply with local legislation. The written program should be readily accessible to all personnel authorized to enter confined spaces and their representatives.

Key Elements of the Confined Space Entry Program:

1. **Written Procedures**: The program should include clear and detailed procedures for eliminating, controlling, or isolating hazards encountered before and during entry into confined spaces.
2. **Annual Review**: A thorough annual review of the confined space entry program should be conducted. This review should assess cancelled permits, changes in confined spaces, identification of new hazards, and review of incidents.
3. **Review Outcomes and Recommendations**: The outcomes of the annual review, along with any recommendations for program enhancements, should be communicated to local management for consideration and implementation.

6.1.2 Identifying Confined Spaces

Identifying confined spaces is a critical first step in ensuring workplace safety and compliance with regulations. Such spaces are typically defined by their limited access and exit points, as well as potential risks due to restricted ventilation, hazardous substances, or challenging working conditions. Refer to **Annexure 3** for a sample confined space inventory.

The Identification Process:

- **Conduct a Workplace Survey**: Systematically Walk through the entire worksite, including buildings, grounds, basements, and roof covers, to identify potential confined spaces.
- **Develop an Inventory**: Create a documented list of all identified confined spaces. Include details such as location, size, access points, and any known hazards. Display these details at the entrance points of confined spaces.
- **Categorize Hazards**: Classify these hazards according to risk assessment criteria.
- **Involve Employees**: Encourage employees to report any suspected confined spaces they encounter during their work.
- **Regular Review and Updates**: Regularly review the inventory at least annually and update it as your workplace changes or new spaces are identified.
- **Notify Employees Through Their Supervisors**: Communicate with all affected employees to raise awareness about potential hazards and to effectively address related issues.
- **Classification of Confined Spaces:**
  Confined spaces are broadly classified as follows:
    - **Entry with Permit Required:** A confined space that meets the criteria described in the forthcoming flow chart (Figure 3). This type of confined space requires written authorization for entry.
    - Entry Without Permit Required: A confined space that does not contain, or with respect to atmospheric hazards, has the potential to contain, any hazard capable of causing death or serious physical harm. The site is responsible for defining the conditions and precautions necessary for entry into non-permit confined spaces. There should also be criteria in place to define a change in conditions. Changes in conditions require re-evaluation of the space and may result in reclassification to a Permit Required Confined Space. Entry without a permit shall be periodically re-evaluated to ensure that the classification remains accurate.

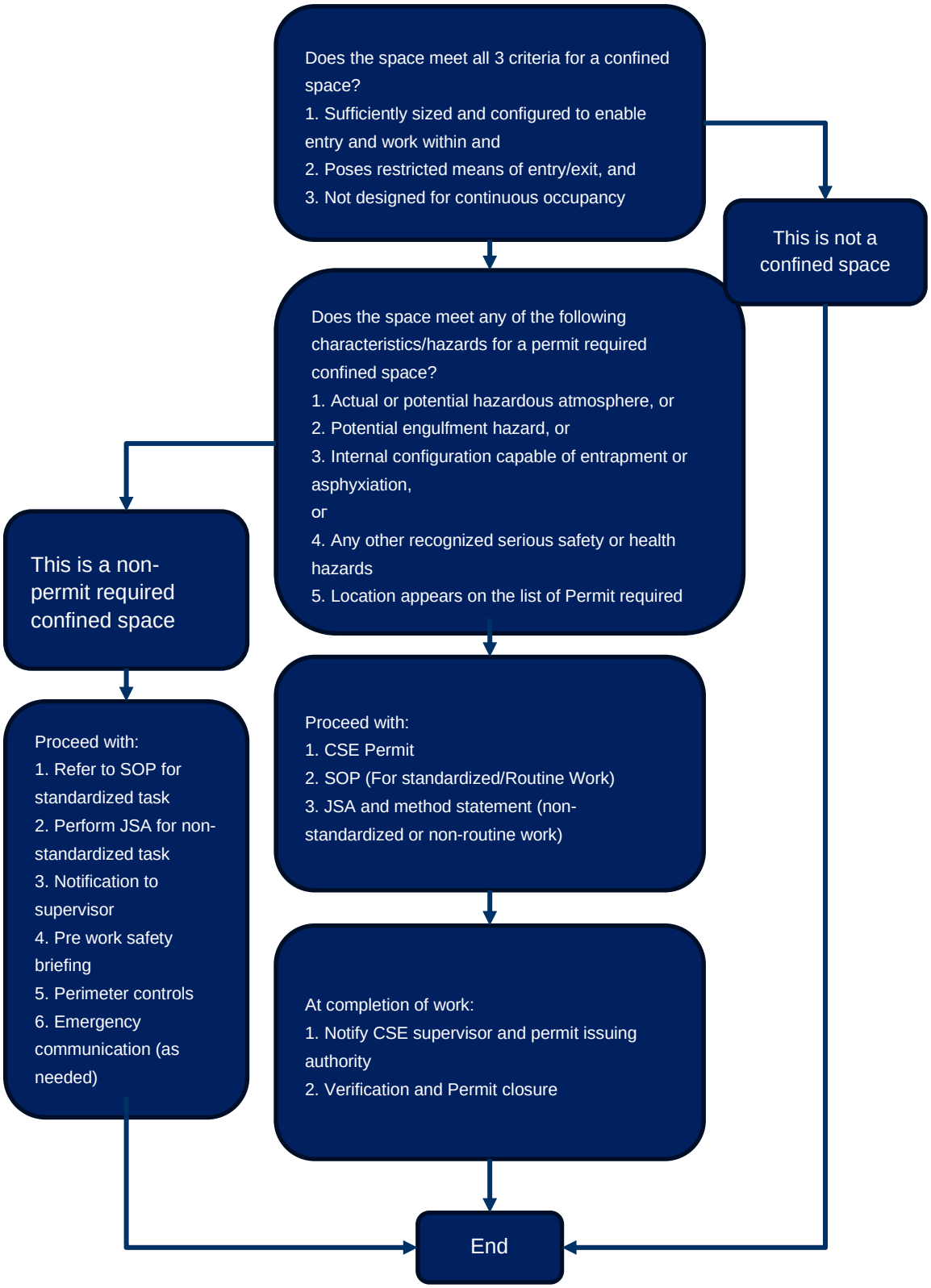


Figure-3: Permit and Non-Permit Required Confined Space

Examples of Confined Spaces:

- Tanks and vessels including reactors.
- Boilers, Heat Exchangers, Distillation columns and vats
- Silos and hoppers
- Utility vaults and pits
- Manholes and sewers
- Pits, Tunnels, and crawl spaces
- Ditches and trenches (with limited egress)
- Ductwork and pipelines
- Sewage Tanks
- Chutes
- Cable Tunnels
- Gas Holders, Flume tunnel, Cold Box
- Skirts (If fulfils Confined Space Entry definition)



Figure-4: Vessel, Hopper, Tank

6.1.3 Evaluation of Confined Space

Evaluating each confined space for chemical or physical hazards is essential. It's important not to assume that a confined space is hazard-free, as different chemical and physical hazards may arise from various work activities within the confined space. Therefore, a comprehensive analysis should consider chemical and physical agents that:

- Will be in the space prior to emptying, draining, or cleaning the space.
- Are reasonably expected to be introduced into the space during emptying, draining, or cleaning of the space.

- Are reasonably expected to be introduced into the space in connection with any subsequent activities in or around the confined space, both planned and unplanned (which may appear suddenly during each phase of confined space work).

Additionally, warning signs should be placed at or near each access point to a confined space to alert employees of potential hazards. The text of the sign should read “DANGER - PERMIT REQUIRED CONFINED SPACE. DO NOT ENTER.” or an equivalent warning message. These signs should be posted at each entrance regardless of whether the space is being entered or not.



Figure-5: Warning Signs

The table below serves as an example of a sample template that can be used to apply confined space criteria to identify confined spaces:

Description of Confined Space	Confined Space Criteria						Confined Space?
	A	B	C	D			
	Is space enclosed or partially enclosed?	Is it likely to be entered?	Does it have a restricted entry or exit?	Does the space contain, is intended to contain, or is it likely to contain:			If the answer to A, B, C and at least one of D is Yes, then the space is a Confined Space
				Harmful level of atmospheric contaminant?	An unsafe level of Oxygen?	Material that has potential to engulf the entrant?	

Note:

I. The examples provided below demonstrate the application of confined space definitions. Each entry into a confined space presents a unique set of circumstances and should be assessed independently when identifying confined spaces.

II. Answering "NO" to any of the four questions does not necessarily imply that the space is safe to enter. Hazards should be thoroughly assessed, and all necessary precautions shall be taken to ensure safe working conditions.

III. If there is any uncertainty regarding whether the criteria are met, further information is required to address or eliminate the uncertainty. If the criteria cannot be determined, it is best to err on the side of caution and apply the provisions of the confined space standard.

Entry into a confined space is deemed to have occurred when any part of the body enters the space, and there is a risk of being affected by the conditions within the space. Typically, this happens when a person's head enters the confined space.

- *A concentration of airborne contaminants that may cause impairment, loss of consciousness, asphyxiation, or exposure to flammable materials.*
- *Oxygen levels below 19.5% or above 23.5% are unsafe and require attention.*

Once confined spaces have been identified, it is crucial to evaluate and document the potential hazards that may exist before and during entry. The identification of the potential hazards and the planned implementation of control measures for a specific confined space does not eliminate the need to follow the standard procedures for entry into permit-required confined space.

6.1.4 Types of Hazards in Confined Space

Confined spaces can pose a variety of hazards to employees who enter or work within them. Understanding these hazards is crucial for ensuring worker safety and implementing appropriate control measures. Here are the main types of hazards found in confined spaces:

Atmospheric Hazards:

- **Oxygen Deficiency:** Levels below 19.5% shall be addressed immediately as they can lead to asphyxiation and impaired judgment.
- **Oxygen Enrichment:** Levels above 23.5% shall be monitored closely, as increased oxygen concentrations can cause flammable and combustible materials to burn violently.
- **Toxic Gases and Vapours:** Substances like carbon monoxide, sulphur dioxide, hydrogen sulphide, coke oven gas, blast furnace gas, or methane shall be assessed for potential harm, as they can be fatal if inhaled.
- **Flammable or Explosive Gases:** Vapours from liquid combustible or flammable substances, such as solvents or fuels, should be evaluated for fire or explosion risks. Note that fire requires three elements: oxygen, fuel, and an ignition source.
- **Inert Gases:** Gases such as nitrogen, argon, or helium should be considered for their potential to displace oxygen and create asphyxiation hazards. Some inert gases are colourless and odourless, so accurate risk assessment is necessary.

Physical Hazards:

- **Confined Space Design:** Restricted spaces may hinder movement and escape, increasing injury risks. Measures to address these limitations should be implemented.
- **Moving Equipment:** Equipment within the confined space should be properly secured, and residual energy should be controlled through lockout and de-energization procedures.
- **Falling Objects:** Loose materials or equipment above should be secured to prevent falling and causing injury.

- **Structural Integrity:** Unstable structures within the space, especially after excavation works, should be evaluated to prevent collapse and trapping of workers.
- **Slip, Trip, and Fall Hazards:** Poor visibility, slippery surfaces, and obstacles within the confined space should be managed to prevent slip, trip, and fall incidents.

Biological Hazards:

- **Mold and Bacteria:** Confined spaces with moisture should be monitored for harmful microorganisms.
- **Insect or Animal Infestations:** Spaces should be inspected for stinging or biting insects or other small animals.

Thermal Hazards:

- **High Temperatures:** Confined spaces with high temperatures should be monitored and controlled to prevent heat-related stress or illnesses.
- **Low Temperatures:** Extremely cold environments should be managed to prevent hypothermia or frostbite.

Ergonomic Hazards:

- **Poor Lighting:** Inadequate lighting should be addressed to ensure hazards are visible and tasks can be performed safely.
- **Uncomfortable Postures:** Limited space should be evaluated to prevent workers from assuming uncomfortable positions that increase injury risk.
- **Repetitive Movements:** Actions in confined spaces should be managed to reduce the risk of strain and musculoskeletal disorders.

Noise Hazards:

- **Excessive Noise:** Loud machinery or noise sources within confined spaces should be controlled to prevent hearing damage, considering the effects of noise reflection off walls.

Electrical Hazards:

- **Exposed Wires:** Open electrical circuits should be addressed to prevent shock or fire risks.
- **Static Electricity:** In flammable environments, static discharge should be controlled to prevent ignition.

Engulfment:

- **Engulfment:** This hazard involves being buried or submerged in soil, sand, gravel, liquid, or chemicals. Confined spaces where such conditions could occur should be carefully assessed to prevent crushing, suffocation, drowning, or injuries from chemical exposure.

Recognizing and understanding these hazards is essential for managing confined space safety effectively. By identifying and mitigating these hazards, the Business Unit can create a safer working environment for all employees involved in confined space work.

6.1.5 Confined Space Entry Plan

In addition to securing a work permit and a confined space entry authorization (as per applicability discussed in **section 6.1.2**), each confined space entry job shall have a comprehensive written plan that outlines safety measures. This confined space entry plan shall address specific hazards within the confined space, including precautions, responsibilities, and emergency procedures.

The confined space entry supervisor shall review and share the plan with entrants and standby workers to ensure they understand the necessary safety measures and practices. The plan should be easily accessible for review by all employees involved in the confined space entry to promote awareness and adherence to safety standards.

While there is no one-size-fits-all template for confined space entry plans, each plan shall be customized to the specific work site and job requirements. This customization ensures that the plan is relevant and effective in mitigating risks associated with the conditions and tasks of the job.

The confined space entry program should include, as a minimum, the following:

- **Assignment of Responsibilities**: Clearly define and assign responsibilities for all personnel involved in the confined space entry.
- **Confined Space Inventory and Hazard Assessment**: Provide a list of each confined space or group of similar spaces and a written hazard assessment of those spaces, prepared by a qualified person.
- **Safe Work Procedures**: Develop written procedures for entry into and work in each confined space. Each procedure should be specific to the hazards present in the space during each entry.
- **Equipment Requirements**: Ensure that the necessary equipment for each entry is provided, including testing devices, air-moving devices, isolation and lockout devices, personal protective equipment, and rescue equipment.
- **Signed Permit**: Obtain and maintain a signed permit where required, based on site procedures.
- **Communication Means**: Establish and maintain effective means of communication between persons working in the confined space and the attendant.
- **Training**: Provide training for all employees affected by the permit-to-work activities, including authorized entrants, standby persons, attendants, entry supervisors, authorized testers, and rescuers (firefighting team members, first aid team members, and other rescuers).
- **Rescue Plan**: Develop and document a comprehensive rescue plan.

This plan should be reviewed regularly and updated as necessary to ensure its continued relevance and effectiveness in managing confined space hazards.

6.1.6 Pre-Entry Preparation

Pre-entry preparation for a confined space job is critical to ensure the safety of all Employee involved. This preparation includes various aspects such as fall protection plans, gas testing, Personal Protective Equipment (PPE) requirements, equipment needs, and emergency response procedures.

6.1.7 Confined Space Entry Log

Employees entering or exiting a confined space shall sign an entry log. In the event of an emergency, the log is used to account for all Employees who have entered the confined space. Please refer to **Annexure 7** for the entry log.

6.1.8 Confined Space Entry Checklist

Permit Authorizer and Applicant should use a checklist to help manage the many details of preparing for a confined space entry job. This approach is guided by Confined Spaces regulations. A checklist should be completed jointly by the work permit authorizer and applicant during their site inspection before signing the work permit.

The Hazard Analysis Checklist on the Confined Space Entry Permit is typically sufficient for most Confined Space Entry tasks; however, a specialized checklist should be created and completed for complex entries as identified by the local proponent. The completed checklist or permit should be kept at the confined space entry site for reference. Please refer to **Annexure 1** for the checklist.

6.1.9 Confined Space Entry Preparation

Before entering a confined space, it is essential to implement all possible controls to prevent employee exposure to potential hazards and maintain safe entry conditions. This involves a comprehensive assessment of the hazards that may be present, as well as the potential hazards that arise from activities within the confined space. Additionally, it is crucial to consider how activities outside the confined space may affect conditions inside.

To ensure the safety of workers, controls should address specific hazards and contaminants according to the following order of effectiveness:

- **Isolate or Shut Down Equipment:** Purge harmful substances or alter work processes to eliminate risks.

- **Test the Internal Atmosphere Remotely:** Check for oxygen levels, flammable gases, vapors, and potential air contaminants.
- **Implement Ventilation Systems:** Maintain a safe atmosphere, use barriers to separate workers from hazardous areas, or change work practices to avoid danger.
- **Provide Personal Protective Equipment (PPE):** Depending on the specific hazards present, include respiratory protection, protective clothing, eye and face protection, and hearing protection.

By following these steps in order of effectiveness, the Business Unit can significantly enhance the safety of workers entering confined spaces. Properly applying controls not only protects workers from immediate dangers but also minimizes the risk of long-term health issues associated with exposure to hazardous conditions.

6.1.9.1 Confined Space Entry Associated Energy Isolation

Confined spaces need to be isolated from any external sources of energy and materials to ensure safety during entry and work. An isolation checklist should be created and attached to the permit for each confined space entry to ensure all necessary precautions are in place. This checklist helps to verify that proper isolation measures have been implemented and ensures consistency and thoroughness in the process.

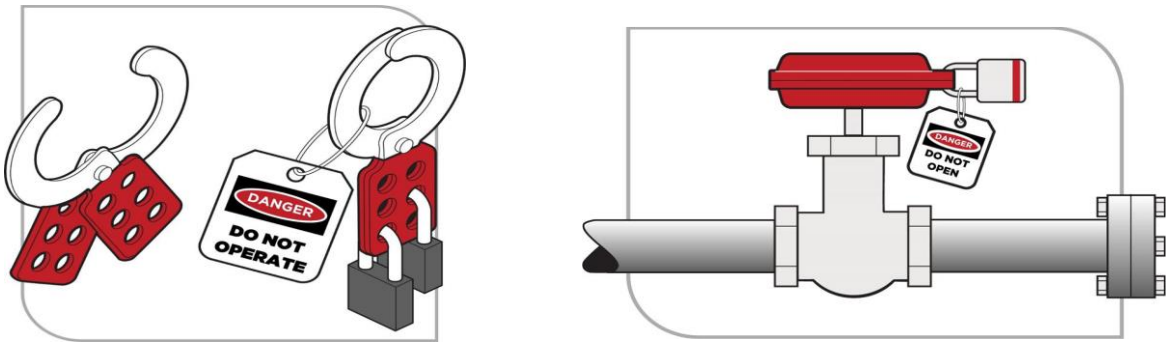


Figure-6: Open End of Pipe Capped with the Nearest Valve Closed, Locked, and Tagged.

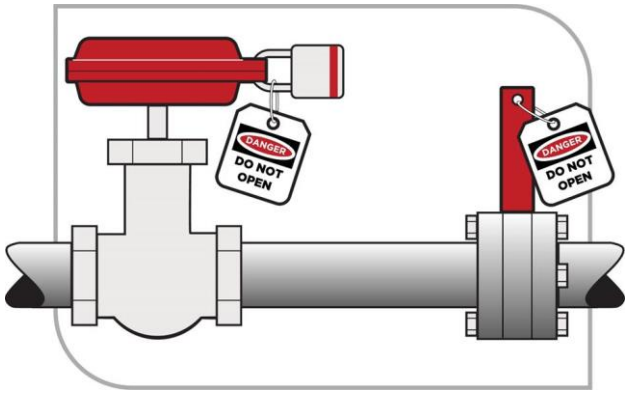


Figure-7: Insertion of Full Pressure Spade or Blank

Isolation of confined spaces by simply closing isolation valves is not acceptable for man entry purposes. To ensure complete isolation of the confined space, all incoming and outgoing pipelines connected to the confined space should be either disconnected or sealed with a physical barrier, such as a blank flange or a spectacle blind. The material, size, and pressure rating of this flange should be suitable for the pipeline. To facilitate the isolation process, each plant should maintain drawings and sketches detailing the preparations required for entry into a confined space.

The requirements for energy isolation and equipment tagging should align with the standards outlined in the Permit to Work procedure (JSW/GHS/GS-08). It is essential to reference the specific PTW number in the Confined Space Entry PTW documentation, ensuring that all necessary safety measures are documented and followed according to established procedures.





Figure-8: Lockout Tagout

Power-driven equipment that may impact the confined space, such as an agitator, should be both mechanically and electrically disconnected from its power source and properly tagged if it has the potential to pose a hazard during entry into the confined space. This precaution should be taken regardless of whether the work being performed involves the specific piece of equipment, as a preventive measure to avoid unexpected operation or hazards. Proper isolation and tagging ensure the safety of employees entering the confined space. Examples of positive isolation of power-driven equipment include, but are not limited to:

- Disconnection of the drive coupling.
- Disconnection of the electrical supply cable from the drive motor by removing fuses.
- Removal of belts from belt-driven equipment.

For detailed guidelines on Lockout Tagout procedure, refer to the JSW/GHS/GS-07 standard.

6.1.9.2 Clean

Removing chemical and atmospheric hazards from confined spaces is essential to ensure the safety of workers entering these areas. Cleaning and preparing the confined space involve several key actions:

- **Removal of Substances:** This step involves removing any substances, materials, gas or liquids from the confined space that may pose a risk. It may include draining, pumping out, or otherwise disposing of any contents in the space.
- **Flushing:** This method uses water or other liquids to wash away residual chemicals or materials from the confined space.
- **Washing:** Thoroughly scrubbing the space's surfaces with cleaning agents can help remove stubborn residues.
- **Rinsing:** Following washing, rinsing the space helps to remove cleaning agents and any remaining contaminants.



Figure-9: Cleaning

These cleaning actions are critical to preparing confined spaces for safe entry and work. Initial cleaning should be performed from outside the confined space as far as feasible. Such initial cleaning, including drainage and scale removal, should continue until the hazard of atmospheric contaminants has been reduced as far as possible. Properly removing chemical and atmospheric hazards helps protect workers from exposure to dangerous substances and conditions, ensuring compliance with safety regulations and standards.

6.1.9.3 Ventilate the Space

If a confined space contains an atmosphere that is oxygen deficient, flammable, contaminated with a hazardous gas, chemical, or material, or is considered Immediately Dangerous to Life or Health (IDLH), the space will require ventilation. Ventilation is also used to provide thermal comfort for entrants working in the space.

A qualified person (e.g., entry supervisor) shall determine the method of ventilation based on the confined space configuration, the types and concentrations of contaminants, the volume and placement of the supply air, and the exhaust locations.

The types of ventilation typically used to provide breathing-quality air in confined spaces are general (dilution) and local exhaust ventilation.

A third, less common method of ventilation is purging. It is often used to remove a flammable or combustible atmosphere by purging the space with an inert gas to eliminate the flammability hazard, followed by ventilation with breathing-quality air prior to entry.

Confined spaces require careful ventilation planning. An assessment shall be conducted to determine the ventilation needs to effectively reduce or eliminate atmospheric hazards while workers are inside. This requires active or continuous mechanical ventilation providing a minimum of six air changes per hour based on the confined space's volume.

Adding oxygen is not a safe method for improving air quality. Ventilation during entry should not replace the prior removal of any residual materials from the space. Ventilation of a confined space should be by natural, forced, or mechanical means to establish and maintain a safe breathing atmosphere and acceptable comfort conditions (e.g. in terms of prevention of heat-related stress). This ventilation shall be continued throughout the period of occupancy. Test shall be carried out to ensure gas / vapour concentrations are below 50% of Threshold Limit Value-Time Weighted Average (TLV TWA).



Figure-10: Ventilation

6.1.9.4 General Ventilation

If a confined space contains an atmosphere that is oxygen deficient, flammable, contaminated with a hazardous gas, chemical, or material, or is considered immediately dangerous to life or health (IDLH), the space will require ventilation. Ventilation is also used to provide thermal comfort for entrants working in the space.

A qualified person (e.g., entry supervisor) shall determine the method of ventilation based on the confined space configuration, the types and concentrations of contaminants, the volume and placement of the supply air, and the exhaust locations.

The types of ventilation typically used to provide breathing-quality air in confined spaces are general (dilution) and local exhaust ventilation.

A third, less common method of ventilation is purging. It is often used to remove a flammable or combustible atmosphere by purging the space with an inert gas to eliminate the flammability hazard, followed by ventilation with breathing-quality air prior to entry. The minimum amount of blower air flow (CFM or cubic feet per minute) for a specific space is calculated as follows:

Volume of Space _____ cubic feet
60 minutes/hr. **X 20 air changes/hr. = Ventilation device minimum flow rate _____ CFM**

The calculation below is performed to determine the minimum amount of time needed to ventilate a space before it can be considered safe to enter. Clean air, at least 20 times the volume of the space, is ventilated into the space to purge the atmosphere. This is based on the American Industrial Hygiene Association (AIHA) recommendation of 20 air changes per hour. The following parameters should be known:

- Volume of the space (cubic feet)
- Ventilation device flow rate (CFM or cubic feet per minute)

To determine the minimum time the ventilator or blower should operate before testing the air prior to entry, divide the volume of the space by the flow rate of the blower. Multiply that by the number of air changes required. If the time calculated is more than 60 minutes, the ventilation device flow rate is not high enough to achieve 20 ACH in the space. A blower with a higher flow rate should be used. If fixed ventilation in the space alone is sufficient to achieve 20 ACH, calculating the time before entry is not applicable.

Continue to ventilate the space at a rate of 20 air changes per hour as needed.

Volume of Space _____cubic feet
Ventilation device flow rate _____CFM **X 20 (# of air changes) = _____minutes**

Ensure that ventilation supply air is drawn from a clean, breathing-quality air source. It is important to place the air-moving device where the air is drawn into the confined space from a contaminant-free source. For example, it is not appropriate to place the air-moving device behind a diesel generator, as the exhaust gas from the generator could be drawn into the confined space.

For a continuous release of contaminants into a confined space, the forced ventilation (Q) (m^3/min) required to dilute the contaminant (molecular weight (MW)) generated at a constant rate of (E) (g/min) to a permissible exposure concentration of (C) (ppm) at 25°C and 760 mmHg is:

$$Q = E \times 24.5 \times 10^{6} / MW \times C$$

- Where: E (gm/min) is the rate of contaminant generation
- MW is the molecular weight of contaminant
- Q (m3/min) is the quantity of the air supplied
- C (ppm) is the PEL of contaminant

6.1.9.5 Local Exhaust

Local exhaust is ideal for flammable and toxic materials that are produced at a single point or for hazards that are introduced into the space, such as in welding, hot work, and painting. Air contaminants are captured close to the source of contamination and removed from the space. The local exhaust system should be evaluated to ensure it has been designed for the removal of the contaminants. Specific recommendations based on best practices include:

- The capture velocity at the task that requires local exhaust ventilation should be at least 100 feet per minute (fpm).
- The exhaust duct should not be more than 1.5 duct diameters in distance away from the work.
- The exhaust duct should be placed so it does not draw contaminants across the worker's breathing zone.

Local exhaust is not ideal when the contamination is widely spread around the space. Exhaust air should be discharged away from the space without creating a hazardous environment. Local exhaust does not replace general ventilation. General ventilation and local exhaust can be used at the same time.

6.1.9.6 Barricading

When accessing a confined space, safety measures need to be implemented immediately. The opening created by removing the entrance cover should be clearly identified and promptly secured with a railing, temporary cover, or another suitable barrier. This includes using signs, ropes, or caution tape. These precautions serve a dual purpose: preventing accidental falls through the opening and protecting workers inside from foreign objects falling in. Furthermore, hazard communication signs should be prominently displayed at the worksite to warn everyone about the confined space and the potential dangers it presents.

6.1.9.7 Gas Purging – Prior to Entry

Gas purging is a technique used to clear hazardous gases from confined spaces before entry. Inert gas, often nitrogen (as well as water, steam, or any other inert gases), displaces or dilutes the dangerous atmosphere, making it safe for workers. The choice of a suitable medium for purging or inerting will depend on factors such as the nature of the contaminants and their concentrations.

However, continuous monitoring is essential to ensure complete purging and safe oxygen levels. This technique requires proper planning and qualified personnel for effective confined space safety. After air purging has been completed, forced draft devices, such as inductors or fans, should be turned off for a sufficient time to allow for a normal atmospheric condition to exist for the gas testing of the confined space workplace.

Inerting is a form of purging that involves removing oxygen from the confined space by displacing it with inert gases such as nitrogen (N_2) and carbon dioxide (CO_2). Inerting is commonly used to remove the potential hazards of fire and explosion by reducing oxygen to a concentration below the level that can support combustion. When inerting, care should be taken to ensure that following the purging of the contaminants with inert gases, the space is ventilated with fresh air to restore the atmosphere to normal conditions. Additionally, when purging flammable substances, the equipment used, such as nozzles and pipes, should be bonded to the space to prevent the build-up of static charges which can cause ignition.

6.1.9.8 Purge Time

The amount of time that is required to remove the contaminants is dependent on the concentration of the contaminants and the capacity of the air moving devices used. If no further contaminant release is expected (static condition), the following formula can be used to calculate the amount of time needed.

$$\mathbf{Q = V / T\ Ln = C_2 / C_1}$$

- Where: T (min) is the time required
- Q (m3/min) is the quantity of the supplied purging medium
- V (m3) is the confined space volume
- C_1 (ppm) is the initial concentration of the contaminants
- C_2 (ppm) is the final concentration of the contaminants after T mins
- Ln refers to a Natural Logarithms

The above requirements assume an ideal mixing and distribution of supplied air. In practice, higher

rate of ventilation may be necessary depending on the efficiency of supplied air distribution.

6.1.9.9 Other Safety Precautions

- Any liquids or free-flowing solids should be removed from the confined space to eliminate the risk of drowning or suffocation.
- All pipes should be physically disconnected, or isolation blanks bolted in place. Closing valves is not sufficient.

- Use two blocking valves, with an open vent or bleed valve between the blocking valves when isolating pipelines or similar conveyances to prevent entry of materials and hazardous contaminants.
- A barrier is present to prevent any liquids or free-flowing solids from entering the confined space.
- The opening for entry into and exit from the confined space should be large enough to allow the passage of an employee using protective equipment.
- Making sure no work is being performed outside of the space that could impact the safety or air quality inside the confined space.
- For worker safety, entry is prohibited when temperatures exceed 50°C (122°F). Confined space work should be postponed until temperatures drop below this level. When entry is necessary, thermal stress measures like increased ventilation, frequent breaks in cool areas, and job rotation should be implemented.

6.2 ATMOSPHERE MONITORING BEFORE AND DURING ENTRY

6.2.1 Instrument Calibration and Verification

Calibration:

- Instrumentation should be used for measuring atmospheric concentrations in confined spaces should be calibrated every six months. The calibration date should be recorded on the instrument itself.

Verification:

- It is recommended to verify the functionality of meters by testing them on a known source for field verification both before and after each use.
- For specific and long-term activities, the frequency of calibration should be adjusted based on a risk assessment. This ensures that the calibration schedule remains appropriate to the level of risk associated with the work being performed.

6.2.2 Representative Sampling

A sampling plan should be established to address the layout of the confined space and the potential contaminants that may be present. Samples should be collected from respective areas throughout the confined space, especially in locations where people will be working. For most spaces, representative sampling should include taking samples from the top, middle, and bottom of the space. Testing should follow a standard sequence: first measure oxygen content (because most combustible gas meters are oxygen dependent and will not provide reliable readings in an oxygen deficient atmosphere), then assess flammability (because of the threat of fire or explosion), and finally check for toxicity (to ensure that toxic gases and vapours are within limits as mentioned below).

Sampling Procedure:

- Begin by identifying potential contaminants through a review of the confined space's history, materials used within the space, and any processes that could introduce contaminants. Collect samples from at least three levels within the space—top, middle, and bottom—to account for gases of varying densities, especially in areas workers may occupy.
- Test the atmosphere in the following sequence: oxygen levels first, then flammability, and finally toxicity levels, to assess the most immediate risks to entrant safety. Perform sampling only after any purging or ventilation processes have stabilized the atmosphere to avoid skewed results.
- For areas that are difficult to access, use extended probes or other tools to collect air samples without entering the space. Sampling should be conducted by trained employees familiar with atmospheric testing, the use of specific instruments, and interpreting results.
- Conduct an initial assessment before entry to establish a baseline and continuous monitoring during entry (using a Personal Alert Monitor (PAM) in the breathing zone), especially when tasks may alter atmospheric conditions. Document all sampling results, including time, date, location, and test outcomes, and review them before authorizing entry.
- Develop response plans for scenarios where atmospheric conditions fall outside safe parameters, including evacuation procedures and corrective actions. In Immediately Dangerous to Life or Health (IDLH) situations, entry should be prohibited until the atmosphere is safe.

6.2.3 Testing in Stratified Atmospheres

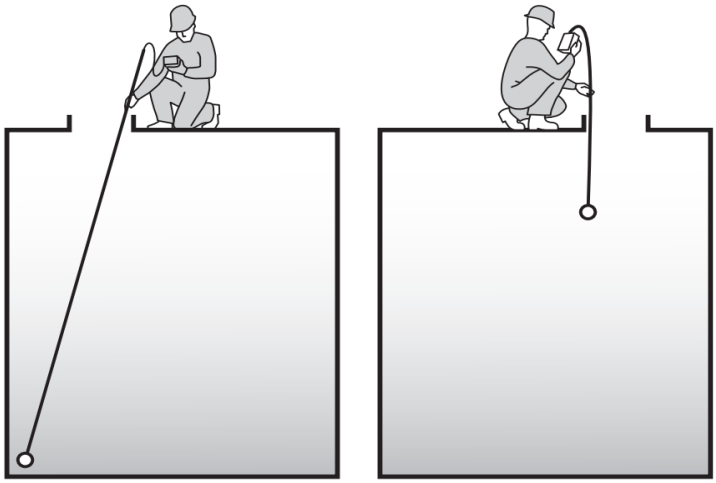
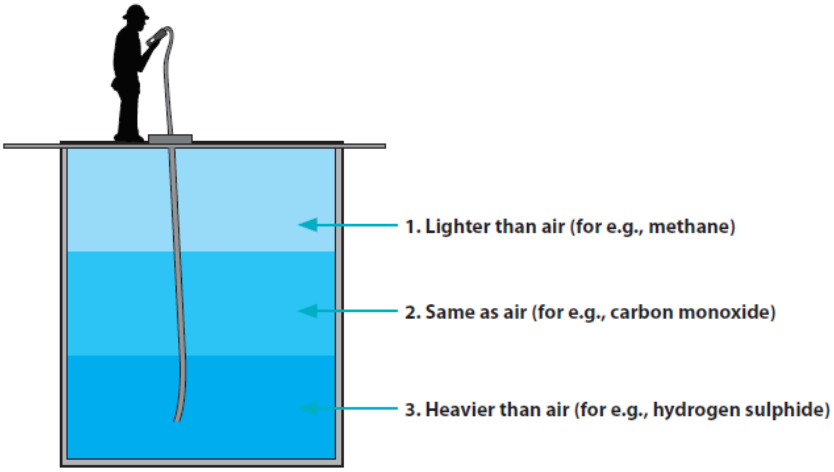


Figure-11: Atmospheric Testing of Remote Regions and Different Levels within the Confined Space.



- It is important that the gas testers understand and consider the geometry of the confined space and the physical properties of the gases to be monitored.
- These gases could be found stratified at different levels or locations of the confined space.

The general rule of thumb for gas testing using sampling hose for a vertical or horizontal entry is 10 seconds for each metre of the sampling hose. Alternatively, the following calculations can be used to work out the sampling time required:

Factors to consider:

- Sampling Distance.
- Internal/External Pump Capacity; and
- Diameter of the sampling hose.

6.2.4 Toxicity Levels

Toxicity readings from commercial meters are only reliable if the equipment has been calibrated for the specific contaminants that may be present. If there is a trace that a toxic substance may be present, a specific test using tools such as a Dräger tube or another direct-reading instrument should be conducted, or respiratory protection should be worn. Substances may be present up to the acceptable exposure limit set by the company or local legislation, whichever is more stringent.

Monitoring should be done before work start in a shift (or simply before shift) and twice in a shift during the course of work. If work duration extends then re-test would be required along with PTW extension.



Figure-12: Toxicity Levels

Exposure to toxic substances can lead to a variety of health effects:

- **Chemical Asphyxiation:** This occurs when the body experiences oxygen deficiency due to inhalation of gases or vapours. For instance, carbon monoxide, which is released during combustion processes such as hot work or from internal combustion engines, can cause chemical asphyxiation.
- **Narcotic Effects:** Symptoms such as headache, dizziness, and nausea can result from exposure to hydrocarbon vapours during activities like spray painting or sludge removal.
- **Cancer:** Certain chemicals like benzene and vinyl chloride monomer, which may be found in cargo tanks, can increase the risk of cancer.
- **Systemic Poisoning:** Inhalation of toxins such as lead from welding fumes or mercury from crude oil can lead to systemic poisoning.

Toxic substances have varying effects on health at different concentrations. Therefore, it's crucial to identify and assess the potential toxic substances in a confined space. This enables the use of the appropriate gas testing equipment with corresponding alarm thresholds set to provide warnings at dangerous levels, also known as permissible exposure limit (PEL).

6.2.5 Oxygen Levels

The quality of the air inside the confined space should be equal to that outside the space. The oxygen concentration in the air outside the confined space is assumed to be 20.9 percent at sea level, allowing for equipment error.

If the air quality inside the confined space is different from that outside the space, then the reason for the discrepancy should be determined and documented before entry into the space is authorized. When there is no discrepancy between the quality of the air inside and outside the confined space, the oxygen level shall fall in the range of 19.5 to 23.5 percent at sea level, allowing for equipment error.

Oxygen deficiency in the confined space which may be caused by -

(i) slow oxidation reactions of either organic or inorganic substances.

(ii) rapid oxidation (combustion).

(iii) the dilution of air with an inert gas.

(iv) absorption by grains, chemicals, or soils; or

(v) physical activity.

Oxygen enrichment in the confined space may be caused by a leaking oxygen cylinder, a faulty pipe connection, an incorrect disposal of liquid gas or an oxygen-fuelled processes like gas welding and cutting with the potential to release excess oxygen into the air.

Effects of various concentration of oxygen is mentioned below.

Oxygen concentration volume %	Effects and symptoms
>23.5	Oxygen-enriched, extreme fire hazard
19.5	Minimum safe entry level
16-19.5	Poor coordination, fatigue
12-16	Rapid pulse, difficulty in breathing
10-12	Very fast and deep breathing, lips begin to turn blue, headache
8-10	Fainting, unconsciousness, nausea,
6-8	Fatal in 8 minutes; 50% fatal in 6 minutes
<6	Coma in 1 minutes, convulsions, respiratory and cardiac arrest, death

6.2.6 Flammability Levels

The accepted maximum for flammable vapours, including for welding and grinding activities, shall be no more than 5 percent of the lower flammability limit (LFL). The optimal result in this test should be zero. Consideration should be given to using instrumentation specific to the potentially flammable agent (e.g. hydrogen).

A source of ignition is present when its temperature meets or exceeds the ignition temperature of a flammable substance. Many processes can create sources of ignition, including:

- Hot work such as welding or gas cutting.
- Pyrophoric materials like iron sulphide
- Sparks from internal combustion engines, such as those used in compressors, drilling, or non-flame cutting.
- Certain material flows such as non-conductive liquids or combustible powders, which can produce static charges that ignite the flammable liquid or combustible powder.

When the concentration of the flammable substance falls between the lower explosive limit (LEL) and the upper explosive limit (UEL), there is a risk of ignition. For flammable liquids, a flammable vapor-air mixture can form if the temperature of the surroundings is at or above the liquid's flash point.

Examples of LEL and UEL values for few flammable substances are given in table

Substance	LEL (% Volume)	UEL (% Volume)	Autoignition Temperature (°C)	Flash Point Temperature (°C)	PEL (PPM)
Benzene	1.2	7.1	498	-11.1	5
Carbon monoxide	12.5	74	607	NA	25
Hydrogen sulphide	4.3	44	260	NA	10
Ethanol	3.5	19	365	13	1000
Styrene	1.1	6.1	490	31	50

6.2.7 Continuous Monitoring and Repeat Testing

Continuous monitoring is essential when the activity inside the confined space can alter atmospheric conditions or when there is a potential for activities outside the space to impact the conditions inside. Monitors should have functioning alarms, and normal breathing should only slightly affect air quality in small, confined spaces.

A continuous monitor should be placed close to the work area and positioned so that the attendant can see and/or hear any alarm, as well as the entrant within the confined space. Continuous monitoring is the most conservative approach, reliable method for detecting changing conditions and is the preferred selection for entry.

If periodic monitoring is employed, establish a frequency that provides adequate protection for entrants and does not exceed a two-hour interval. Before re-entering a space after any break in continuous entry, the area should be evaluated to ensure safe conditions.

Personal monitoring should be done using PAM worn in breathing zone – Personal alert monitor only.



Figure-13: Monitoring

6.2.8 Radioactive Material

Entry into a confined space where naturally occurring radioactive material is known or suspected should be regulated by:

- Ensuring that any radioactive sources present in the vicinity of the confined space is positively isolated or removed from the work site.
- Ventilate confined spaces, such as vessels, columns, or tanks, for at least four hours before entry.
- Employee and equipment exiting the confined space should undergo a survey for naturally occurring radioactive material contamination.
- Segregate and decontaminate Employee or equipment contaminated with naturally occurring radioactive material.

6.2.9 Mercury

There are three forms of mercury:

- Elemental Mercury: This is a very heavy, odourless, silver-coloured liquid that, when evaporated, turns into an invisible, odourless, toxic vapor. Inhalation of elemental mercury vapours is the primary cause of toxicity. Elemental mercury can be found in crude refining vessels.
- Breathing in mercury vapor may lead to symptoms such as chills, metallic taste, mouth sores, swollen gums, nausea, vomiting, abdominal pain, diarrhoea, headache, weakness, confusion, shortness of breath, cough, chest tightness, bronchitis, pneumonia, and kidney damage.
- Inorganic Mercury Compounds: These compounds, also known as mercuric salts, are corrosive and can cause kidney damage.
- Organic Mercury Compounds: Found in many products, organic mercury can affect all body systems and pose significant health risks.

6.3 IDENTIFYING AND CONTROLLING HAZARDS

There should always be a reliable communication method between the attendant and the entrant whenever the entrant is inside the confined space for the purpose of summoning rescue services in case of emergency. This communication could involve tugging on a rope or enabling the attendant to stop an activity in environments that are noisy or hinder visibility.



Figure-14: Visibility

6.3.1 Temperature

Maintain a safe temperature within the confined space to protect employee during entry. High temperatures can lead to heat stress, while low temperatures can cause hypothermia.

6.3.2 Atmosphere

Ventilation can help minimize or eliminate atmospheric hazards created during employees work in a confined space. Active ventilation is preferred over natural ventilation for more effective control of air quality.

Never attempt to improve air quality in a confined space by introducing fresh air from the external environment. Instead, use forced ventilation to circulate the air within the confined space. Do not use pure oxygen to make the atmosphere safe.

Air suction (or negative exhaust) should draw air away from the immediate work area. This method is effective for removing potential pollutants generated during tasks such as welding or cutting within the confined space.

Implement active ventilation to control atmospheric hazards. Avoid using pure oxygen, as it can increase the risk of fire or explosion. Use air suction to remove contaminants from the work area and monitor air quality regularly.



Figure-15: Ventilation Means

6.3.3 Process Equipment within the Space

Any equipment that has the potential to move should be secured properly to prevent accidents. This may involve using mechanical locking devices, blocking, or de-energizing the equipment to ensure it remains stationary. Regular checks and inspections of these safety measures are essential to maintain a safe working environment.

Even when process equipment such as a vessel within a confined space is isolated, it can still pose a significant hazard. This equipment may move unexpectedly or obstruct Employee, making movement or rescue difficult.

6.3.4 Visibility

Ensure sufficient lighting and visibility for entrants and attendants. Use flame-proof lighting in potentially explosive environments and take measures to protect against electrical hazards. When visibility is inadequate, additional illumination should be given both prior to entry and during the work. The type of lighting used should not create additional hazards. 24 V DC hand lamps should be used as they are typically light weight, portable, intrinsically safe and easy to handle. If illumination is required for entry and work in the confined space, the lighting used should not introduce new hazards. Options such as low-voltage lights, including air-powered lights, and intrinsically safe lighting are recommended. Lighting should be positioned so that attendants can clearly observe entrants working within the confined space.

6.3.5 Fall Prevention

Create a written fall prevention plan that includes the use of platforms, scaffolding, fall arrest systems, and rescue methods. Regularly inspect fall protection systems and train employee on their use.



Figure-16: Fall Prevention

6.3.6 Personal Protective Equipment (PPE)

Select PPE based on the identified hazards and the nature of the work to be done. Regularly reassess hazards when using forced ventilation and provide appropriate respiratory protection when necessary. Refer **Annexure 2** and PPE Management Standard (JSW/GHS/GS- 05) for more details on PPE.

6.3.7 Static Electricity

Ground equipment to mitigate static electricity, which can pose a hazard during activities in or around the confined space. A check should be made to ensure that the equipment in use is securely earthed to ensure any static electricity is discharged safely. Proper grounding prevents the risk of sparks and explosions.

6.3.8 Electrical Hazards

Protect entrants from electrical risks by using low-voltage tools and lighting (24V), or by implementing safety systems such as earth leakage circuit breakers (ELCB) or residual current circuit breakers (RCCB). Ensure all electrical systems are properly grounded and maintained.
By addressing these points, you can effectively manage hazards in confined spaces and ensure the safety of all Employee involved in confined space entry.



Figure-17: Electrical Hazard

6.3.9 Hot Work

A hot work is a work that involves activities generating heat, flames, or sparks within a confined or enclosed area. This can include welding, cutting, brazing, soldering, grinding, and other similar tasks. Performing such work in confined spaces presents significant safety hazards due to the potential for fire, explosion, or oxygen depletion. If Hot Work is to be carried out in a confined space, a Hot Work Permit to Work should be issued. Steps should be taken to protect the persons in the confined space from fumes produced by the Hot Work. The use of extraction fans and air blowers as specified in the mandatory requirements are necessary to keep the confined space well-ventilated and free of fumes. In an event where fans/air blowers cannot be installed, other means of ventilation should be considered, (e.g. insert an air supply line into the vessel following risk assessment also referred to safe location of air inlets).



Figure-18: Hot Work

6.4 PERMIT SPACE ENTRY COMMUNICATION AND COORDINATION.

Reliable and effective communication between the attendant and the entrants is crucial for the safety of Employee involved in confined space operations. To maintain seamless communication, the following enhanced protocols are established:

- Use Modern Communication Technologies: Utilize dependable communication technologies suited to the challenges of confined spaces, such as digital radios, hands-free voice-activated devices, and wireless intercom systems capable of penetrating confined space walls. Test these systems in each specific confined space environment before entry to ensure clear communication.
- Implement Backup Communication Systems: Establish a backup communication system in case the primary method fails, such as secondary wireless devices, hard-wired communication lines, or simple auditory or visual signals for immediate emergencies. For example, where visual or oral communication is not possible, a system of rope signals could be devised. Microwave, long wave, or low wave radio equipment can be used in confined spaces where normal radio is unsuitable.
- Establish Clear Communication Procedures: Develop clear procedures for initiating, maintaining, and terminating communication during confined space operations, including check-in/check-out procedures, regular status updates, and emergency communication processes.
- Develop Emergency Communication Plans: Create specific emergency communication plans that detail how to communicate hazards, initiate evacuations, and call for emergency assistance from within a confined space. Customize these plans to each confined space's unique layout and potential risks, ensuring all entrants and attendants are trained in these procedures.
- Provide Comprehensive Training: Offer comprehensive training for all confined space employees on the proper use of communication systems, including troubleshooting common issues and switching to backup systems when necessary. This training should be part of the regular confined space entry program and updated with any new technologies.
- Supplement with Visual Communication Aids: When feasible, supplement auditory communication systems with visual communication aids, such as signage, hand signals, or flashing lights to convey messages or alerts. Develop a standardized set of visual signals for all team members to understand.



Figure-19: Entry Communication and Coordination

6.5 PERMIT-REQUIRED CONFINED SPACE PROGRAM

Entry into a confined space should be authorized, and each confined space requires an entry permit unless exempted by mandatory requirements. Permits may cover different time periods based on the duration of work in the confined space. Permits should be revalidated or reissued when there is a change in the Employee overseeing the work, an interruption in work (e.g., a lunch break), changes in the work scope introducing new hazards not covered by the current permit, or the need for new control measures arises. Refer **Annexure 4** for sample confined space entry permit.

6.5.1 Duration

Each entry permit shall specify its valid duration, which shall not exceed one shift or the job duration. Permits shall be reauthorized for work spanning multiple shifts not exceeding 24 hours from issuance of initial permit. Frequent checks maintain the integrity of precautions. Full checks should be conducted for each new or reauthorized permit. Business Units should outline how responsibility will be transferred if the entry supervisor leaves the unit.

6.5.2 Permit Content

Entry permits should include the following elements:

- Description of the space, work location, and ID number of the confined space and task(s)
- Date and authorized permit duration.
- List of potential hazards at the outset and during the activity
- List of essential preparation controls for the space
- List of essential controls during entry (e.g., isolations, hazard control measures, PPE, warning notices, rescue plan, communication procedures)
- Atmospheric test data and the testing times (Before shift, and twice during the work)
- Name and signature of the entry supervisor.
- Names and signatures of all authorized entrants, stan by persons, attendants, entry supervisor, rescuers (firefighting team members, first aid team members, other rescuers, and the Employee who performed the testing.
- Sign-off box to indicate task completion and the time of entry completion.
- The Government-approved PTW Authorizer shall sign the permit as required by legislation, if applicable. For instance, in Odisha, it is mandated to obtain state authority approval to authorize individuals to sign as Confined Space Entry PTW Authorizers.

The entry permit should be displayed in a prominent place to facilitate signing and clearance. A copy should be held by the Site employer.

6.5.3 Scope Change

Cancel the entry permit if the task's scope changes. Issue a new permit that accounts for the new task.

6.5.4 Permit Retention

Keep permits until the annual review is complete. The respective department should retain the permits. All records should be made available to the executors and the regulatory authority inspectors on request.

6.5.5 Closure of Confined Space

Both the permit authorizer and supervisor/ applicant should personally verify everyone has exited before final closure. The entry point is then secured to prevent accidental re-entry. Additionally, all equipment and materials brought in for the work need to be cleaned, removed, and stored properly. In cases where re-entry is necessary for closure purposes, a confined space attendant should be present to ensure continued safety.

6.6 Authorization and Signatures

Authorization and signatures are required from all employees involved in confined space work. Here's how authorization and signatures are handled:

- **Entry Supervisor/ Applicant:** An entry supervisor, who is a trained and designated employee, is responsible for reviewing the confined space and confirming that it is safe for entry. This includes verifying that all safety measures and preparations are in place according to the permit.
- **Permit Approval:** Once the entry supervisor confirms the space is safe for entry, they sign the permit. This signature represents authorization for Employee to enter the confined space.
- **Entrants and Attendants:** All authorized entrants and attendants should sign the permit to acknowledge they have read and understand the work to be done, the hazards involved, and the precautions necessary to maintain safe entry conditions.
- **Testing Verification:** The employee who conducts the atmospheric testing of the confined space should also sign the permit and record the test data and the time the testing was performed.
- **Display and Completion:** A copy of the permit should be displayed near the confined space so that all involved parties can reference it. The entry supervisor should note the time of completed entry on the permit.

Note: Refer Annexure-5 for roles and responsibilities.

6.7 Entering and Maintaining the Continuity of Conditions in the Confined Space

Confined spaces are enclosed areas that are not designed for continuous human occupancy. These spaces often have limited openings for entry and exit, and may contain hazards such as toxic gases, lack of oxygen, or the potential for entrapment. Properly entering and maintaining the continuity of conditions in confined spaces is critical for ensuring the safety and well-being of workers. In this article, we will explore key aspects of confined space entry and maintenance, including risk assessment, preparation, monitoring, and emergency response.

6.7.1 Change of Conditions

Employees should be alert of activities that can change conditions within the confined space. If conditions deviate from those specified in the permit, the entry should end immediately, and a reassessment of the hazards and necessary control measures should be conducted. Reauthorization for entry is required before proceeding. Activities like oxygen-consuming processes (e.g., welding, bacteria, and metal oxidation) can decrease available oxygen, while external activities (e.g., engine exhaust) can introduce toxic materials or change oxygen levels. Additional changes may include disturbing residues, creating fumes, or generating hot spots. Any incidents that affect the space or rescue team availability should result in immediate suspension of the confined-space entry, such as fire or fume-release alarms. Employees should be alert, and the entry permit should be revalidated whenever it becomes evident that the duration of work will involve one of the following:

- A change in the person responsible for the direct control of the work in a confined space.
- A significant break in work continuity.

- A significant change in atmosphere or work to be performed.

6.7.2 Warning Against Unintentional Entry

Once a confined space is opened, a sign and physical barrier should be installed at each potential entry point to prevent unintentional access. These barriers should only be removed during authorized entries. The employer, prior to any person entering a confined space, and during any occupancy of the confined space, should ensure appropriate signs and protective barriers are erected to prevent entry of people not involved in the work.



Figure-20: Warning Against Unauthorized Entry

6.8 CONFINED SPACE ENTRY STANDBY PERSON

A standby person oversees the internal and external activities related to work in and around a confined space. The minimum number of stand-by persons required should be recorded on the entry permit. Positioned near the entry point of the confined space where the work occurs, this employee serves as the 'eyes' and 'ears' of those inside and remains in constant communication with all workers inside the confined space. Given the necessary nature of monitoring confined space entry activities, the standby employees sole duty is to oversee these tasks. In some situations, the standby employees may also take on the role of a fire watch. Observation between those in the confined space and the stand-by person(s) should be constantly maintained.

Before starting a confined space entry job, the standby employees should review the confined space entry plan and work permits, understanding the hazards, precautions, and emergency procedures. standby employee should monitor entrants, keep a log of those entering and exiting, and prevent unauthorized access. The standby employee should maintain two-way communication with entrants, watching

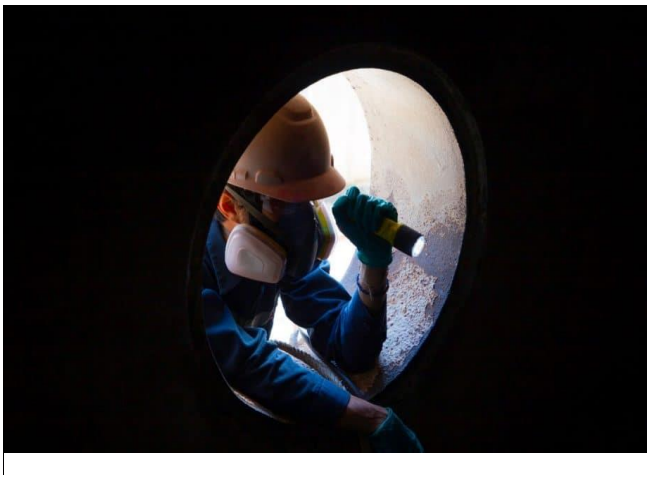


Figure-21: Standby

for signs of exposure to hazards, and alerting them if evacuation is needed. In emergencies, standby employee should sound the alarm and notify supervisors. The standby employee remains stationed at the entry point and does not leave until relieved by another standby employee, as noted on the work permit.
The standby employee should be be notified immediately if an entrant recognizes:

- unusual action/ behavior.
- an unexpected hazard.
- an unsafe act; or
- detects a condition prohibited by the permit.

The standby person should have PAM (personal alert monitor only) which they should worn in breathing zone before entry.

6.9 STOP WORK IN CASE OF EMERGENCY

In the event of an emergency, the confined space entry supervisor should halt all confined space entry activities and cancel work permits. If entry is suspended for any reason, the supervisor should barricade the entry point and post a "NO ENTRY" sign. Following prolonged work stoppages, whether due to an emergency or at the end of the workday, atmospheric gas testing should be performed as done before initial entry, with ventilation turned off.

7. SPECIAL CASES

Vessels are commonly recognized as confined spaces, but there are other less apparent spaces with similar hazards. Therefore, the precautions outlined in this standard should be followed in these areas as well. In certain situations, confined space hazards may be less severe, and if risks and safety measures are clearly identified and established, then not all aspects of this standard may be necessary.
All confined spaces require a permit for entry unless exempted by the specific provisions outlined in this section.

7.1 CONFINED SPACE CONFIGURATION

The configuration of a confined space encompasses its size, shape, and physical features such as the number, size, and location of entry and exit points. It influences the level of hazards and plans for emergency egress or rescue. Confined spaces are not necessarily designed for regular personnel work, but they are large enough for workers to enter and perform certain jobs.
An open internal configuration allows free movement within the space, like in a drained and locked-out water tank. An obstructed configuration contains obstacles like baffles, mixing blades, tubes, or scaffolding, increasing the risk. Such configurations may also include converging walls or sloping floors that trap entrants. Entry and exit points 1.2 meters (4 feet) or higher elevation can complicate entry and exit, especially in emergencies. A good entry point offers unrestricted access, while restricted points (24 inches or less) make emergency entry and exit difficult.
Horizontal entry points are located on the side of the space, complicating the use of rescue retrieval lines. Vertical entry points, on the top or bottom of the space, require climbing and may need a hoist for safe rescue during emergencies.

7.2 NON-PERMIT CONFINED SPACES

In certain situations, confined space hazards can be clearly defined and effectively controlled. When this is the case, and based on site-specific risk assessments and local regulations, work may proceed without requiring a full Confined Space Entry permit, under an alternative control system.

These spaces should be classified as "Restricted spaces, “wherein entry does not mandate a comprehensive Confined Space Entry permit but requires inclusion in an access register e.g. Cellar, Unauthorized persons should not be permitted to enter cellars and units/business shall refer JSW Group protocol and Steel Ministry guidelines to access the cellar.

The access register serves to document entries, ensuring accountability and enabling effective risk management.

A documented work control system should be in place to reclassify confined spaces as non-permit requiring and outline the conditions necessary to maintain this status. These spaces should remain free from hazards such as:

- Hazardous atmospheres due to their contents or nature of work.
- Risks of engulfment.
- Spaces with inwardly converging walls.
- Any other identifiable safety or health hazards.

7.3 AREAS NOT CLEARLY DEFINED AS "CONFINED"

Certain spaces may not meet the criteria for confined spaces but could present similar hazards upon entry, such as entering a 12-inch (30-cm) diameter pipe or a nitrogen-purged vessel. In these scenarios, a work hazard assessment should be conducted, and appropriate controls implemented to address potential hazards. Some units may choose to use the confined-space permit system for such activities, depending on local regulations.

7.4 INERT GAS PURGING OF SPACES

Inert gas purging in confined spaces can create atmospheric hazards near and beyond openings into the space. Precautions for entry preparation and during entry should include defining hazardous zones around openings, setting up barricades to prevent unauthorized access, and placing warning signs. Atmospheric testing should verify the accuracy of hazardous zone boundaries.

7.5 DIKES

Dikes can be considered similar to open-topped tanks and may qualify as confined spaces. The confined space definition applies here, particularly about restricted entry and exit and additional hazards. A dike with vertical walls of 4 feet (1.2 meters) or higher without fixed steps to the top is considered to restrict entry or exit. Open-topped tanks should be considered as confined spaces regardless of related risk assessment when the potential vapor o gas that is likely to be present inside is heavier than air.

7.6 EXCAVATIONS AND TRENCHES

Excavations and trenches, whether temporary or permanent, are like dikes in that they require careful assessment regarding their safety. Physical hazards primarily involve the ease of exiting the area, which is easily assessed. Chemical hazards concern whether employees might be exposed to chemicals, particularly gases. A critical consideration is whether the task requires workers to operate with their heads below the trench or excavation edges. For example, a trench 3 feet (1 meter) deep may not be a confined space, but lying down in it to work could make it one.

As with chemical hazards, the typical approach is to isolate potential sources and prove the area is a non-permit confined space. The transient nature of trenches and excavations that might be classified as confined spaces makes it impractical to list them as confined spaces on a Site's registry. However, proper warning signs should be displayed on-site to adhere to the safety principles outlined in this standard.



Figure-22: Excavation and Trenches

7.7 DISPLAY OF WARNING NOTICE

To ensure worker awareness, all confined spaces requiring a permit for entry should be clearly identified and labelled. These labels will serve as a visual alert, informing employees about the existence and location of these potentially hazardous areas.

Additional hazards can override height or fixed step considerations. These may include physical hazards, such as obstructive pipe layouts, or chemical hazards, such as heavier-than-air gases stored or used in the area. The extent of the hazard may depend on the task being performed. The usual approach to chemical hazards is to isolate potential sources and prove the area is a non-permit confined space.



Figure-23: Display of Warning Notice

Provision of signs should be implemented in a manner appropriate to the workplace at each entry to the confined space, as a warning against entry by persons other than those who are listed on the entry permit. Signs for these confined spaces shall be located near potential points of access and should have dimensions of 10 inches in height and 14 inches in width.

7.8 EXTERNAL ACTIVITIES

Hazardous conditions and activities outside a confined space should be recognized, controlled, and assessed for their potential effects on the confined space. For instance, diesel exhaust fumes from vehicles can pollute the air in a nearby confined space. Other external confined space entry hazards include the release of gases or vapours from product loading and unloading, as well as overhead crane dangers such as falling objects.

8. MEDICAL FITNESS

All JSW businesses should ensure that employees working in confined spaces are medically fit to perform their tasks safely. Medical surveillance is strongly recommended on an annual basis, or with a different frequency as evaluated by the occupational physician of the Company.

Ensuring the medical fitness of employees who work in confined spaces is crucial for their safety and well-being. Some key precautions are listed below:

- **Respiratory Health**: Confined spaces often have limited ventilation, which can lead to poor air quality and potential exposure to harmful gases, vapors, or particulates. Employees should undergo respiratory assessments (based on spirometry) to ensure they can tolerate the respiratory challenges posed by confined spaces.
- **Cardiovascular Health**: Working in confined spaces can be physically demanding and may require employees to exert themselves more than usual. Assessments of cardiovascular health can (based on electrocardiogram) help determine if employees are fit enough to perform tasks in confined spaces without risking heart-related issues.
- **Musculoskeletal Fitness**: Confined spaces often have restricted movement and awkward postures, which can increase the risk of musculoskeletal injuries. Employees should be evaluated for their ability to perform tasks requiring bending, lifting, and working in cramped conditions without sustaining injuries (medical visit related to ergonomic postures).
- **Psychological Fitness**: Working in confined spaces can be mentally challenging due to factors like isolation, claustrophobia, and the potential for high-stress situations. Employees should be assessed for psychological fitness (psychological tests) to ensure they can cope with the psychological demands of working in confined spaces.

In addition, potential drug/ alcohol addiction should be monitored since the use of alcohol and/or drug, for employees involved in confined space, should be strictly prohibited during the work shift.

Confined space employees should undergo specific medical examinations in addition to general check-ups, also including:

- Spirometry with Bronchodilation Test: Conducted every two years.
- Chest X-ray: Following ILO standards.
- Psychological Tests: Such as PMK and/or Zulliger

Employees with medical conditions identified in the examinations that contraindicate confined space work should not be assigned such tasks. Those with temporary health limitations posing risks should face temporary work restrictions. Return to work should be authorized only after a new medical examination confirms the employees is free from restrictions.

A pre-work health assessment, including blood pressure and Breathalyzer tests, should be performed before any confined space work begins. Other physical factors such as height, weight, and body structure may also be evaluated by a physician before permitting work in confined spaces.

Decisions regarding fitness for work should be made by a qualified physician. Additionally, a medical practitioner may recommend other tests based on specific risks identified at the site level.

9. EMERGENCY RESPONSE AND PLANNING

The Business Unit should assess emergency scenarios associated with confined space entry and develop a rescue plan for each entry, specifying rescue teams, equipment, facilities, and assigned responsibilities. The safety protocol process will encompass detailed emergency planning and rescue procedures, with the plan receiving authorization at multiple levels according to the safety protocol process.

The Units evaluation for effective rescue management will consist of two key components:

- **Initial Evaluation:** This evaluation determines whether a potential rescue service team has the necessary training, capabilities, and equipment to carry out confined space rescues effectively and respond promptly in emergencies.
- **Performance Evaluation:** This evaluation assesses the performance of the site's emergency rescue capabilities during actual rescue scenarios or practice rescue mock drills.

Entrants should be trained to exit the confined space as quickly as possible, when an order to evacuate is given by the attendant or entry supervisor or an entrant recognizes a sign or symptom of over-exposure, or an unacceptable condition arises, or an evacuation alarm is activated.

9.1 RESCUE PLAN

Each Unit should have written rescue plans specific to the confined space entry activities they oversee. Before granting entry authorization, the rescue plan should be evaluated to ensure it is designed to the specific confined space entry activity in question.

The written plan should account for the potential to implement a non-entry rescue, which is preferable because it is faster and safer for both entrants and rescue Employee. Confined space entry rescues should be planned for and executed only when non-entry rescue methods are not feasible.

9.2 INITIAL EVALUATION OF RESCUE

The effectiveness of a rescue plan can vary depending on the type of confined space and the potential hazards present. The following questions should be addressed and evaluated to determine the site's capability to perform rescues effectively:

- Response Time: Can the rescue team respond appropriately and promptly? What are the time limits for response? For confined space entries where an immediately dangerous to life or health (IDLH) atmosphere could occur, a ‘Swift Rescue’ plan should be in place, with the rescue team ready and on standby at the confined space during entry work. In other cases, swift rescue is desirable but not critical.
- Availability of Rescue Team: Is the rescue service and key personnel available when confined space entries may be happening? If the rescue service becomes unavailable during an entry, is there a reliable communication channel to promptly abort the entry?
- Equipment (PPEs) and Training: For rescues into spaces with significant atmospheric hazards where rescuer entry and victim packaging and retrieval cannot be safely accomplished within 10 to 15 minutes, are airline respirators with self-contained breathing apparatus (SCBA) or air bottles available for the rescuers and for supplying air to those in need? If SCBA is to be used, does the rescue service have the proper equipment and training?

- Technical Knowledge: If the confined space has a vertical entry over 4 ft. (1.2 m) deep, can the rescue team perform rescues properly? Does the team have the technical knowledge and equipment for rope work or elevated rescue?
- Medical Skills: Does the rescue team possess skills in medical evaluation, victim packaging, and emergency response? Is there access to a medical doctor and medical facility?
- Equipment Availability: Is the necessary equipment available for performing rescues effectively?

9.3 RESCUE TEAM REHEARSALS

To ensure the highest level of preparedness for confined space rescue operations, the rescue team should participate in comprehensive rescue rehearsals at least once a year. These rehearsals help maintain proficiency and adapt to the evolving challenges of confined space rescues.

The rehearsals should include a variety of scenarios that mock the specific hazards, configurations, and access challenges of the confined spaces within the Business Unit. Scenarios should range from simple extractions to complex rescues involving hazardous materials, medical emergencies, or equipment failures.

Whenever possible, rehearsals should take place in actual confined spaces or similar environments, using dummies, mannequins, or volunteer participants to simulate victims. This provides realistic training on manoeuvring and extracting employees under different conditions.

Each rescue rehearsal should be thoroughly evaluated to assess the effectiveness of rescue strategies, team coordination, and equipment use. Feedback should be given to all participants, and lessons learned should be incorporated into future training sessions and updates to the rescue plan.

Detailed records of rescue rehearsals should be maintained, including scenarios, participants, evaluator notes, and any areas for improvement. These records are important for tracking progress, identifying trends, and planning future training needs.

In rehearsal spaces, certain elements should be incorporated to ensure safety and efficiency:

- Internal Configuration: The space contains obstacles that rescuers would need to navigate around, such as a baffle, mixing blade, or large equipment like a ladder or scaffold.
- Elevation: A confined space where the entrance or opening is 4 feet (1.22 meters) or more above ground level. This type of space requires knowledge of high-angle rescue techniques due to the challenge of moving and transporting a patient from the elevated entry point.
- Portal Size: A portal with a dimension of 24 inches (61 cm) or less. Such a small opening prevents a rescuer from easily entering the space while wearing a self-contained breathing apparatus (SCBA). It also limits the ability to provide standard spinal immobilization for an injured Employee.
- Space Access: Horizontal: The portal is located on the side of the confined space, which can complicate the use of retrieval lines.
- Vertical: The portal is located at the top or bottom of the confined space, requiring rescuers to climb down or up to enter the space. Vertical access may necessitate knowledge of rope techniques or specialized methods for safely retrieving an incapacitated entrant.





Figure-24: Horizontal and Vertical Entry

9.3.1 Make Sure Units Have Adequate Rescue and Emergency Services Available.

Ensure there are enough rescue and emergency services in place during any permit-required confined space entry operations.

- The entry supervisor should ensure that the rescue-plan for the specific confined space has been completed and that all the rescue equipment identified in the plan are available to support a safe rescue in the confined space.
- Assess and choose rescue teams or services that can:
    - Respond quickly to a rescue call based on the hazards identified in the permit-required confined space. The response time should align with the risks present, allowing rescuers to reach potential victims promptly.
    - Effectively rescue employees from confined spaces in your workplace. Rescuers should have the necessary equipment suited for the type of rescue required.
    - Agree to notify you promptly if the rescue service becomes unavailable.
- Ensure at least one member of the rescue team or service has up to date first aid and CPR certification.
- Inform each rescue team or service about the specific hazards they may face when conducting a rescue.
- Provide the rescue team or service with access to all permit spaces where rescue may be needed. This enables them to create suitable rescue plans and practice rescue operations.
- Provide employees assigned to perform permit-required confined space rescue and emergency services with the following at no cost:
    - Personal protective equipment (PPE) necessary for safe entry.
    - Additional equipment needed for safe and effective rescues.
    - Training to ensure they are:
        I. Competent in using PPE and other rescue equipment.
        II. Skilled as an entrant in permit-required confined spaces.
        III. Capable of carrying out rescue and emergency tasks safely.
        IV. Versed in basic first aid and CPR.
- Conduct practice sessions for permit-required confined space rescues at least once every 12 months using dummies, manikins, or actual people. These sessions should occur in:
    - Actual permit spaces, or
    - Representative spaces that mimic the size, configuration, and accessibility of permit spaces where rescues will occur.
- Develop and implement procedures for:
    - Contacting rescue and emergency services.
    - Rescuing entrants from permit-required confined spaces.
    - Providing emergency services to rescued entrants.
    - Preventing unauthorized Employee from attempting a rescue.

9.3.2 Equipment

Ensuring readiness and effectiveness in confined space rescue operations requires comprehensive management of rescue equipment.

A detailed inventory of all rescue equipment needed for confined space operations should be included in the written rescue plan. This inventory should include personal protective equipment (PPE), mechanical retrieval systems (e.g., winches, tripods), communication devices, emergency medical supplies, and specialized tools suited to the confined space's hazards and layout.

Each authorized entrant should wear a safety harness and lifeline to aid in rescue, except in cases where the equipment may hinder rescue efforts or increase risks.

The rescue plan should specify the essential rescue equipment, ensuring the team has suitable gear for entry rescues. Establish strict procedures for regular inspection and maintenance of equipment to guarantee its immediate readiness. Pre- and post-use inspections are mandatory, with a log documenting maintenance, inspections, and any issues or corrective actions taken.



Figure-25: Equipment

Prioritize non-entry rescue techniques by ensuring retrieval equipment is properly installed and functional before entry. This includes safety harnesses and lifelines designed for the confined space's specific challenges, aiming to reduce risks for entrants and rescuers.

In spaces requiring vertical access, provide suitable retrieval equipment capable of safely managing an employees' weight and movement. Vertical rescue gear should minimize risk during use, supported by clear operational protocols.

9.3.3 Off-Site Rescue Services

Employees expected to perform on-site rescues should be qualified for the role. Units should conduct drills with external rescue personnel to ensure their rescue capabilities meet the required standards.

10. TRAINING

Employees involved in confined space entry should receive training from knowledgeable and experienced instructors that covers the content outlined in this standard. This training should be provided by a competent and qualified Employee who possesses the necessary knowledge and experience to teach the required skills and information. Any legal framework if exists should be fulfilled including local legislation, statutory or Factory act/ rule requirements.

10.1 General Awareness Training

All Employees who may encounter potential confined spaces should receive information explaining what a confined space is and the requirement for a permit before entering. Initial general awareness training should be administered to ensure that all employees understand the purpose and function of the confined space program in case that they are expected to operate close to confined space or supervise employees performing works near confined spaces.

10.2 Task-Specific Training

Training and certification should be provided to those involved in confined space entry, including entry supervisors, authorized entrants, attendants, authorized tester, and rescue team Employees. Training topics should include:

- General terminology
- Written entry program
- Confined space characteristics

- Potential hazards of confined spaces
- Authorization procedures for confined space entry
- Rescue procedures.

10.3 REFRESHER TRAINING

Task-specific training for confined spaces work, including refresher training, is essential to ensure the safety of workers who may encounter such environments. Confined spaces present unique hazards due to limited access, poor ventilation, potential exposure to harmful substances, and other critical risks. Below are listed some key elements that should be included in training programs for confined spaces work:

- **Recognition of Confined Spaces:** Trainees should understand what constitutes a confined space according to relevant regulations (e.g., OSHA in the United States, EU Directives in Europe) and be able to identify such spaces in the workplace.
- **Hazards Identification:** Workers should learn to recognize the various hazards associated with confined spaces, including but not limited to:
  - Atmospheric hazards (e.g., lack of oxygen, toxic gases, flammable gases)
  - Physical hazards (e.g., limited entry and exit points, engulfment hazards, heat related continuous stress)
  - Biological hazards (e.g., presence of bacteria, mold, or other pathogens)
  - Mechanical hazards (e.g., moving parts, equipment, or materials)
  - Any other hazard associated to confined space based on Site risk assessment.
- **Risk Assessment:** Trainees should be taught how to assess the risks associated with entering and working in confined spaces, including their duties in conducting atmospheric testing, evaluating potential hazards, and determining appropriate control measures.
- **Safe Entry Procedures:** Workers should learn proper entry procedures, including Permit to Work system and other necessary permits, testing, and monitoring the atmosphere, (using PAM in breathing zone – Personal alert monitor only), implementing appropriate ventilation measures (and related types of records and documentation), and ensuring proper personal protective equipment (PPE) is worn.
- **Emergency Procedures:** Training should cover emergency response procedures, including how to respond to incidents such as atmospheric hazards, engulfment, injury, or equipment failure. This should include procedures for rescue and evacuation, as well as first aid and basic firefighting techniques.
- **Communication and Monitoring:** Workers need to understand the importance of communication while working in confined spaces, including maintaining continuous contact with a designated attendant outside the space and using communication devices as necessary. Continuous monitoring of atmospheric conditions and the work environment is also critical in terms of specific training need. i.e. (using PAM in breathing zone – Personal alert monitor only)
- **Equipment Training:** Training should include specific instructions on the proper use of equipment commonly used in confined spaces work, such as gas detectors, ventilation systems, harnesses, lifelines, and rescue equipment.
- **Practical Exercises and Simulations:** Hands-on training exercises and simulations can help reinforce learning and provide practical experience in a controlled environment. These exercises should include simulated different categories and configurations of confined space entries, emergency scenarios, and rescue drills.
- **Documentation and Recordkeeping:** Trainees should be educated on the importance of documenting all aspects of confined space work, including risk assessments, permits, atmospheric testing results, confined space equipment inspection records, training records, and incident reports.
- **Regular Refreshers and Updates:** Confined spaces work training should be periodically reinforced through refresher courses and updates to ensure that workers remain knowledgeable about current regulations, best practices, and any changes in equipment or procedures implemented at Site level.

General awareness and task-specific training should be provided before entry whenever:

- Confined space hazards change
- Written programs change.
- There are deviations from permits or entry procedures.
- An employee's knowledge or procedure use is inadequate.

Simulated rescue drills should be conducted annually for all Employees involved in rescue operations.

Refresher training should be given at intervals not exceeding two years.

10.4 CONTRACTOR QUALIFICATIONS

Contractor employees should be trained for their roles in confined space entry. Units should ensure contractors working in confined spaces have adequate knowledge of entry, rescue, and duty-specific tasks. The contractor should provide the training and assess employee knowledge. The unit training program should meet the standard outlined in this document and the local legislative requirements. Unit-specific confined space entry requirements and procedures should be coordinated with contractors before any entry begins. Any legislation or statutory requirement w.r.t contractor qualification shall be fulfilled.

10.5 TRAINING RECORDS

Training records should be retained until retraining occurs or as required by local regulations.

11. RACI MATRIX

Activity Description	Department In-charge	Department Head	Safety Officer	DIC	APEX
Identification and Assessment of Site Condition	R	A	C	-	I
Planning, Preparation, Risk Assessment	R	A	C	R	I
Assign Responsibility for Implementing Control Measures	R	A	C	I	-
Protective and Rescue Equipment Plan	R	A	C	C	I
Job Execution	R	A	C	I	-
Training and Certification	R	A	C	I	-
Personal Protective Equipment (PPE)	R	A	C	I	-
Audit for Compliance	R	A	C	C	I
Identify Recue Team	R	A	C	I	-

R	= Responsible	expected to participate in the activity and contribute the best of his/her abilities
A	= Accountable	ultimately responsible for the results
C	= Consulted	contributes towards decision making
I	= Informed	informed about the progress or outcome of the work or task

12. MANAGEMENT OF RECORDS

All inspection records related to confined spaces should be retained for the life of the equipment or three years, whichever is longer.

Confined Space Rescue Plans
All prepared Confined Space rescue plans should be attached to the closed Permit to Work (PTW) records and retained in accordance with defined retention requirements.
Records to be maintained by the concerned department include:

- **Confined Space Register:** A comprehensive register listing all identified confined spaces within the facility.
- **Restricted Space Register:** A comprehensive register listing all identified Restricted spaces within the facility.
- **Confined Space Assessments:** Documentation of assessments for confined spaces, including hazards identified, control measures proposed, and corrective actions taken.
- **Authorized Personnel List:** A list of personnel authorized to approve confined space entry permits and oversee confined space operations.
- **Permit Records:** Records of issued permits, including associated risk assessments, implemented control measures, and permit closures.
- **Maintenance Plans and Schedules:** Detailed plans and schedules for maintenance activities within confined spaces, including safety protocols and key considerations.
- **Incident Records:** Records of all incidents or accidents related to confined spaces, maintained by the Health and Safety Department, and preserved for a minimum of five years.

13. LEGAL AND OTHER REQUIREMENTS

JSW site shall access, identify, evaluate, and keep up to date the Confined Space requirement as per prevailing law in operation.

14. KEY PERFORMANCE INDICATORS

To ensure conformance to confined space entry requirements and maintain a safe working environment, the following Key Performance Indicators (KPIs) should be identified, communicated, recorded, and monitored:

Indicative list of KPI'

- Compliance with Confined Space Management Standards
- Number of Confined Space Permits
- Compliance to Local legislative and statutory requirement w.r.t CSE
- Marked and Register of Confined Space and Restricted Space
- Number of Confined Space Assurance/Audit Programs
- Equipment Inspection and Maintenance
- Pre-entry and Post-entry Reviews
- Confined Space related training initiatives
- Accidents, incidents and high potential near misses associated to Confined Spaces
- Documentation and Record Keeping

Depending on the specific confined space program at each site, additional KPIs may be identified and monitored as appropriate. Monitoring these KPIs will help ensure compliance with safety standards and continuous improvement in confined space entry operations.

15. ASSURANCE

Each Site shall conduct self-assurance program to ensure compliance with this STANDARD as part of its safety assurance program. Third party system audit shall be conducted by Group Safety or external consultants to ensure compliance with the standard.

16. DEFINITIONS

Term	Definition
Atmospheric Testing	The process of using equipment to measure the levels of hazardous gases, oxygen, and other factors in a confined space before and during entry.
Attendant	A designated (competent/experienced) person who will remain outside the confined space and maintain constant communication with all confined space entrants. This person will have completed all confined space training requirements. The attendant also called as observant. • Know the hazards that may be faced during entry, including information of the signs or symptoms and consequences of the exposure. • Continuously maintains an accurate count of authorized entrants in the permit space. • Communicates with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate the space if necessary. • Summon rescue and other emergency services as soon as the attendant determines that the authorized entrants may need assistance to escape from the permit space hazards. • Warns the unauthorized persons that they should stay away from the permit space.
Authorized Entrant	An authorized entrant is an employee permitted by the business unit to enter a confined space or permit space. This employee is knowledgeable about potential hazards, necessary precautions, the scope and limits of the specified work, evacuation and communication procedures, and the roles of others involved in the entry. • Know the hazards that may be faced during entry, including information of the signs or symptoms and consequences of the exposure. • Communicates with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space.
Barrier	means a physical obstruction that blocks or limits access.
Calibration	A method design to adjust of the instrument's reading to coincide with a known concentration (generally a certified standard) of test gas.
Competent person	A person who has, through a combination of training, education, and experience, acquired knowledge and skills enabling that person to correctly perform a specified task.
Confined Space	A space that meets three criteria: (a) is large enough for a worker to enter and perform tasks; (b) has limited or restricted means of entry or exit; and (c) is not designed for continuous human occupancy.
Confined Space Evaluation Form	Form used to document the classification of confined space.
Entry	an act that begins when any part of the body crosses the plane of an opening to a confined space where the aperture is sufficient to allow full-body access to the space.
Entry permit	A written procedure outlines the operation of the system and specifies who is authorized to approve certain jobs and who is accountable for identifying and implementing the necessary safety measures.

Term	Definition
Entry supervisor	An entry supervisor is a person authorized to confirm that all conditions for entry into a confined space are met. They define ongoing precautions to ensure safe working conditions during the entry, authorize the entry, and can cancel the permit allowing entry. This role may also be referred to as a proprietor, work group supervisor, or authorizing person. • Know the hazards that may be faced during entry, including information of the signs or symptoms and consequences of the exposure. • Verifies, by checking that the appropriate entries have been made on the permit, that all tests specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin. • Terminates the entry and cancels the permit. • Verifies that rescue services are available and that the means for summoning them are operable. • Removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations.
Hazard	means a physical hazard or hazardous atmosphere.
Hazardous Atmosphere	An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness from one or more of the following causes: • Flammable gas, vapor or mist equal to or higher than 10 percent of its lower flammable limit (LFL) • Airborne combustible dust at a concentration that meets or exceeds its LEL. • Atmospheric oxygen concentration equal to or below 19.5 percent or above 23.5 percent. • Presence of toxic gases. (For example, equal to or more than 10 ppm hydrogen sulfide measured as an 8-hour time-weighted average). If the presence of other toxic contaminants is suspected, specific monitoring programs will be developed. • Any other atmospheric condition that is immediately dangerous to life or health (IDLH)
Hazardous Entry Condition	Applies to entry into confined spaces which have not been established as "Gas Free" and have been positively isolated, depressurized, and drained but do not have minimum oxygen contents of 20% or are suspected to contain hazardous fumes or residues or in excess of 21% oxygen or having combustible gases of greater than 1% but no more than 10% of LEL. It also applies to entry to confined space when H2S gas is free or entry with full Breathing Apparatus (B.A.) Set.
Hot Work Permit	A written authorization to perform hot work, received from authorized supervisor or other site personnel authorized to write and issue hot work permits.
IDLH (Immediately Dangerous to Life or Health)	means any condition that would interfere with an employees' ability to escape unaided from a permit space and that poses a threat to life or that would cause irreversible adverse health effects.
Isolate or isolation	means the process by which employees in a confined space are completely protected against the release of energy and material into the space, and contact with a physical hazard, by such means as: Blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; blocking or disconnecting all mechanical linkages; or placement of barriers to eliminate the potential for employee contact with a physical hazard.

Term	Definition
Isolation	The process of blanking or blinding, removing a section of line, duct or pipe, a double block and bleed, lock-out / tag-out of all sources of energy as may be required to protect a permit space against the release of energy and material into the space.
Lockout	means the placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.
Lower Flammable Limit (LFL) or Lower Explosive Limit (LEL)	The minimum vapor concentration of flammable liquid in air, below which flame propagation does not occur on contact with an ignition source.
Non-Hazardous Entry Condition	Applies to confined spaces which have been established gas free and safe for entry, positively isolated, depressurized, drained, cleaned, vented, and having minimum oxygen contents of 20% but not more than 21% and combustible gases equal to or less than 1% LEL.
Permit-Required Confined Space (Permit Space)	A confined space that has one or more of the following characteristics: o Contains or has potential to contain a hazardous atmosphere; o Contains a material that has the potential for engulfing an entrant; o Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or o Contains any other recognized serious safety or health hazard.
Rescue Team	A group of employees trained and equipped to perform rescues from confined spaces.
Standby Man	A person trained in the use of Breathing Apparatus and appointed by the Permit Applicant or the Authorizing Signatory to standby at the point of entry into the confined space and communicate with the occupant
Testing	Process by which that hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space.

17. ANNEXURES

ANNEXURE-1: CHECKLIST FOR CONFINED SPACE ENTRY

Checklist	Remark		
Risk Assessment			
Are all confined spaces in workplace identified and inventoried?			
How often are risk assessments conducted for each confined space?			
Who is responsible for conducting risk assessments, and what training do they receive?			
How are risk assessment findings documented and communicated to workers?			
Identifying Hazards			
What types of hazards (atmospheric, physical, chemical, etc.) have identified in each confined space?			
Are the hazards unique to each confined space documented and regularly reviewed?			
How are workers informed about the specific hazards in each confined space?			
What measures are taken to control identified hazards?			
Risk Control			
What specific control measures are implemented to mitigate the hazards in confined spaces?			
How often are control measures reviewed for effectiveness?			
What procedures are in place if control measures fail?			
How are workers trained on the use and importance of risk control measures?			
Do site have a written confined-space entry program?	Yes	No	
Does the program comply with applicable regulations and standards?	Yes	No	
How often is the confined-space entry program reviewed and updated?			
Who is responsible for overseeing the implementation of the program?			
Identifying Confined Spaces			
How site identify confined spaces in your workplace?			
Are confined spaces properly marked and labeled for easy identification?			
How is the inventory of confined spaces maintained and updated?			
Evaluation of Confined Spaces			
How often is each confined space evaluated, and who conducts the evaluations?			
Are evaluations documented and accessible for reference?			
How are workers informed about the hazards in confined spaces?			
What specific safety measures are in place to address the types of hazards?			
Preparing Confined Spaces for Entry			
How do site prepare for confined spaces for entry?			
What procedures are in place for isolation, lockout, and tagout?			
How are confined spaces cleaned and ventilated before entry?			
Monitoring the Space's Atmosphere Before and During Entry			
Are all monitoring instruments calibrated according to manufacturer specifications? PAM should also be calibrated.	Yes	No	
How often are instruments calibrated, and who conducts the calibration?			
Are calibration records maintained and easily accessible?			
What methods are used for representative sampling in confined spaces?			
How often is representative sampling conducted, and who performs the sampling?			
Are sampling results documented and reviewed for safety compliance?			
Toxicity Levels			
How are toxicity levels monitored and managed in confined spaces?			
What is the acceptable range for toxicity levels, and what measures are taken if levels exceed limits?			
Oxygen Levels			
How are oxygen levels monitored and managed in confined spaces?			

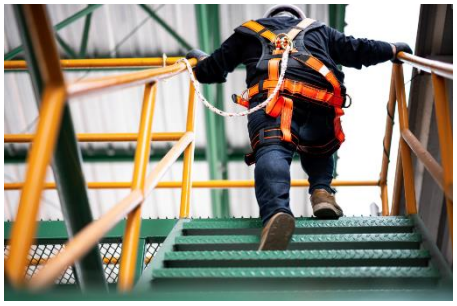
What is the acceptable range for oxygen levels, and what measures are taken if levels fall outside limits?	
Flammability Levels	
How are flammability levels monitored and managed in confined spaces?	
What is the acceptable range for flammability levels, and what measures are taken if levels exceed limits?	
How is continuous monitoring of confined spaces performed during entry?	
How often are repeat tests conducted to ensure ongoing safety?	
Who is authorized to sign permits, and what is the process for obtaining signatures?	
Are authorization and signatures documented and recorded?	
Are records of permits and signatures maintained and accessible?	
Entering and Maintaining the Continuity of Conditions in the Confined Space	
How are conditions in confined spaces continuously monitored during entry?	
What measures are taken if conditions change during entry?	
How are safety and continuity of conditions maintained throughout the entry?	
What procedures are in place for the safe use of inert gas purging in confined spaces?	
How do you monitor oxygen levels during inert gas purging?	
Display of Warning Notice	
Are warning notices displayed around confined spaces and hazardous areas?	
How do ensure workers and visitors are informed about the risks and controls in place?	

ANNEXURE-2: PERSONNEL PROTECTIVE EQUIPMENT

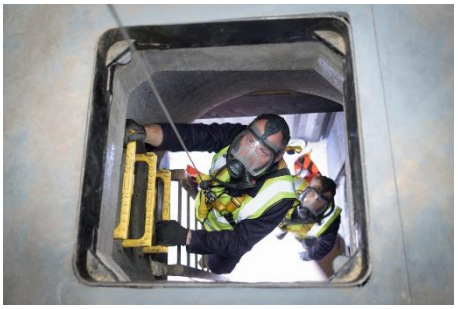
- Safety Helmet
- Eye Protection
- Hand Protection
- Reflective Clothing



- Safety Shoes
- Fall Protection/Lifelines



- Respiratory Protection
- Equipment Such as Pocket/Personal Gas Detector/ Torchlight







ANNEXURE-3: CONFINED SPACE INVENTORY AND RESTRICTED SPACE REGISTER

Confined Space No.	Name or Description of the Confined Space	Location (Department, Area, or Equipment)	Size Or Volume of the Confined Space	Entry Opening Size	Access Type (Vertical or Horizontal	No. of Opening's	Configuration	Potential Safety Hazards

Restricted Space Register

Serial No.	Date	Time In	Time Out	Restricted Space Location/ Description	Nature of Work	Authorized Entrant Name (s)	Permit Applicant/Supervisor Name	Pre-Entry Check Completed	Remarks
								Atmosphere Checked (Y/N) Task specific PPE Worn (Y/N) Persons Authorized (Y/N) If not authorized, not allowed Hazards eliminated or brought to ALARP	

ANNEXURE-4 SAMPLE CONFINED SPACE ENTRY CERTIFICATE

CONFINED SPACE ENTRY CERTIFICATE
Yellow Permit Applicant / Holder, White – Works Site, Green – Authoriser
THIS IS NOT A PERMIT TO WORK

1. APPLIED BY PERMIT APPLICANT (To be filled by Applicant)

Sign …… Name…… Date ……	Plant …… Location …… Equipment ……	Certificate No. Permit No. ……
Description of Confined Space:	Work Description:	Equipment/Tools/Chemicals used for this W

2. TYPE OF HAZARDOUS WORK

Combustion Hazards	**Spark Producing**	
Welding _____	Chipping _____	Electrical _____
Burning _____	Grinding _____	Rotating space _____
Open flame _____	Drilling _____	Task-generated _____

__ Toxic material_____	__ Spilled material_____	__ Adjacent Processes_____	__ Working on unguarded. equipment
__ Corrosive material_____	__ Flammable material_____	__ Hot Equipment or process _____	__ Other_____
__ Biological agents_____	__ Electrical Close clearance	__ Radioactivity	_____
__ Chemical and jet clearing	__ Fall prevention	__ Tightening joints under Pressure	_____
__ Disconnect and blank	__ Hazardous materials from drains, sumps	__ Welding fumes and heat	_____

3. SAFETY PREPARATIONS

Personal Safety
__ Protect against _____ by _____

__ Fresh air blower	__ Rubber boots
__ Fresh air mask	__ Ear Protection
__ Escape air pack	__ Other barrier Clothing
__ Dust respirator	__ Evacuation instructions
__ Coveralls	__ Two escape routes
__ Safety Shower	__ Lifeline harness
__ Acid suit	__ Chemically resistant lifeline
__ Acid hood	__ Lifeline belt/wristlets
__ Face shield	__ Fire Alarm box
__ Chemical goggles	__ Escape ladders
__ Rubber gloves	__ Mechanical extraction device

Space Preparation
__ Isolate
__ Lockout/tag out
__ Disconnect and blank
__ Post work signs
__ Rope off work area
__ Erect barricade
__ Block roadway
__ Protect against external hazards

Electrical Precautions
__ Lock out circuits
__ Pull fuses

Equipment Cleaning and Draining
__ Steam_____
__ Fill and drain_____
__ Remove deposit_____
__ Visual Inspection_____
__ Neutralize contents_____

Fire Safety
__ Specify fire watch in "Remarks"
__ Area alarm no._____
__ Fire hose laid out
__ Water hose running

Communications: __ Telephone __ Radio __ Other __ Location/type of additional assistance (third alternate) _____ Remarks _____ __	__ Spark containers and shields __ Welding arc protection __ Ground fault interruption __ Proper grounding	__ Keep area wet __ Cover sewer openings __ CO2 Extinguisher __ Dry powder extinguisher __ Other_____

4. Any other Observations:

_____

Person carrying out the test Name: _____Sign: _____

5. CHECKLIST	**Items to be checked by Area in-charge before confined space entry can proceed**			
1.	a. The above equipment has been isolated from all sources of dangerous liquid gases and fumes by Insertion of spades by removing a section of pipe work and blanking open end of the circuit	**Yes**	**No**	**NA**
1	b. Equipment has been isolated from all sources of electrical and mechanical power			
	Equipment free of all dangerous materials. All flushing /inert gas purging completes, all liquid drained and ventilation atmosphere restored in confined space			
	Equipment surrounding area checked and safe from hazard arising from other work/operation			
	Lifeline, breathing apparatus and resuscitation equipment available			
	Adequate access and escape routes are provided			
	Fresh air supply equipment installed and operational. vessel sufficiently cooled for access			
	Procedure and rescue plans formulated and discussed with permit holder, personnel entering vessel and stand by personal. vacation exercise conducted where stated as required on permit			
	Stand by personal appointed			
	Fire Extinguishers / Fire Hydrant line available?			
	All persons engaged for working provided required training?			

Name of the area in-charge: _____ Sign: _____ Date: _____
Time:_____

6. GAS TESTING

RESULT OF TEST	**GAS**	**LIMIT**	**RESULTS**
	OXYGEN	19.5-23.5% VOL	%
	HYDROCARBONS	0% LEL for Hot work	%
	CO	50 PPM (0.005%)	PPM
	NH3	25 PPM	PPM
	TEMPERATURE		°C
	DUST	10mg/Cu.M	mg/Cu.M
	Any other fumes		

Confined Space Tested (Please refer to the Confined Space Standard for further details on testing values.)
I have tested this space for the above gases, with the results shown.
GAS TESTER: Name_____ Signature_____ Date_____
Time_____

7. TEST HAVE BEEN CARRIED OUT IN THE ABOVE-MENTIONED CONFINED SPACE AND ENTRY IS PERMITTED AS INDICATED BELOW.
Recommendation for Periodic Checking _____ minutes/Hrs (Subsequent gas testing reports should be recorded)

Entry into the confined space is permitted with / Without Breathing Apparatus.

From Date_____ Time_____ Until Date_____ Time_____

Entry wearing Breathing Apparatus subject to the following conditions.

i. An observer should be positioned outside the confined space.

ii. Where practicable, each man is wearing belt or harness with lifeline attached and that the observer positioned outside is holding the free end of the lifeline and is capable of pulling out the men.

8. PERMIT APPLICANT	**9. PERMIT HOLDER**
I understand all the above safety precautions. I will ensure that work only take place when all these safety precautions are complied with.	
Name: Sign: Date: Time:	Name: Sign: Date: Time:
PERMIT AUHTORISER: **I certify that the above results indicate that the confined space covered by this certificate is safe to enter.** **NAME: SIGN: DATE: TIME**	

RETURN OF PERMIT TO WORK

The work planned inside the confined space is completed / incomplete / not taken up. The confined space and the equipment therein are left in safe condition. The permit to work Permit No: _____ issued based on this certificate should be closed.

PERMIT APPLICANT	**PERMIT HOLDER**	**PERMIT AUTHORISER**
Name:	**Name:**	**Name:**
Sign:	**Sign:**	**Sign:**
Date: Time:	**Date: Time:**	**Date: Time:**

ANNEXURE-5 ROLES AND RESPONSIBILITIES

Confined Space Entry Supervisor/ Permit Applicant:

- Oversee the entire confined space entry process, including planning and coordination of entry activities.
- Ensure that all necessary permits and documentation are in order prior to entry.
- Conduct thorough hazard assessments and implement controls to mitigate risks.
- Ensure all team members are trained and qualified for their roles in the entry job.
- Maintain clear communication with all team members and supervise the entry process.
- Coordinate emergency plans and procedures, including rescue plans and resources.
- Monitor and enforce adherence to safety protocols, permits, and entry conditions.
- Cancel work permits and terminate confined space entry activities if necessary, ensuring safety.

Entrant:

- Follow all safety procedures, work instructions, and permit conditions.
- Wear appropriate PPE for the specific hazards in the confined space.
- Maintain awareness of the work environment and promptly communicate any changes in conditions to the attendant.
- Exit the confined space immediately if instructed or if any hazards arise.

Standby Person/ Attendant:

- Always maintain visual or verbal communication with the entrant and monitor their safety and work environment.
- Be prepared to initiate emergency response procedures, including summoning help if necessary.
- Prevent unauthorized entry into the confined space.
- Alert entrants to potential hazards and assist them in exiting the space if necessary.

Permit Authorizer:

- Evaluate the confined space and entry conditions to determine if a permit is required.
- Issue permits and ensure all safety measures and precautions are in place.
- Verify proper atmosphere testing and other safety checks before issuing the permit.
- Monitor entry conditions and make necessary updates to permits as conditions change.

Rescue Team:

- Be on standby and prepared for immediate response in case of an emergency.
- Maintain knowledge and skills in confined space rescue techniques and equipment.
- Work closely with the Confined Space Entry Supervisor to coordinate rescue efforts seamlessly.
- Participate in regular drills to stay familiar with the specific confined space and rescue procedures.

Safety Officer:

- Provide guidance on safety protocols and regulations specific to confined space entry.
- Conduct safety training and ensure compliance with safety standards.
- Investigate any incidents that occur and recommend corrective actions.

ANNEXURE-6: ADDITIONAL RECOMMENDATIONS FOR THE CONDUCT OF HOT WORK IN CONFINED SPACES

Information should be provided on the possibility of hot work reducing the oxygen level and that hot work itself may release hazardous substances.

PERMITS

Hot work inside or on the external surfaces of an occupied confined space should not begin until a hot work permit is issued. This permit may be included as part of the confined space entry permit. The hot work permit should confirm that all necessary safety precautions have been taken and specify the frequency of any required testing to maintain safe conditions.

(a) When a confined space or a space adjacent thereto has contained a flammable liquid, vapour, or gas, in addition to the requirements, the permit should be issued only after inspection and testing have ensured that the following factors have been considered:

- The concentration of flammable vapours or gases in the atmosphere.
- The liquid and solid residues have been removed as necessary to prevent the release of flammable substances that will raise the concentration of flammable substances in the atmosphere.
- The concentration of flammable vapour or gas within any piping within the confined space or connected to it.

(b) In a confined space having last contained dry material that creates an explosive atmosphere when dispersed in air, the permit should be issued only after inspection has ensured that loose dust has been removed from the confined space and all appropriate surfaces have been cleaned or the material has been rendered safe.

(c) Where fixed fire-extinguishing equipment employing an extinguishant which may affect the safety of the environment protects the confined space; such equipment should be positively isolated when the space is occupied, regardless of whether it has manual or automatic activation controls. It should be noted that the discharge of certain fixed extinguishing systems can rapidly cause the atmosphere in a confined space to become dangerous to life. In such cases, alternative fire protection should be provided in the confined space by adequate numbers of the appropriate size and type of portable fire extinguishers.

FIRE PREVENTION

(a) Remove all combustibles near the hot work to a safe location. If removal isn't possible, cover items with a non-combustible blanket or flame-resistant tarpaulin to prevent ignition from heat, sparks, or slag.

(b) Consider assigning a fire watch during hot work and for at least 30 minutes after completion. The fire watch may be performed by the stand-by employee(s).

(c) When welding or cutting a tank shell or conductive boundary, take the same safety precautions both inside and outside the space to avoid explosion or fire hazards from sparks or heat transfer.

(d) Before starting hot work on a surface with a preservative or protective coating, evaluate the flammability and thermal decomposition products. Remove flammable coatings from the hot work area to prevent ignition. Have a pressurized fire hose or other suitable extinguishing equipment available.

(e) When arc welding is paused for a substantial period, such as during breaks or overnight, de-energize the power source, remove electrodes from holders, and secure holders to prevent accidental contact or arcing.

(f) When gas welding or cutting is paused for a substantial period, such as during breaks or overnight, close torch and cylinder valves. If possible, remove and depressurize the torch and hose outside the confined space.

(g) Avoid placing compressed gas cylinders or associated manifolds inside the confined space, except for those used for self-contained breathing apparatus.

(h) If possible, remove flammable metal anti-corrosion anodes from the worksite.

CONTROL OF FUMES

(a) Test the atmosphere in the confined space before starting hot work on coated metal surfaces to ensure the concentration of flammable vapours, dust, or gases from coatings with flashpoints below ambient temperature and does not exceed LEL safety limits. Conduct periodic atmospheric tests during hot work to maintain these limits.

(b) Strip coatings that decompose or volatilize into toxic, corrosive, or irritant components under heat from the hot work area. Remove coatings from a sufficient distance around the hot work area to minimize temperature increases in unstripped metal. Cooling surrounding metal may be necessary to limit the area requiring cleaning.

(c) Provide a means to exhaust contaminated air from the confined space, positioning the exhaust suction point as close as possible to the source of contamination (e.g., welding). Direct the exhaust to a location where it poses no hazard and is not recirculated back into the confined space.

ANNEXURE-7: LIST OF PERSONS ENTERING THE CONFINED SPACE

Date: _____

Plant: _____ **Equipment Tag No.: _____**
Area: _____ **Permit No.: _____**

Details of Trained Person entering in the confined space:

No.	Name of Trained Person entering in the confined space	Gate pass No.	In Time	Sign of Person entering	Out Time	Sign of Person coming out
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						

Name of the Stand-by Person: _____

Signature: _____

18. REFERENCES

References Document	Full Title, Brief Description and Web Links
1. 29 CFR Part 1926 Subpart AA, Occupational Safety and Health Administration, Department of Labor	Confined Spaces in Construction
2. Occupational Safety and Health Standards, Standard Number: 1910.146 1926.1200	Permit-required confined spaces 1910.146 - Permit-required confined spaces | Occupational Safety and Health Administration (osha.gov) 1926.1200 - Reserved | Occupational Safety and Health Administration (osha.gov)
3. CCOHS	Confined Space
4. Work Health and Safety Queensland	Confined spaces, Code of practice 2021
5. WorkSafe Australia National Standard	Safe working in a confined space, AS 2865 – 1995
6. Health and Safety Executive	Confined spaces
7. UK Labour Department	Code of Practice for Safety and Health at Work in Confined Spaces (labour.gov.hk)
8. International Standard • ISO 24510:2007 • ISO 13935-2:2014 • ISO 13854:2017 • ISO 14122 series • ISO 14122-2:2016 • ISO 14122-3:2016 • ISO 14122-4:2016 • ISO 16069:2004 • ISO 20421:2007	"ISO 24510:2007 - Ships and marine technology - Breathing apparatus for ships - Self-contained breathing apparatus (with a maximum working pressure of up to 30 MPa) for firefighters - Requirements, testing, and marking of sets" ISO 24510:2007 - Activities relating to drinking water and wastewater services — Guidelines for the (iteh.ai) "ISO 13935-2:2014 - Textiles - Seam tensile properties of fabrics and made-up textile articles - Part 2: Determination of maximum force to seam rupture using the grab method" EN ISO 13935-2:2014 - Textiles - Seam tensile properties of fabrics and made-up textile articles - (iteh.ai) "ISO 13854:2017 - Safety of machinery - Minimum gaps to avoid crushing of parts of the human body" ISO 13854:2017 - Safety of machinery — Minimum gaps to avoid crushing of parts of the human body (iteh.ai) The ISO 14122 series consists of multiple parts, each focusing on different aspects of permanent means of access to machinery. For example: ISO 14122-1:2016 - "Safety of machinery - Permanent means of access to machinery - Part 1: Choice of fixed means and general requirements of access" "Safety of machinery - Permanent means of access to machinery - Part 2: Working platforms and walkways" "Safety of machinery - Permanent means of access to machinery - Part 3: Stairs, stepladders, and guardrails" "Safety of machinery - Permanent means of access to machinery - Part 4: Fixed ladders" EN ISO 14122-1:2016 - Safety of machinery - Permanent means of access to machinery - Part 1: Choice (iteh.ai)

References Document	Full Title, Brief Description and Web Links
	"ISO 16069:2004 - Mobile and self-propelled cranes - Safety - Requirements for tower cranes" ISO 16069:2004 - Graphical symbols — Safety signs — Safety way guidance systems (SWGS) (iteh.ai) "ISO 20421:2007 - Gas cylinders - Refillable welded steel cylinders for liquified petroleum gas (LPG) - Design and construction" ISO 20421-1:2006 - Cryogenic vessels — Large transportable vacuum-insulated vessels — Part 1: (iteh.ai)
9. National Institute for Occupational Safety & Health Number 80-106	Working in Confined Spaces (80-106) | NIOSH | CDC
10. European Legislation • Directive 89/391/EEC • Directive 92/57/EEC • Directive 2009/104/EC • Directive 2014/27/EU • Directive 92/91/EEC • Directive 92/104/EEC • Directive 2014/68/EU (Pressure Equipment Directive)	**Directive 89/391/EEC**: This directive lays down the general principles of occupational health and safety and requires employers to ensure the safety and health of workers in every aspect related to work. **Directive 92/57/EEC**: This directive concerns the implementation of minimum safety and health requirements at temporary or mobile construction sites. It includes provisions for ensuring safe work in confined spaces within construction sites. **Directive 2009/104/EC**: This directive focuses on minimum safety and health requirements for the use of work equipment by workers at work. It includes provisions relevant to equipment used in confined spaces. **Directive 2014/27/EU**: This directive amends Directive 2009/104/EC concerning work equipment, and specifically includes additional requirements for machinery and equipment used in potentially explosive atmospheres, which could apply to confined spaces where explosive gases or dust may be present. **Directive 92/91/EEC**: Related to health and safety of workers in industries extractives for drilling. **Directive 92/104/EEC:** Related to health and safety of workers in open pit or underground mining industries. **Directive 2014/68/EU (Pressure Equipment Directive)**: While not specific to confined spaces, this directive sets out the requirements for the design, manufacture, and conformity assessment of pressure equipment. It may be relevant in cases where confined spaces involve pressure vessels or systems
11. European Standard • EN 15614-1:2007 • EN 14593-1:2005 • EN 14593-2:2005 • EN 15011:2005 • EN 689:2018 • EN ISO 14122-4:2016 • EN 12021:2014 • EN 13794:2002 • EN 136:1998 • EN 138:1994	"EN 15614-1:2007 - Equipment for use in the detection and measurement of combustible gases in the range 0 to 100% LEL - Part 1: General considerations and performance requirements" EN 15614:2007 - Protective clothing for firefighters - Laboratory test methods and performance (iteh.ai) "EN 14593-1:2005 - Respiratory protective devices. Compressed air line breathing apparatus with demand valve. Devices with a full-face mask - Requirements, testing, marking" EN 14593-1:2005 - Respiratory protective devices - Compressed air line breathing apparatus with (iteh.ai) "EN 14593-2:2005 - Respiratory protective devices. Compressed air line breathing apparatus with demand valve. Devices with a half mask, mouthpiece or mouth mask - Requirements, testing, marking"

References Document	Full Title, Brief Description and Web Links
• EN 140:1998 • EN 141:1990	EN 14593-2:2005 - Respiratory protective devices - Compressed air line breathing apparatus with (iteh.ai) "EN 15011:2005 - Respiratory equipment. Air quality for respiratory protective devices. A test based on toxic gas removal" EN 15011 - Cranes - Bridge and gantry cranes (iteh.ai) "EN 689:2018 - Workplace exposure - Measurement of exposure by inhalation to chemical agents - Strategy for testing compliance with occupational exposure limit values" EN 689:2018 - Workplace exposure - Measurement of exposure by inhalation to chemical agents - (iteh.ai) "EN ISO 14122-4:2016 - Safety of machinery - Permanent means of access to machinery - Part 4: Fixed ladders" SIST EN ISO 14122-4:2016 - Safety of machinery - Permanent means of access to machinery - Part 4: (iteh.ai) "EN 12021:2014 - Respiratory equipment Compressed gases for breathing apparatus" EN 12021:2014 - Respiratory equipment - Compressed gases for breathing apparatus (iteh.ai) "EN 13794:2002 - Respiratory protective devices - Half masks without inhalation valves and with separable filters to protect against gases or gases and particles or particles only - Requirements, testing, marking" EN 13794:2002 - Respiratory protective devices - Self-contained closed-circuit breathing apparatus (iteh.ai) "EN 136:1998 - Respiratory protective devices - Full face masks - Requirements, testing, marking" EN 136:1998 - Respiratory protective devices - Full face masks - Requirements, testing, marking (iteh.ai) "EN 138:1994 - Respiratory protective devices - Fresh air hose breathing apparatus for use with full face mask, half mask or mouthpiece assembly - Requirements, testing, marking" EN 138:1994 - Respiratory protective devices - Fresh air hose breathing apparatus for use with full (iteh.ai) "EN 140:1998 - Respiratory protective devices - Half masks and quarter masks - Requirements, testing, marking" EN 140:1998 - Respiratory protective devices - Half masks and quarter masks - Requirements, testing, (iteh.ai) "EN 141:1990 - Respiratory protective devices - Fresh air hose breathing apparatus for use with full face mask, half mask or mouthpiece assembly - Requirements, testing, marking" EN 141:1990 - Respiratory protective devices - Gas filters and combined filters - Requirements, (iteh.ai)

JSW Group

MANAGEMENT STANDARD
LOCKOUT AND TAGOUT
JSW/GHS/GS-07

MANAGEMENT STANDARD LOCKOUT AND TAGOUT

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Document	JSW/GHS/GS-07	**Revision**	01

Document Issue and Revision History		
Date	Revision Number	Change Summary
10.12.2024	01	• 9.4.9.5. Energy Isolation of Railway Tracks added. • PTW Holder Role added. • Cross-references have been included. • Removal of lock, approval changed from business head to site head. • Added Key Performance Indicators

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1. PURPOSE

The Lockout and Tagout Standard (hereinafter referred to as 'STANDARD') provides a framework to prevent exposure to hazardous energy while undertaking servicing, inspection, and maintenance activities. The objective is to ensure that all energy sources from equipment and machinery are properly isolated from processes, fluids, or gas streams.

This standard outline the essential practices and procedures to isolate machinery or equipment, preventing the discharge of hazardous energy during servicing, inspection, and maintenance activities. Energy isolation and the control of hazardous energy should be implemented before conducting any activity on live systems or components where unexpected energy release could occur. Controlling hazardous energy is fundamental for the safety of personnel working on equipment requiring isolation. Implementing a Lockout/Tagout (LOTO) program is crucial to protect personnel from the sudden release of hazardous energy. Hazardous energy includes electrical, mechanical, hydraulic, pneumatic, chemical, thermal, radiation, stored potential, and other energy sources. Servicing, inspection, and maintenance activities encompass erecting, installing, constructing, overhauling, adjusting, inspecting, clearing machinery jams, troubleshooting, assessing, cleaning, and dismantling machines, equipment, or processes. "Equipment" refers to both fixed and mobile machines.

2. SCOPE

This Standard applies to all JSW Companies, subsidiaries, managed sites, corporate offices, research and development facilities, as well as new projects and newly merged and acquired entities. The requirements outlined here apply to all JSW company employees, contractors, and third-party personnel and shall remain applicable throughout the entire lifecycle of any establishment, including offices, manufacturing sites, and project sites where servicing, inspection, and maintenance activities are conducted.

The Standard applies to all energy isolation, process isolation, fluid stream isolation, and locking requirements for work performed on fixed plant equipment, machinery, and mobile equipment within JSW Group premises, along with the respective responsibilities of stakeholders.

In the Standard, the following verbal forms are used to indicate requirements, recommendations, permissions, or capabilities:

- "shall" indicates a requirement.
- "should" indicates a recommendation.
- "may" indicates a permission.
- "can" indicates a possibility or capability.

3. REVIEW

The Standard shall be reviewed at least every 5 years or when a serious incident or high potential near miss is recorded. The review shall include the evaluation of the following:

- Comprehensive survey record to identify equipment and machines that need to be covered under LOTO program.
- Risk assessments conducted task by task, or through job safety analysis, method statements, or HAZID methodology, with particular attention to changes in exposed personnel.
- Availability of number of lock and tag.
- Introduction of new machines, equipment or processes.
- Review of new machines, equipment or processes to ensure if they are fitted with proper means to isolate them from all energy sources.
- New layouts or schemes for isolation points.
- Need for modifications and review of equipment specific isolation procedures.
- Action plan to implement LOTO for all source of hazardous energy.
- Training Records.
- Work permits issued.
- Results of previous audits on LOTO Program.
- Changes to industry standards, laws, and regulations.

4. PROCESS FLOW

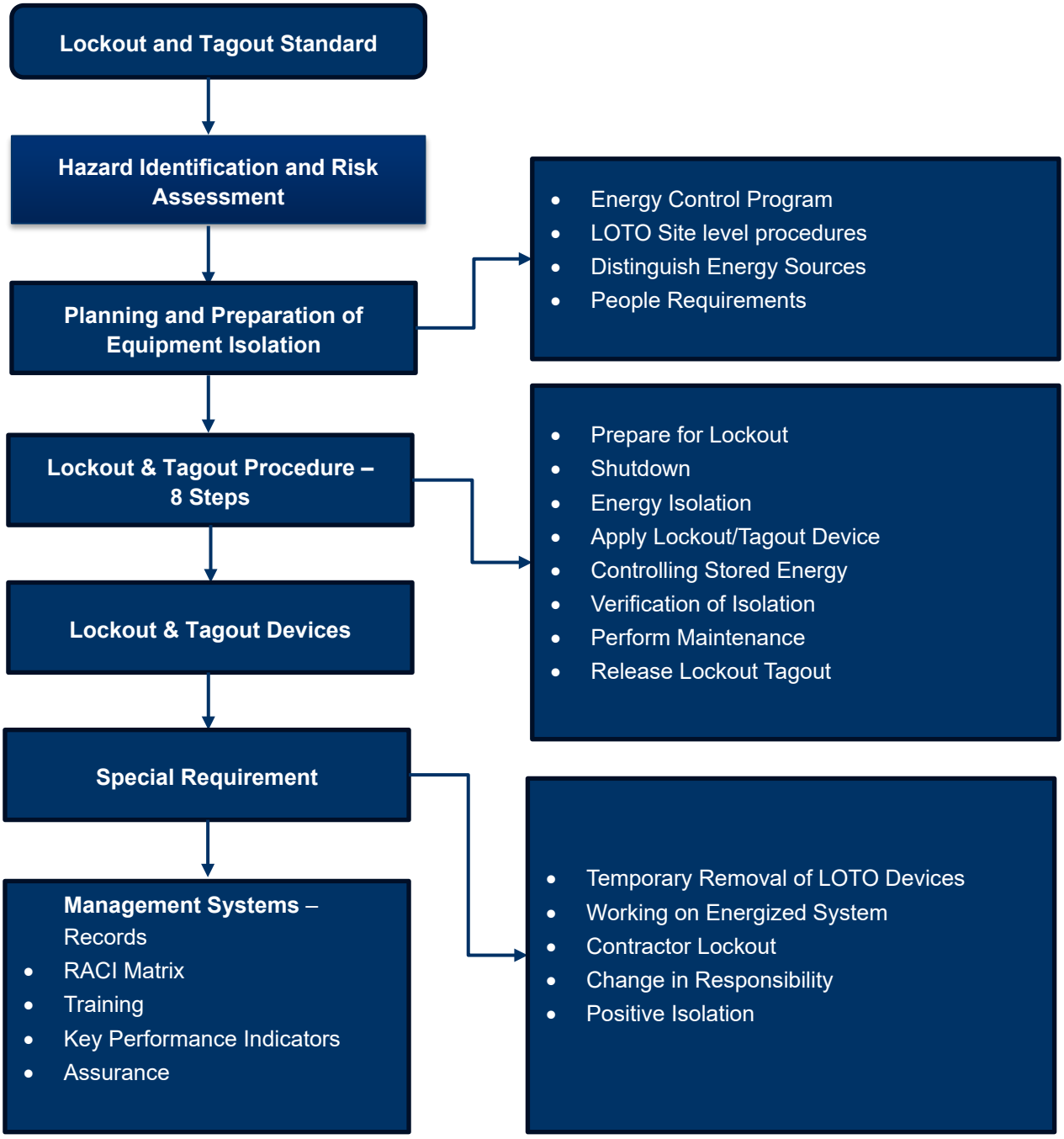


Figure -1 : Process Flow LOTO Standard

5. HAZARD IDENTIFICATION, RISK ASSESSMENT

5.1 HAZARD IDENTIFICATION

Types and sources of hazardous energy should be identified, classified, and addressed appropriately. The identification of hazards associated with performing an activity, those present in a facility, or those in an area where the possibility of exposure to hazardous energy exists, is referred to as Hazard Identification/Analysis. Once the specific risks associated with the worksite are identified, appropriate preventive and protective actions should be determined by site management during the risk assessment process.

Examples of hazardous source of energy are, but are not limited to following:

Table-1 : Types of Hazardous Energies

Type of Energy	Examples
Chemical	Liquids, such as gasoline, diesel, benzene, acids, and caustics; Gases, such as propane, natural gas, and methane. Solids, such as fertilizer, wet and dry cell batteries, and combustible dust.
Electrical	Alternating (AC) and direct (DC) currents, includes equipment and conductors at both household and industrial-voltages, photovoltaic systems, circuit breakers, transformers, capacitors, inverters, motors, and hybrid vehicles.
Gravitational/Potential	Objects such a hoisted vehicle, raised dumpster lids, objects supported by a crane, and elevated dump truck beds.
Hydraulic	Pressurized hydraulic systems, including hoses, pumps, valves, actuators, and reservoirs such as those on a forklift, in an automotive vehicle hoist, power press equipment, or an injection molding machine.
Mechanical	Sources such as a breeze rotating a wind turbine, water moving a paddle wheel, vehicle/mobile equipment movement, and a spring under compression. Extreme sound is also a hazardous mechanical energy.
Pneumatic	Pressurized air or gas systems, including pipes, pumps, valves, actuators, and pressure vessels such as those found in coating or pesticide sprayers, air compressors, and tank and pipe purging systems.
Radiation	Visible light, infrared, microwave, ultraviolet, and X-rays. Non-ionizing radiation includes lasers, Radio Frequency (RF), and microwave (MW). Ionizing radiation includes Computed Tomography (CT) and X-rays.
Thermal	Hot water, heated oil, steam, and equipment need time to cool, while liquefied gases, such as nitrogen, need time to warm to safe thermal levels.

5.2 RISK ASSESSMENT

When a potential hazard is identified, the relevant permit recipient is responsible for ensuring that a risk assessment is conducted by a competent person. This assessment should determine the hazards and risks associated with the activity and apply control measures to reduce the risk to an acceptable level before proceeding with the work.

The Risk Assessment shall be carried out in accordance with JSW Risk Management Standard (JSW/GHS/GS/17) and shall consider but not limited to, the following factors:

- The nature of work to be done.
- Timing of work (day or night)
- Environmental Conditions.
- Types of energy involved.
- Training & competence of personnel.
- The range of methods by which work can be done.
- The equipment used to perform the work, to isolate all hazardous energy and to test if residual energies are still present.

- The hazards involved and the associated risks.
- The method selected for effective isolation.
- PPE's to be used and its effectiveness.
- Abnormal Situations (Non-Routine), if any.

6. PLANNING AND PREPARATION OF EQUIPMENT ISOLATION

6.1 LOCKOUT AND TAGOUT PROGRAM REQUIREMENTS

- All JSW sites should develop a documented Lockout and Tagout (LOTO) program to ensure the safety of personnel during servicing or maintenance of machinery and equipment.
- This program should prevent unexpected energization, startup, or release of hazardous energy, ensuring isolation points are:
  - Clearly identified.
  - Lockable to prevent accidental reconnection.
  - Accessible for operators to confirm the energy remains cut off during maintenance activities (e.g., de-jamming, cleaning, or servicing).

6.2 ISOLATION OF PLUGGED MACHINERY

For machinery connected via plugs:

- Plug removal is sufficient if the operator can verify that it remains disconnected and under exclusive control.
- In cases where verification is not possible, a blocking device should be used to prevent accidental insertion.

6.3 ENERGY DISSIPATION

- After isolating energy, any residual energy in the machinery or circuits should be safely dissipated.
- Methods of dissipation should align with the machine's operating instructions or standard risk assessments, ensuring no harm to operators or others.

6.4 SPECIAL CASES FOR ENERGY CONNECTION

In some cases, certain circuits may remain energized for specific functions (e.g., holding parts in place or lighting).

For these situations:

- Additional safety steps should be documented in site-specific work instructions.
- Risk assessments should detail how operator safety will be maintained.

6.5 RISK ASSESSMENT AND PROCEDURE DEVELOPMENT

Before commencing any activity involving live systems or components:

- A Task Risk Assessment or Job Safety Analysis should identify associated hazards.
- Based on the assessment, LOTO procedures should be developed, including detailed isolation, verification, and re-energization steps.

6.6 EQUIPMENT SPECIFIC ISOLATION PROCEDURE

Each piece of equipment should have specific procedures for de-energization, isolation, and re-energization. These should include:

Isolation diagrams, equipment isolation procedures, P&IDs, process flow/line diagrams, and/or photographs.

A detailed plan covering all energy sources involved.

The procedure should document:

Equipment Details:

- Equipment control authority.
- Operator-specific training requirements.
- Equipment number, location, and layout or circuit schemes.

Energy Source Identification:

- Types of energy (e.g., electrical, hydraulic, pneumatic).
- Proper LOTO devices for isolating each source.

Energy Dissipation:

- Identification of residual energy.
- Steps for safe dissipation.

Verification Steps:

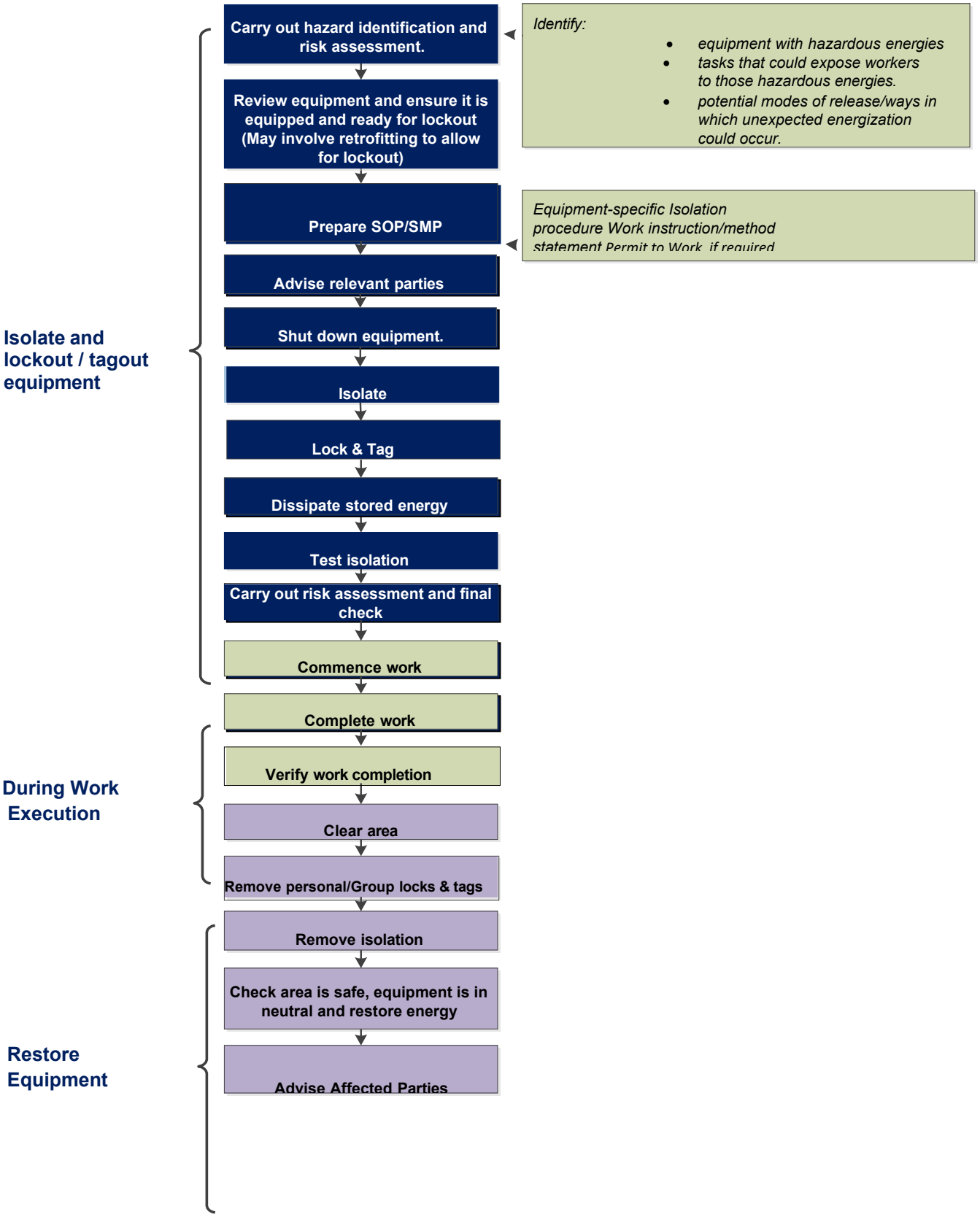
- Tools and methods to verify successful isolation.
- Practices to confirm that no residual energy remains.

Restart and Post-Isolation Checks:

- Steps to attempt machine restart to ensure isolation.
- Final inspections to ensure safety during re-energization.

These isolation procedures should integrate into site-specific LOTO instructions, detailing steps to secure machinery during servicing or maintenance.

6.8 ENERGY CONTROL PROGRAM



6.9 TYPE OF LOCKOUT TAGOUT

Three types of Lockout Tagout are identified as follows:

6.9.1 Electrical Lockout Tagout

Electrical Lockout Tagout will be performed either in the electrical MCC rooms or at field isolation points, following the Electrical Safety standard (JSW/GHS/GS-11) when working with equipment. This typically includes locking out and tagging out breakers, control circuit switches, fuses, and racking out switchgear.

6.9.2 Mechanical Lockout Tagout

Mechanical Lockout Tagout includes:

- Closing of manual valves for pneumatic and hydraulic circuits, as well as lube oil circuits.
- Providing physical blinding for process-related gas piping by opening and closing a pair of flanges after installing a solid blind in between.

6.9.3 Operational Lockout Tagout

Operational Lockout Tagout involves:

- Procedures and controls for ensuring safety during operational activities.
- Incorporating mechanical methods, such as those outlined in Mechanical Lockout Tagout, for hydraulic and pneumatic systems.

6.10 PEOPLE'S REQUIREMENTS

Each site shall identify the authorized persons, hereinafter referred to as Isolation Officers, for every type of job. An authorized person is an employee who has been specifically trained in the Lock-Out/Tag-Out (LOTO) procedure and equipment-specific LOTO working instructions for a specific kind or set of hazardous energies, and whose job requires working with machinery and equipment that could release hazardous energy. Only these persons shall be authorized to perform energy isolation for the job.

Criteria for Authorization:

- The list of Isolation Officers shall be approved by the Head of the Department, and a written record shall be kept in the department.
- Employees who have been trained in the LOTO procedure and whose jobs require working with machinery and equipment that could release hazardous energy are authorized and expected to:
    - Notify the workplace supervisor and any other affected person before locking or tagging out equipment and follow the appropriate LOTO procedures.
    - Report any deviations from the LOTO procedure to their immediate job supervisor.
    - Comply with all requirements of the LOTO program and any site-specific energy isolation procedure, or LOTO procedures and associated site Permit to Work system.

While identifying the Isolation Officer, the Head of the Department shall follow these guidelines:

- The person should meet any statutory requirements if required for conducting the job.
- The person should be appropriately trained, competent, and familiar with the concerned department.
- The complexity of isolation shall also be considered while granting authorization.

6.10.1 Isolation Officer (Authorized Person)

The Isolation Officer is responsible for ensuring that the LOTO procedures are properly followed to achieve a safe start/stop of machinery or equipment before any work begins. Their duties include the following:

Execution of LOTO Procedure: The Isolation Officer ensures that the LOTO procedure is executed according to the LOTO Standard. They should inform the Permit Authorizer when the equipment or plant has been taken out of service.

Application of Lock and Tag: The Isolation Officer is responsible for applying the first lock and tag, and it should be the last one removed. The Isolation Officer's lock should be a master series lock, as it remains on

the equipment when the responsibility is handed over to subsequent shifts or another Isolation Officer. The Isolation Officer retains custody of the key to all locks applied to the equipment.

Personal Lock for Single-Shift Jobs: For jobs that are completed within a single shift, and where the use of a master series lock is not appropriate, the Isolation Officer will apply their personal lock and identification tag.

Clearing the Area: After applying the lock and tag, the Isolation Officer is responsible for clearing the area of personnel before conducting a trial step to ensure the equipment or plant is properly isolated, the zero-energy state is achieved, and the isolation is verified.

Best Practice for Master Lock with HASP: To ensure that no conflicts occur when multiple permits are issued for the same equipment, the Isolation Officer should apply a master lock with HASP. This allows the application of new locks (for new permits) while ensuring that energy is not restored until all related permits are surrendered and the locks removed.

Authorization for Electrical Jobs:

- Isolation officer shall have three years of experience.
- The person shall have the SSC (Supervisory Competent Certificate) for the relevant voltage level for which they are being authorized. This is a statutory requirement.

In European countries, details for authorizing electric activities are included in local country regulations (e.g., Italian local requirements are based on technical regulation CEI 11-27:2021 that transposes the European Standard EN 50110-1).

6.10.2 Permit Authorizer

The Permit Authorizer is responsible for ensuring that all safety protocols are adhered to during the job execution and that isolations are properly managed. Their duties include:

Knowledge and Oversight: The Permit Authorizer should have thorough knowledge of the system or process and be aware of all possible hazards associated with the job.

Communication and Documentation: They should inform all relevant parties (such as affected agencies) that the equipment or plant will be taken out of service. The Permit Authorizer decides the number of isolations required for the specific Work Permit and is responsible for ensuring all isolations are completed by the Isolation Officers.

Effectiveness of Controls: The Permit Authorizer should confirm that the necessary safety controls (including those to prevent unauthorized access to the live work area) are in place.

Signing Off on the Permit: Once all isolations are complete, and the zero-energy state is verified, the Permit Authorizer signs off on the Work Permit and ensures all personnel have removed their locks before re-energizing the equipment or plant.

Please refer Permit to Work Standard JSW/GHS/GS-08 for more guidance.

6.10.3 Permit Applicant

The Permit Applicant plays a vital role in initiating the Permit to Work process and ensuring that LOTO procedures are correctly implemented:

LOTO Application: The Permit Applicant should take the Permit to Work and apply the LOTO over the Master Lock Box.

Visitor Safety: The Permit Applicant ensures the safety of visitors involved in the work by providing a Personal Lock if the visitor is directly involved in the job.

Execution of Isolation: The Permit Applicant is responsible for ensuring that the safe start/stop and execution of the job is in accordance with the established isolation procedures.

Lock Placement: The Permit Applicant ensures that all affected persons working under their direct supervision place their Personal Locks on the Site Lock Box and the same is documented in the Work Permit.

Please refer Permit to Work Standard JSW/GHS/GS-08 for more guidance.

6.10.4 Permit Holder

The Permit Holder is responsible for ensuring that all safety protocols, including LOTO and other associated safety measures, are followed throughout the job:

Overseeing Safety: The Permit Holder ensures that the work site is safe for the operations. They should verify that all safety measures, including the placement of personal locks on the lock box, are in place before any operations begin.

Visitor Safety: The Permit Holder oversees the safety of visitors by providing them with a Personal Lock if they are directly involved in the job.

Verification of Safety Measures: The Permit Holder should ensure that all required safety measures are documented in the Work Permit and are actively maintained throughout the job.

6.10.5 Competent Person

An employee who is responsible for ensuring there is a safe procedure recorded for all aspects of the Control of Hazardous Energy in the systems/areas for which they are responsible. It will be the responsibility of competent person to shut down, empty/drain and flush the machine or equipment so as to achieve zero energy state, this will either be through an established local procedure or referenced on a Permit to Work.

6.10.6 Affected Employees

Employees who operate the relevant machinery or whose jobs require them to be in an area where service or maintenance is performed shall be notified by the authorized person whenever a lock-out/tag-out application is applied or modified.

Registers/records of those authorized to carry out isolations (i.e., Authorized Persons/Isolation Officers) should be maintained, including equipment competencies, site/work area limitations, and competency durations.

It should be ensured that all contractors carrying out isolations or working on isolated equipment on behalf of JSW do so in accordance with the JSW Operation's LOTO Standard, that they are competent (through provision of written evidence of training, examination, etc.), and that they are appropriately supervised. If, however, it is agreed that the contractor may use their own LOTO procedures (for example, in a defined work area where no JSW personnel could be present), then this should be clearly communicated to all personnel who could be affected so that they understand and comply with the requirements.

6.10.7 Records and Contractor Compliance

Authorized Persons Record: Registers/records of those authorized to carry out isolations (i.e., Authorized Persons/Isolation Officers) should be maintained, including equipment competencies, site/work area limitations, and competency durations.

Contractor Compliance: Contractors performing isolations or working on isolated equipment should comply with JSW's LOTO Standard and demonstrate competency through documented training and supervision. If contractors use their own LOTO procedures, it should be clearly communicated to all affected personnel to ensure compliance with the safety requirements.

7. LOCKOUT TAGOUT PROCEDURE

The Lockout Tagout procedures for the implementation of energy control (the lockout or tagout procedures) shall cover the following elements and actions in recommended sequence:

7.1 STEP:1 - PREPARE FOR LOCKOUT

The first step in the lockout tagout procedure is preparing to shut down the equipment or machinery. The Person In-Charge (Generally Permit Authoriser) shall be responsible for preparation for Lockout and Tagout. Before shutting down, the authorized employee (s) should understand the following:

Responsibilities of Personnel: The Person In-Charge (typically the Permit Authorizer) should communicate specific duties and responsibilities to all involved personnel before starting the isolation process. This includes the Isolation Officers, workers performing maintenance, and anyone affected by the shutdown.

Sources of Energy and Isolation Points: A detailed identification of all energy sources should include electrical, mechanical, hydraulic, pneumatic, and thermal energy, specifying isolation points for each type. The **Annexure-2 reference (showing isolation points to be locked and tagged)** is helpful but should be specific and easily accessible to all personnel.

Competency: It's important to confirm that all personnel involved are competent to perform their specific tasks related to energy isolation. Competency should be defined, verified, and documented.

Permit Completion: Ensure that all required **Permits to Work (PTW)** are completed before proceeding, in accordance with the PTW standard (JSW/GHS/GS-08). This step should verify that proper safety documentation and approvals have been obtained.



Figure-2 : Prepare for Lockout.

Energy Source Identification: If multiple energy sources exist, the Person In-Charge should prepare an energy source identification sketch or diagram (process flow diagram) for better visualization. This ensures that all involved are aware of the potential energy sources and isolation points.

7.2 STEP:2 - SHUTDOWN

The machine or equipment shall be turned off or shut down as per the procedures established for the machine or equipment. An orderly shutdown should be carried out to avoid any additional or increased hazard(s) to employees because of the equipment stoppage.

Before an Authorized Employee turns off a machine, or a piece of equipment, the authorized person shall have knowledge of the type and magnitude of the energy, the associated hazards of the energy to be controlled,

and the method or means to control the energy according to both received training and the machinery or equipment or plant use and maintenance manual, or operating manual, or equivalent technical documentation.

Refer **Annexure 4: Shutdown Procedure Checklist**.

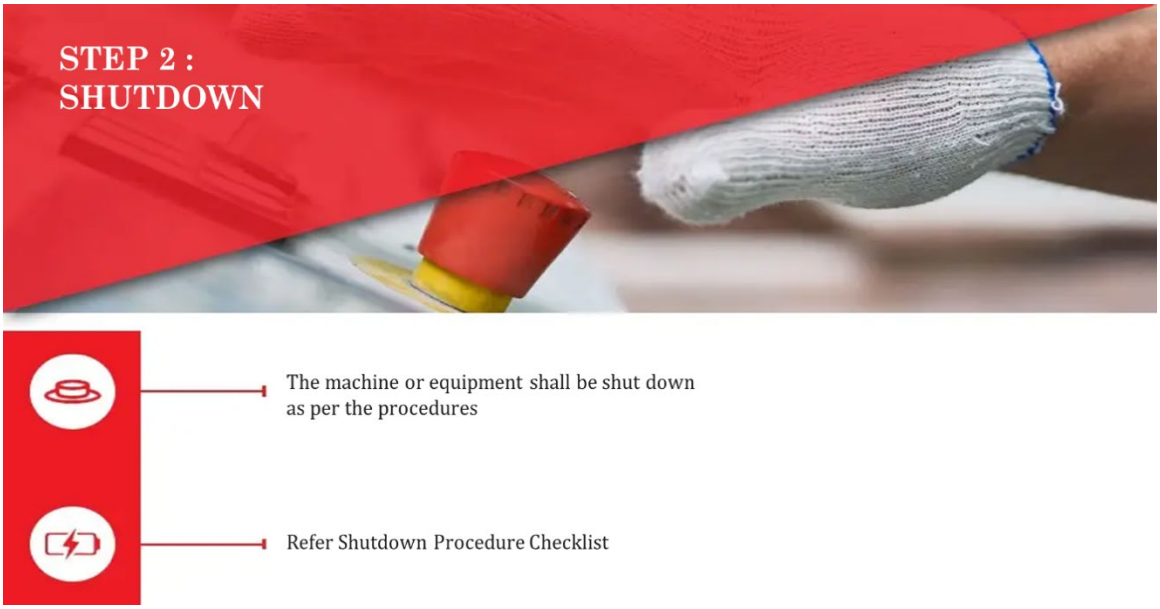


Figure-3 : Shutdown of Equipment/Machinery.

7.3 STEP:3- ENERGY ISOLATION

All energy isolating devices shall be sited and operated to entirely de-energize and isolate the equipment. Lockout or tagout devices shall be attached to each energy isolating device by authorized employee. If more than one authorized employee is involved, a team leader shall make sure that everyone has applied their individual Lockout and Tagout device. Lockout devices shall be attached to hold the energy isolating devices in a "safe" or "off" position.

Group lockout or tagout: When servicing and/or maintenance is performed by a crew, craft, department, or other group, they shall utilize a procedure which affords the employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device. Refer Section 8.5 for further details. Isolation shall be considered complete only when no associated control device can energize the equipment.



Figure-4 : Energy Isolation

7.4 STEP:4-APPLY LOCKOUT OR TAGOUT DEVICE

All authorized employees should apply a lockout device (e.g., a padlock) over each energy-isolating device to ensure that all hazardous energy sources cannot be restored unexpectedly or accidentally. Lockout devices should be durable and strong enough to prevent accidental removal.

Each lockout device shall be affixed with a durable tag to indicate the identity of the person applying the lockout. An improper dangerous tag is a tag that is placed with the intention of warning persons that the device is under isolation (and should not be operated/switched on) and that is subject to being inadvertently removed or not positioned to be clearly visible. Tags are essentially warning devices affixed to energy-isolating devices and do not provide the physical restraint on those devices (the safe restraint is provided by a lock only). Tags may evoke a false sense of security, and their meaning needs to be well understood through training of all employees involved in the LOTO program. International industry practices include requirements for tags:

- Tag attachment devices shall be of a non-reusable type, attachable by hand, self-locking, and have a non-releasable unlocking strength of 22 kg.
- Tags shall be at least 7.5 x 12.5 cm, constructed of durable plastic, have a means of attaching to equipment, and be designed to withstand adverse weather conditions and corrosive environments.
- The tag-out device shall state the identified equipment, isolation point, date, isolation certificate number, reason for lockout/tag-out, and the name or role of the person who is allowed to remove the tag-out device and associated lock-out device.
- Tags used without the installation of energy control devices do not belong to LOTO programs and are not acceptable for isolation.
- The tag serves as a warning that a work activity involving the machine is in progress and it should not be turned on under any circumstances.
- The tag shall warn against hazardous conditions if the machine or equipment is energized and shall include a message such as “Do Not Start,” “Do Not Close,” “Do Not Energize,” or “Do Not Operate.”
- Tags shall be securely attached to energy-isolating devices so that they cannot be inadvertently or accidentally detached during use.
- Tags shall be legible and understandable by all people whose work operations are or may be in the area to be effective.

Examples of Lockout Tagout/ Isolating Devices

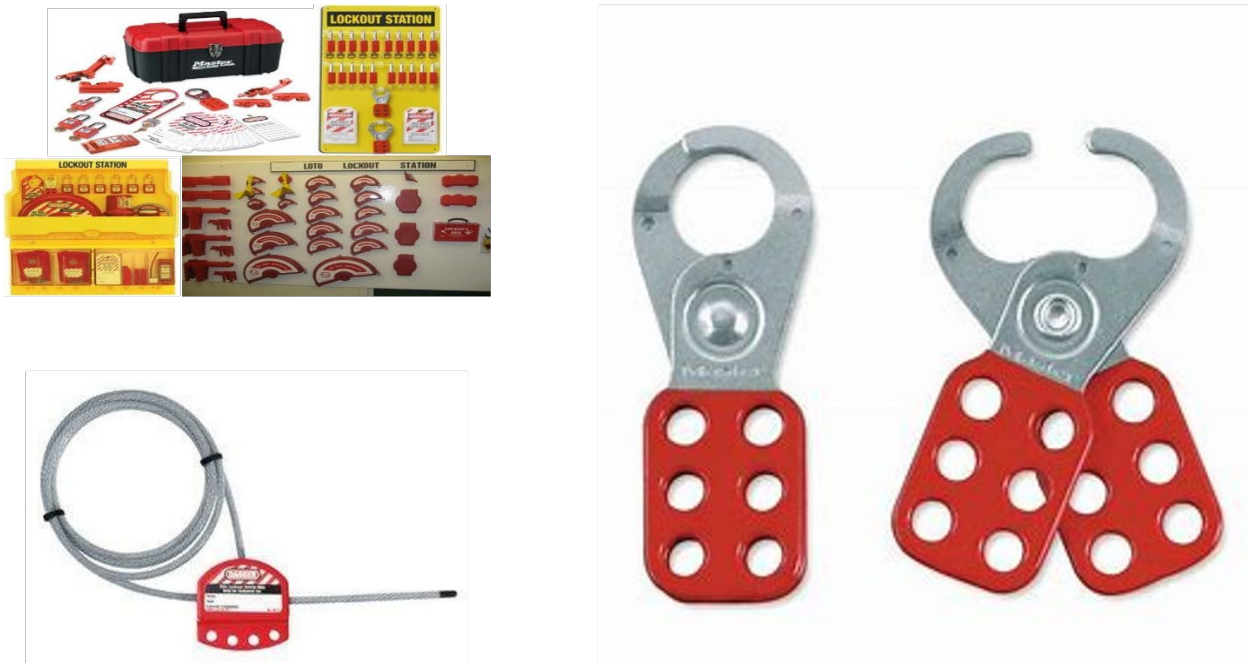


Figure-5 : Lockout Kit/Stations, Scissor Lock Devices/Hasp, Cable Lockout.



Figure-6 : Universal Wall Switch Lockout, Electrical Plug Lockout, Electrical/Pneumatic Lockout.

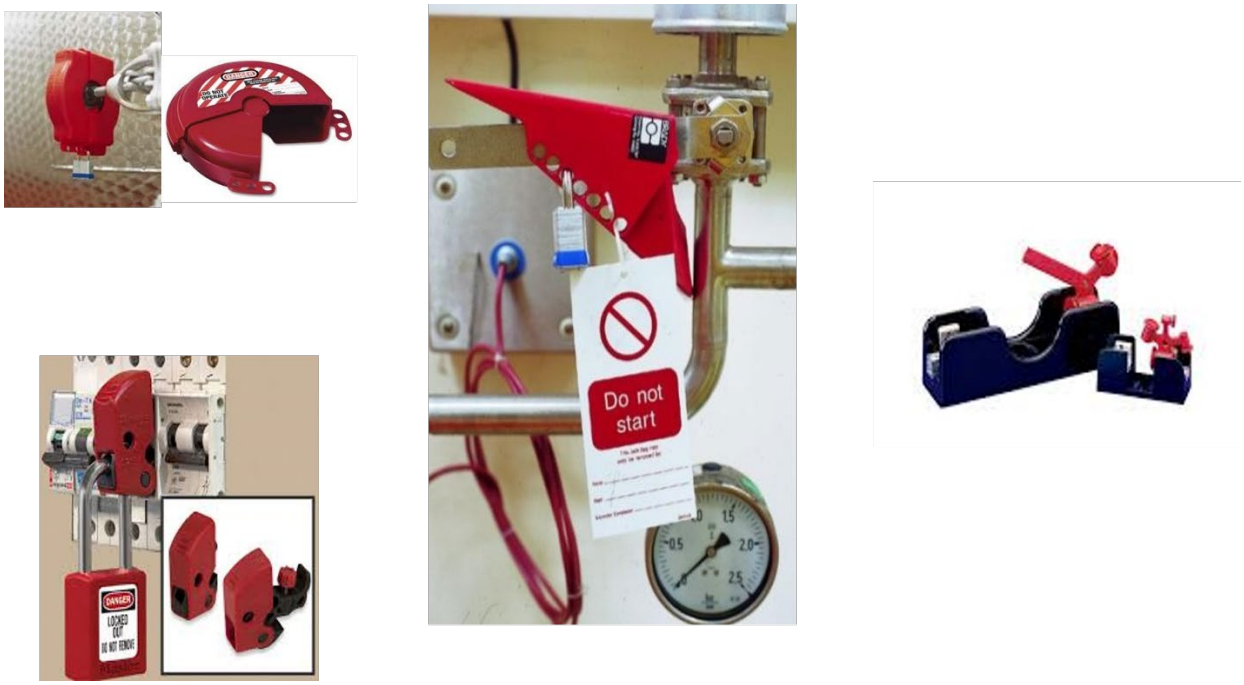


Figure-7 : Gate Valve Lockout, Ball Valve Lockout, Fuse Lockout, Circuit Breaker Lockout.

3″ x 5.5″



Figure-8 : Example of Caution/Danger Tags.

7.5 STEP:5 -CONTROLLING STORED ENERGY

Following the application of lockout and tagout devices to energy isolation points, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained, and otherwise rendered safe. Energy isolation is achieved when there is no energy left to be released, i.e., Zero Energy State (ZES).

Examples of safe practices for dissipating potential energy include:

- Drain pressurized fluids or gases until internal pressure reaches atmospheric levels.
- Discharge capacitors by grounding them.
- Double block and bleed process piping.
- Release or block tensioned springs.

- Ensure that all moving parts, such as flywheels and saw blades, have come to a complete stop.
- Allow equipment components to cool (or warm) to safe thermal levels.

If there is a possibility of re-accumulation of stored energy to a hazardous level, verification of isolation shall be continued until the servicing or maintenance is complete, or until the possibility of accumulation no longer exists.

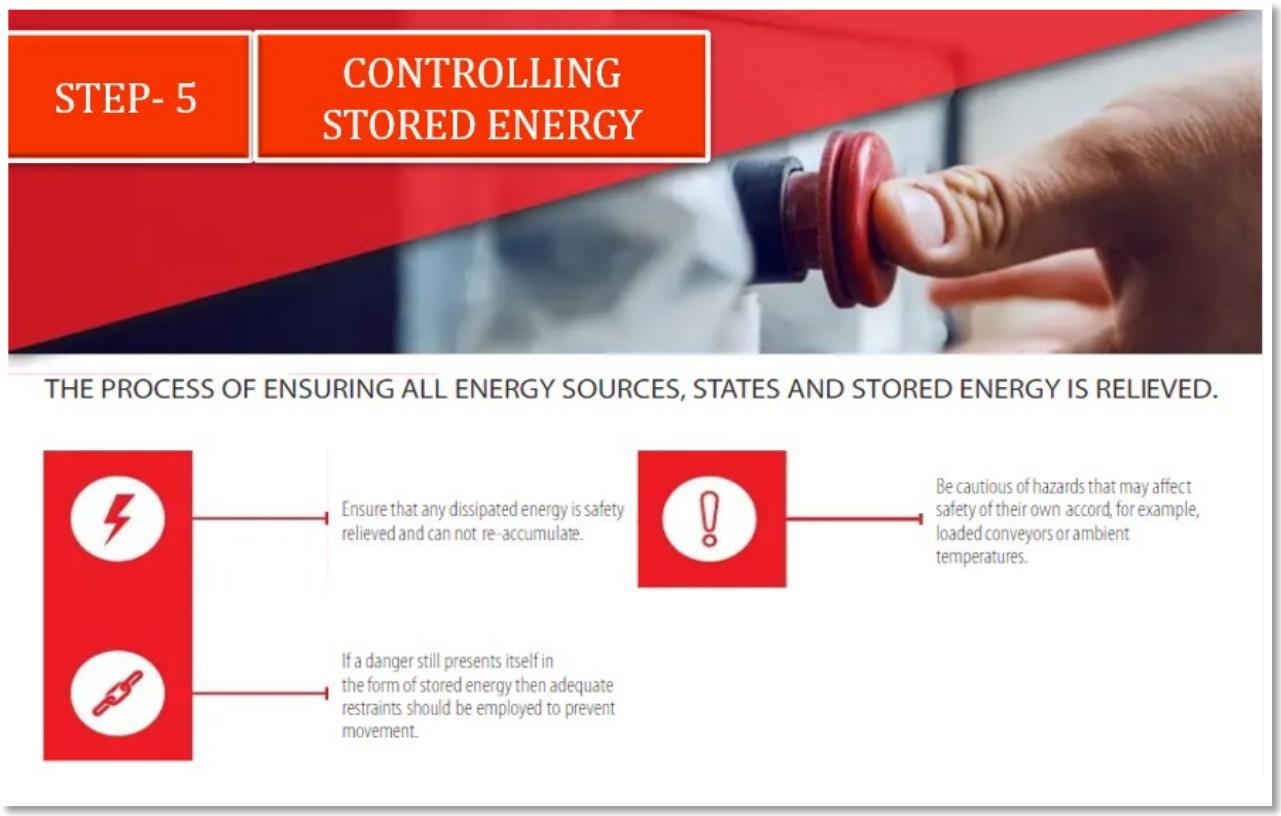


Figure-9 : Controlling Stored Energy

7.6 STEP:6 - VERIFICATION OF ISOLATION

Work shall not be allowed to commence, nor shall any maintenance material or device be placed on the isolated equipment until a verification test has been performed to ensure isolation has been correctly carried out and that no residual energy exists within the equipment. The work area shall be made “clear” of all potential hazards associated with an accidental start-up (e.g., tools, materials, and personnel at a hazardous location) prior to the verification test. The verification test (or “try”) shall be witnessed by all affected parties and shall be conducted for each potential energy source for the equipment being isolated.

Verification means purposely confirming that equipment is separated from its energy source; therefore, it is “isolated.” The authorized employee shall verify that:

- Equipment has been properly turned off/shut down.
- Energy isolating devices were identified and used to effectively isolate energy.
- Lockout or tagout devices have been attached to the energy isolating devices.
- Stored energy has been removed or controlled.

Attempting to restart the equipment is one way to confirm isolation; however, testing equipment ensures that capacitors have been properly discharged, hazardous heat has dissipated, and excessive pressures have been relieved.

Energy control programs are also referred to as “**Lock, Tag, Try**” or “**Lock, Tag, Test**” or “**LOTOTO**” to emphasize this important verification step.

For electrical isolation verification, only a “qualified person” as per the local electricity rule shall use test equipment to test the circuit elements and electrical parts of equipment to which employees may be exposed

and shall verify that the circuit elements and equipment parts are de-energized. In addition to the verification carried out by the “qualified person,” it is essential that the following should be verified:

- Verification tests of isolation and testing equipment – e.g., regarding the use of proprietary two-pole voltage meters, test lamps, or volt meters with insulated probes/fused leads (but not multi-meters or non-contact devices). In addition to training, some guidance on instrument calibration, pre/post-use testing, and maintenance/inspection.
- Protection from any nearby parts that may still be live – e.g., use of physical barriers or temporary insulation to prevent inadvertent contact.
- Identification of underground cabling.
- Earthing/grounding all conductors, capacitors, and/or at the point of work as a fail-safe measure.



Figure-10 : Verification of Isolation

7.7 STEP:7- PERFORM MAINTENANCE

Work shall be commenced by authorized personnel after verification of "Zero Energy State" of the equipment.

7.8 STEP:8 - RELEASE FROM LOCKOUT TAGOUT

Each lockout or tagout device shall be removed from each energy-isolating device by the employee who applied the device. Before lockout or tagout devices are removed and energy is restored to the machine or equipment, procedures shall be followed, and actions taken by the authorized employee(s) to ensure the following:

- Remove tools and replace equipment components, including guards.
- Inform co-workers that lockout or tagout devices will soon be removed.
- Ensure all workers are clear of the work area.
- Verify power controls are off or in a neutral position.
- Remove the lockout or tagout device.

After lockout or tagout devices have been removed and before a machine or equipment is started, affected employees shall be notified that the lockout or tagout device(s) have been removed.

When the authorized employee who applied the lockout or tagout device is not available to remove it, that device shall be destroyed (as there is only one key for each lock) under the direction of the Supervisor and with approval from an authorized person as per the hierarchy of the site management.



Figure-11 : Release from Lockout

8. LOCKOUT TAGOUT DEVICES

8.1 COLOUR CODING FOR LOCKS

- For ease of identification of the department or working area to which the executing Persons/Team leader is associated, the locks shall be identified by defined colours, as mentioned below:
- Electrical & Instrumentation department/ employees lock – Red
- Mechanical department/ employees lock – Blue
- Process/Operations department/ employees lock – Green.
- Others – Orange

8.2 LOCKS AND TAG SPECIFICATION

Lockout and tagout devices shall meet the following criteria to ensure that they are effective and not removed inadvertently:

- **Durable:** Lockout devices should work properly under the environmental conditions in which they are used. Lockout and tagout devices should be capable of withstanding the environment to which they are exposed for the maximum period that exposure is expected. Warnings on tagout devices should be legible even in wet, damp, or corrosive conditions. Tags shall be securely attached to energy-isolating devices so that they cannot be inadvertently or accidentally detached during use.
- **Standardized:** Lockout and tagout devices shall be designated and distinguished by standardized color, shape, or size. Tagout devices shall have a standardized print and warning format.
- **Substantial:** Lockout devices and tagout devices shall be strong enough that they cannot be removed inadvertently. Tagout devices shall be attached with a single-use, self-locking material such as a nylon cable tie.
- **Identifiable:** Lockout devices and tagout devices shall be singularly identified; shall be the only devices used for controlling energy; and shall not be used for other purposes. Any employee who sees a lockout or tagout device should be able to recognize who attached it and understand its purpose. In many cases, employees are given individual locks with engraved names and employee identification numbers.
- **Unique:** Each lock should have a unique key; this means that only the employee who uses the lock has the key to that lock under the “One Lock One Key” policy. If the lock comes with more than one key, other keys should be destroyed for LOTO purposes. A record of the issue of locks shall be maintained by a designated person. Locks and tags shall clearly identify the employee, and tags shall include a warning legend.

8.3 LOCKOUT AND TAGOUT STATION

A lockout/tagout station shall be established in each department. The lockout station includes padlocks, tags, multiple safety locks, valve lockouts, plug lockouts, circuit breaker lockouts, etc. Supervisors shall have access to the lockout station containing other lockout devices, which can be used by authorized employees. Supervisors will provide extra locks or tags whenever an employee needs them.



Figure 12 : Lockout and Tagout Station

8.4 PERSONAL/INDIVIDUAL ISOLATION

Business units and employees shall ensure that dangerous machines are properly isolated and unable to be started up again prior to the completion of maintenance or repair work. The concept of personal or individual isolation is a fundamental aspect of the LOTO standard, ensuring that each worker is protected by their own lockout/tagout devices.

Key elements related to personal/individual isolation:

Personal Lockout Devices

Personal Locks: Each worker should use their own lock, which they control exclusively. This ensures that only the individual who placed the lock can remove it.



Figure 13: One Person One Lock and Key

Unique Identification: Locks should be uniquely identifiable, often engraved with the worker's name or employee number, to ensure accountability.

Application of Lock: Each worker should apply their own lock to the energy-isolating device. This personal involvement ensures that the worker is directly responsible for their own safety.

Removal of Lock: Only the worker who applied the lock should remove it. If the worker is not available to remove their lock pertaining to approval from Site Head after:

- Determining why the owner cannot remove the lock.
- Making every reasonable effort to contact the lock owner or establishing their whereabouts.
- Ensuring that the area and equipment is safe for the removal of the lock.
- Authorising the removal of the lock in writing (often an Abnormal Lock Removal Form is established for this purpose); and

- Advising the owner at the earliest opportunity that the lock has been removed.

8.5 GROUP LOCKOUT TAGOUT

Service or maintenance work involving several employees, several energy sources, and isolating devices can make traditional individual lockout complicated. In such cases where multiple agencies are involved in the job, sites may develop a group isolation and Lockout Tagout procedure suitable to their needs. Under group isolation, one designated person in the group shall assume responsibility for securing each energy-isolating device. Thus, the group lockout tagout procedure reduces the number of locks and makes it easier for employees to coordinate their activities.

An example of Group Lockout and Tagout is illustrated in **Figure 14** below:
a. The designated person (shown in red) locks out each of these energy-isolating devices and puts the keys into a group lockbox with a multi-lock hasp.
b. These authorized employees (shown in blue) place their locks on the group lockbox before they begin work. After each authorized employee finishes the job, they remove their lock from the group lockbox.
c. After all the employees have finished their service work and removed their personal locks from the lockbox, the authorized employee who placed the key in the box removes it.

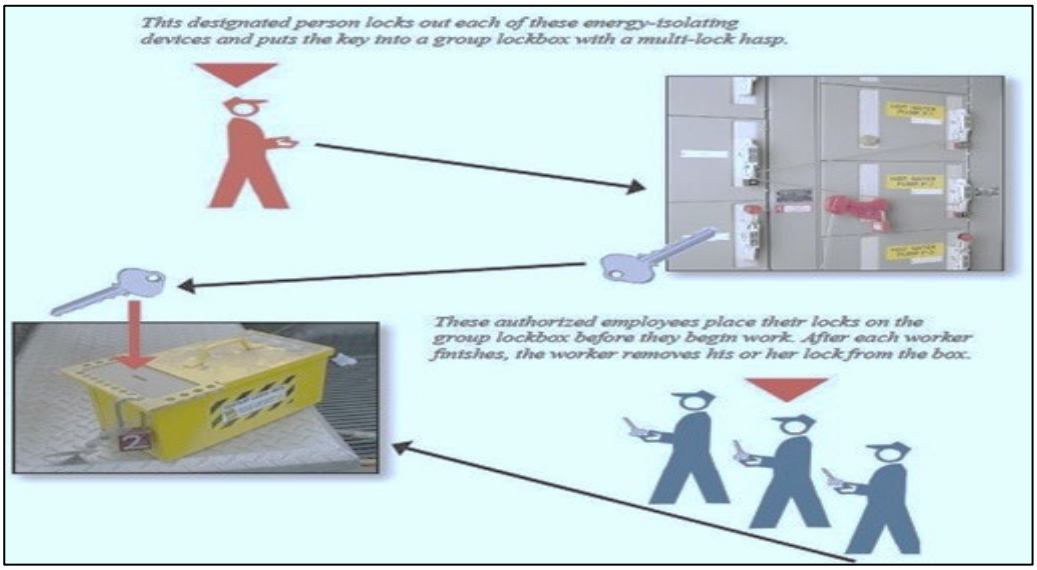


Figure 14 : Example of Group Lockout Tagout

9. SPECIAL REQUIREMENT

9.1 TEMPORARY REMOVAL OF LOTO DEVICES

Sites shall develop written energy control procedures to address the temporary removal of lockout/tagout devices and maintain adequate protection for employees engaged in testing work with an appropriate approval protocol, ensuring that temporary removal does not become part of normal activity. If this temporary removal is necessary for release from LOTO, perform the work and reapply LOTO using steps 1 to 6 (**Sections 7.1 to 7.6**) as mentioned above.

Temporary removal of LOTO devices may be required in situations where the energy sources are locked and tagged, and there is a need for temporary re-energizing for testing/taking trial of the equipment, machine, or part thereof. The following shall be mutually agreed upon between the Permit Applicant and the Permit Authorizer:

- Scope of testing
- Testing procedure
- Duration of testing
- Assessment of hazards as an outcome of testing
- Additional precautions to be taken during the restoration of energy, duration of testing, and re-isolation of energy.
- Suspend all work associated with this lockout.
- All work group/personnel to remove their locks and tags from the Key Control Box
- Ensure the rotating equipment's coupling or belt(s) guard is installed and tagged after the coupling or belt(s) has been removed.
- Ensure the local start/stop switch is tagged in the OFF position.
- Clear all personnel prior to racking in the circuit breaker.
- If uncoupled, the coupling or belt(s) guard should be reinstalled and tagged before the motor can be re-energized. The "Danger - Do Not Operate" tag should indicate the reason for the equipment being uncoupled. No other work shall be done on the equipment. The equipment and the motor shall remain in this condition until all work is completed and the motor is again de-energized to reinstall the coupling or belt(s).
- The system is restored to its lockout condition when testing/trial work on the motor is completed, and lockout is restored.

Where necessary, these requirements are specified in the method statement/work instruction; the entire process of energization and re-isolation is documented in the applicable work permit. In particular, in justified situations where the lock-out/tag-out devices have to be temporarily removed for the purpose of testing (e.g., Sanction to Test) or positioning the machine, equipment, and components thereof, the following sequence shall be followed:

- Clear the machine or equipment of tools and/or material.
- Remove employees from the machine or equipment area.
- Energize and complete the testing or positioning.
- De-energize all systems and repeat isolation procedures.
- The same series of checks and precautions is required when considering the temporary removal of lock-out/tag-out.

In this case, a written instruction shall be prepared and approved along with the Permit to Work to allow temporary energization/de-energization of the equipment or machine.

9.2 WORKING ON ENERGISED SYSTEM (UNDER CONTROL POWER)

If a job involving maintenance, repairing, cleaning, servicing, adjusting, or setting up operations (including the energy-isolating device itself) cannot be accomplished with the prime mover or energy source disconnected, such tasks shall be performed under the following requirements:

- The Person In-charge shall nominate a qualified person who shall keep the machine/equipment (e.g., control panel, remote control unit, circuit breaker, switches, etc. from where the machine can be activated) under their exclusive control throughout the duration of the job.
- The qualified person shall ensure that all executing personnel are always in their clear sight or in direct communication with them for the duration of the job.
- The qualified person shall ensure that all executing personnel are beyond the reach of the machine/equipment part which may move/actuate and cause exposure to hazardous energy/material.
- If the qualified person needs to leave the operating station, the equipment/machine shall be de-energized until the qualified operator resumes control of the machine/equipment.

Refer **Indicative Self-Assessment Checklist: Annexure -5**

9.3 CONTRACTOR LOCKOUT TAGOUT

Whenever outside servicing personnel (e.g., contractors, vendors, Equipment Service Engineers, etc.) are to be engaged in activities covered by the scope and application of this standard, the Permit Authorizer/Permit Issuer/Person In Charge shall inform them and ensure the implementation of proper lockout or tagout.

When a contractor or vendor is performing work on JSW sites, the respective site shall ensure that the contractor is provided with specific training and competence aimed at implementing the energy LOTO procedure and that the energy LOTO procedure is used and strictly followed by the contractor's working team. Specifically, those functions at the site level responsible for monitoring the safe completion of maintenance, servicing, or testing activities performed by contractors are expected to identify the risks or hazardous energy involved (and their impact on both site operations and contractors) and to require the use of the site LOTO procedure.

All outside servicing personnel (e.g., contractors, vendors, Equipment Service Engineers, etc.) shall comply with all applicable lockout/tagout standards or requirements. The Contractor Supervisor shall ensure that their employees understand and comply with the applicable lockout/tagout standards or requirements.

In the case of new installations that are not yet transferred to operations (such as greenfield and brownfield projects), equipment shutdown is the responsibility of the person in charge of the project.

9.4 CHANGE OF RESPONSIBILITY

9.4.1 Change Of Responsibility with Face-To-Face Handover

When there is a face-to-face change of responsibility for the isolation, lockout, and tagout, the following steps shall be followed:

- The isolator/executor handing over responsibility for the lockout should provide a face-to-face explanation of the isolation and lockout in place to the isolator/executor taking over the responsibility.
- The isolator/executor taking over responsibility for the lockout should place their lock(s) and tags, while the isolator/executor handing over the lockout will remove their lock(s) and tags.
- The changing of locks should happen simultaneously. The machine or equipment should not be left without a lock and tag attached to the lockout points. Locks may include isolation and personal locks.
- The process should be documented.

These activities should be carried out in accordance with the Permit to Work System, which sets out the requirements for the extension or renewal of the PTW.

9.4.2 Change Of Responsibility with Face-To-Face Handover Between Lockout Leaders – Group LOTO

If a change is needed for the Lockout Leader, the outgoing Lockout Leader should give a face-to-face explanation to another authorized person who will then become the new Lockout Leader.

The incoming Lockout Leader shall place their lock and tag on the multi-lock device (lockout box or hasp), and the outgoing Lockout Leader will remove their lock and tag from the lockout box or hasp. The changing of locks shall happen simultaneously. The machine/equipment should not be left without a lock and tag attached to the lockout points and/or the lockout box or hasp.

The isolation locks on the isolation points on the machine/equipment do not have to be changed if the key(s) to those locks are inside a lock box, but the incoming Lockout Leader is responsible for reviewing the lockout to ensure it is correct and should then perform all required verifications to ensure energy isolation. The process should be documented by both the incoming and outgoing Lockout Leaders.

9.4.3 Change Of Responsibility for Isolation and Lockout Between Shift (S) In Charge

There should be a face-to-face handover of custodianship over the keys to equipment locks from the outgoing Shift in Charge to the incoming Shift in Charge.

- The outgoing Shift in Charge shall hand over custodianship of the keys to the locks in a face-to-face handover with the incoming Shift in Charge. This includes handing over the key to the key-cabinet that secures all keys of the isolation locks.
- Both the incoming and outgoing Shift in Charge should inspect the contents of the key-cabinet and verify that all keys listed on the key control register are locked in the key-cabinet. Both should sign the Isolation and Lockout Register and the key-cabinet control register.

9.4.4 Powered Fixed Equipment Isolation

Prior to any work starting on powered equipment, it shall be positively isolated. Electrically powered equipment shall be isolated, locked, and tagged out from its power supply in accordance with the requirements of this LOTO procedure.

Specific guidelines for the selection and application of Lockout/Tagout (LOTO) devices and techniques should be provided, especially for isolating non-electrical energy sources such as hydraulic or pneumatic systems.

Before work commences, a rigorous verification of isolation should be performed using appropriate methods such as voltmeters for electrical circuits or pressure gauges for hydraulic systems to ensure no energy is present.

Diesel-driven equipment shall be positively isolated by removing and tagging out the ignition key, securing the electrical isolation switch, and considering the disconnection of the battery, which has its own risks of generating sparks and damaging circuit boards. Steam, hydraulic, or pneumatic equipment shall be positively isolated from its energy source by positive isolation of its motive force. Further isolation will depend on the type of equipment and may include pipe and additional physical isolation.

Detailed procedures for safely handling and isolating energy storage components, such as capacitors in electrical equipment or accumulators in hydraulic systems, should be included to ensure they do not pose a risk during maintenance activities.

All steps of the isolation and subsequent de-isolation of equipment should be thoroughly documented, creating an audit trail that includes details of the equipment isolated, the reason for isolation, steps taken to ensure safe isolation, and confirmation of isolation effectiveness.

9.4.5 Vehicles And Portable Equipment

The following procedure should be followed to Lockout / Tagout any vehicle to conduct work on the vehicle or any equipment on the vehicle:

- Park the vehicle safely, preferably at the maintenance workshop.
- Turn off the vehicle ignition, remove the vehicle keys, and turn the master battery isolation switch OFF.
- For portable equipment, ensure that all power sources are disconnected, and that energy is fully dissipated or neutralized.
- Install a lockout tag on the steering wheel, including the fleet number of the vehicle, the date and time, and your name and signature. For portable equipment, attach a lockout tag to a clearly visible part that effectively prevents operation or energy flow. If possible, install a lockout tag on the master battery isolation switch.
- Verify that all energy sources (electrical, mechanical, hydraulic, etc.) have been properly isolated using appropriate verification methods such as visual inspections, testing with multimeters, or pressure gauges.
- Inform all relevant personnel who may be affected. This includes notifying them through verbal communication, emails, or posted notices, ensuring that the scope and duration of the lockout are clearly communicated.
- Follow the General LOTO procedure as described to undertake the necessary repair works.
- If multiple individuals are working on the same vehicle or piece of equipment, ensure that each person applies their personal lock or tag to the group lockout device.
- Personnel applying or removing LOTO devices should be trained and authorized specifically for LOTO procedures. This includes understanding the types of energy involved, the hazards presented, and the specific steps for safely isolating and de-isolating equipment.
- In case of emergency or the need for immediate access to the locked-out vehicle or equipment, follow the documented emergency procedure, which outlines steps for safely bypassing the LOTO devices. This may involve contacting a supervisor or safety officer for authorization and ensuring that all safety measures are in place before proceeding.
- The lockout tag shall only be removed by the maintenance fitter or the manager, following repair work and test driving/operation. Ensure that a final inspection is completed to verify that the work area has been cleared of tools, personnel are safely positioned, and the vehicle or equipment is ready to be re-energized.
- Document the entire LOTO process, including details of the isolation, verification checks, individuals involved, and the clearance for re-energization, in the lockout register or permit to work. This record should be kept as part of the safety documentation.

9.4.6 Application Of Isolation

Plant Isolations

Plant isolations should be approved by the Permit Officer (to ensure the work is safe under the isolation) and the Site Representative (to assess any business operational impact). The responsible person(s) will execute the isolations. All isolations should be viewed and tested to confirm they are in place before work begins under the isolation. If the work is covered by a task breakdown, the isolations should be specified within the procedure.

Area Isolation

The work area should be clearly identified and cordoned off to ensure there is no risk from traffic, personnel not associated with the work, or other external sources.

Vessel Isolation (not for confined space entry)

The highest quality and security of isolation that is reasonably practicable should always be used. Positive isolation should be provided for all work other than cold work. Vessel isolations (e.g., filter changes) for routine, short-duration, cold work that are not positive isolation should be subject to a risk assessment. This is only allowed where the work duration is short (less than four hours), and the immediate work site should not be left unattended.

Confined Space Entry Isolation (General)

Given the specific hazards of confined space entry, LOTO plans should be risk assessed. Isolations should be made to prevent the accidental introduction of materials into the confined space through equipment such

as piping, ducts, vents, drains, conveyors, service pipes, or firefighting systems. The method of isolation should be by positive isolation, with air gapping as the preferred method. Isolations should be made as close as possible to the confined space to be entered. If isolation at the vessel cannot be achieved due to the size of a piping connection, or where piping connections are welded to the vessel/equipment, the isolation should be made at the nearest available place to the vessel/equipment. The interconnecting piping between the vessel/equipment then becomes an integral part of the confined space and should be considered when preparing for entry and issuing confined space entry permits.

Particularly important aspects to consider are:

- The natural “chimney effect” of large vertical towers, vessels, and pipework (e.g., overhead lines).
- The effects of winds creating a low-pressure area downwind of manways and other openings, which could result in airflow and contaminants moving inside a vessel/equipment in the reverse direction to that expected.
- Connecting piping can contain harmful materials not removed from the systems during purging and gas freeing, which can be subsequently released due to airflow and/or solar heating, or hot work.

Confined Space Entry Isolation (Tanks)

Positive isolation of all sources of energy is mandatory for confined space entry into tanks. Valves and/or sections of pipe from each connecting pipeline, including foam pipelines (where installed), should be removed from as near to the shell as possible, and the open end of the pipelines should be sealed with an appropriately line-rated blank flange. Potential energy sources should also be discharged, e.g., floating suctions, by landing these onto solid supports.

Confined Space Entry Isolation (Valve Chambers and Tank Turrets)

Positive isolation of all external sources of energy is often not practically achievable for pipeline valve chambers and tank turrets. The highest level of isolation practically achievable should be determined in the risk assessment, with appropriate controls and monitoring of isolation detailed, and response to the loss or containment detailed in emergency response plans.

9.4.7 Incident Learning

The site should regularly review safety alerts and past incident Corrective and Preventive Actions (CAPA) from the CAPA e-module to verify and align the implementation of lessons learned from previous incidents relevant to the specific type of work being performed. These requirements should be checked and aligned before the execution of work at the site. Additionally, incident learnings should be communicated to all personnel involved in the specific activity.

9.4.8 Positive Isolation

Isolation is regarded as the most secure method and should be considered in the development of all LOTO Plans. Proper and complete separation should be identified for plant circuits and equipment to be worked on from other parts of the system. Isolation is typically ensured by means of a fixed barrier, such as a blank flange with appropriate gaskets (following spool removal), skillet, blind plate, or spectacle blind, bolted or clamped in place and conforming to the piping work or equipment specifications. This provides an equivalent safety standard of proper containment to the piping or plant circuit on which it is installed.

Positive isolation is defined as:

- **Spool removal**: Removal of a pipework section or spool piece and blanking the live end, also called ‘air gapping’.
- **Blind isolation**: Insertion between flanges of a blind (spade); the swinging closed of a spectacle blind (plate); or replacement of a spacer (slipring) with a line blind (spade). Blind specification should be used as per OEM guidelines or defined by site technical services.
- **Securing mechanical linkages**: Ensuring that all mechanical linkages, gears, and levers are secured against unintended movement.

Positive isolation by spool removal or air gapping should be considered the minimum sole means of isolation for confined space entry, with an exception for the use of line-rated blind only as authorized by the Engineering (O&M) Head. When a spool or valve is removed (air gapped), the ‘live’ pipework side should be fitted with a

blank flange. In most circumstances, the isolated equipment (vessel or pipework) flange should be left open to allow the vessel or pipework to “breathe”. Positive isolation by spool removal should be achieved for any isolation lasting longer than one month.

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9.4.9 Valve Isolation

9.4.9.1. Double Block and Bleed

Double block and bleed are the most secure form of valve isolation but should only be used if the valve(s) can provide a reliable seal under the conditions of service. The main valve should be locked and tagged closed, and the bleed should be wired and tagged open to prevent inadvertent operation.

Double block and bleed valve isolations may be considered the minimum sole means of isolation for routine, short-duration cold work at moderate and high pressures. This type of isolation should only be used if the duration of the work is short (less than 4 hours), and the immediate work site should not be left unattended. These conditions should be included in a mandatory risk assessment, which should be part of the Work Permit and kept with the permit.

9.4.9.2. Single Valve

In single valve isolations, the integrity of the isolation is critically dependent upon the reliability of the seal under the conditions of service and the security of the single valve operating stem. Isolation against a tested single valve may be used for the purpose of swinging a spectacle blind, inserting a line-rated spade, or fitting a blind flange to achieve higher integrity isolation.

Single valve isolations may be considered the sole means of isolation for routine, short-duration cold work where pressures on the active side are less than 200 kPa gauge. The duration of work should be short (less than 4 hours), and the immediate work site should not be left unattended. These conditions should be included in the risk assessment, which should be part of the Work Permit and kept with the permit.



Figure-15 : Single Valve Isolation with Lock and Tag.

9.4.9.3. Valve Actuators

When used for isolation:

- **Manually operated valves** should be locked and tagged to prevent unauthorized or inadvertent operation.
- **Electrically actuated valves** should have the power supply positively isolated, and any manual override should be manually locked.
- **Pneumatic and hydraulic operated valves** that fail closed should have the control lines isolated and physically disconnected. Pneumatic and hydraulic operated valves that fail open or fail as-is should is not used for isolation purposes.

9.4.9.4. Isolation Of Other Energy Sources

Other energy sources can include heat, gas, steam, gravity, and pressure. These shall be isolated by a physical break which is identified by a tag and secured by a lock or an equivalent mechanical means that cannot be neutralized without the use of tools. Open ends shall be blanked or capped.

9.4.9.5. Energy Isolation of Railway Tracks

Energy isolation for railway tracks, especially in scenarios involving maintenance, repair, or other operational activities, requires a detailed and robust approach to ensure the safety of personnel working in or around live track environments. The Lockout/Tagout (LOTO) standard for railway tracks should incorporate the identification of potential energy sources, both electrical (in the case of electrified tracks) and mechanical (such as moving trains or residual forces in track systems). First and foremost, the isolation procedure should account for the energy types present in the track system, such as overhead catenary systems (OCS) for electrified railways or third-rail electrical supplies, along with mechanical energy stored in trains, moving parts of rail switches, and rail tension. A key element of the isolation process is a clear understanding of the types of equipment to be isolated, such as track switches, signals, and the rolling stock, and ensuring that any electrical systems powering these mechanisms are fully de-energized. Equally critical is the isolation of mechanical energy, including ensuring that trains or other vehicles near the maintenance site are immobilized and prevented from moving. Track isolation should be accompanied by locking and tagging of energy-isolating devices and other mechanical systems to physically prevent the accidental energization or movement of trains.

The LOTO standard should also ensure that personnel are trained to recognize all potential hazards, including both visible and hidden energy sources. For electrical isolation, procedures should include securing and locking out electrical breakers or switches, ensuring that all overhead or third-rail power sources are de-energized, and verifying no residual voltage remains. In the case of mechanical isolation, securing train movements or preventing the movement of track-switching devices through manual or automatic track locks is paramount. Furthermore, the procedure should mandate the use of proper lockout and tagout devices — ensuring that lockout devices are applied to electrical isolation points, while tags should communicate the work being conducted and clearly mark the isolation points. Significantly, a verification step is necessary to confirm that no energy remains — electrical or mechanical — before work proceeds, which includes testing the isolated equipment and systems to ensure complete de-energization. The LOTO standard should clearly define how energy isolation is verified and the process for re-energizing the track or related systems once work is completed. These requirements should be carefully documented and monitored to ensure safety, with ongoing checks for compliance, particularly in high-risk areas like railway yards or electrified rail networks.

9.4.9.6. New Equipment/Machine

All sites shall ensure that whenever new machines or equipment are installed, energy isolating devices for such machine or equipment shall be designed to accept a lockout device and these requirements shall be part of the technical specification of the equipment. This requirement shall also be part of Management of Change and new product introduction programs. Old equipment with no facility for lockout should be modified based on risk assessment to facilitate energy isolation.

10. EMERGENCY RESPONSE AND PLANNING

JSW Site shall prepare and maintain a comprehensive emergency response plan specific to Lockout/Tagout (LOTO) operations. This plan should address potential risks and hazards associated with energy isolation and control activities and include:

- **Failure to isolate hazardous energy**, leading to unintentional equipment startup.
- **Release of stored energy**, such as hydraulic, pneumatic, or mechanical energy, during maintenance or servicing.
- **Electrical shocks or electrocution** during electrical isolation or LOTO procedures.
- **Exposure to hazardous substances** caused by improper isolation of chemical or thermal systems.
- **Inadequate or missing LOTO devices**, resulting in accidents or injuries.

The emergency response plan should detail the necessary requirements, actions, and mitigation measures for each identified scenario.

It should ensure clear and precise procedures for emergency preparedness and response, including:

- **Immediate shutdown protocols** in case of LOTO failure or related incidents.
- **Rescue and first aid procedures** for injured personnel.

- **Coordination with local emergency services** for severe incidents or equipment-related accidents.
- **Inspection and verification** protocols to confirm proper energy isolation during emergencies.
- **Training and drills** for personnel to effectively respond to LOTO emergencies.

This plan should be periodically reviewed and updated to align with any changes in equipment, processes, or identified risks.

11. TRAINING

As a general requirement, workers assigned to use any work equipment at the workplace should receive all necessary information and instructions about the safe and unsafe conditions of its use, including foreseeable abnormal or emergency situations. According to local country regulations, maintenance operators receive specific training based on both risk assessment results for their job and tasks, as well as local regulations. For example, in Italy, the requirements for electric maintenance staff and responsible persons are based on technical regulation CEI 11-27:2021, which transposes the European Standard EN 50110-1.

Specifically, Lockout and Tagout training shall be included in annual training plan of the following group of personnel who are having active role in implementing LOTO program.

- Authorized Employee.
- Affected Employee; and
- Other Employee

The level of the training shall be decided based on their specific role as mentioned in Section of People's Requirement. It is suggested that the training modules (virtual, classroom and /or hand-on training) should be designed to include:

Table-2 : Training Plan

Training item	Authorized employee	Affected employee	Other employee
Purpose and use of lockout/tagout program/procedures	√	√	√
Recognition of applicable hazardous energy sources	√	√	√
Type and magnitude of hazardous energy sources	√		
Methods and means for isolation and control of hazardous energy	√		
LOTO Procedures	√		

Refresher training should be mandated at regular intervals, such as annually, or whenever there are significant changes to processes, equipment, working practices, or if workplace inspections, post-accident investigations, or risk assessments identify shortcomings in the existing level of competency. On-site, emergency response and rescue training should include mock drills, stop work signals, and conditions under which the emergency response plan should be triggered.

Competency standards should be established for:

- Persons undertaking surveys to identify hazardous energy sources associated with plant, equipment, or machinery.
- Persons performing the functions of an Isolation Officer.
- Persons performing the functions of a Personal Lock Holder.

Training and formal competency assessments are required for these personnel, who should be authorized to isolate plant, equipment, or machinery and place locks. All training and competency assessment results should be recorded, including:

- Employee's name and job assignment.
- Employer.
- Date of training.
- Content of the training received.
- Name of the person conducting the training.
- Method of verifying the employee's understanding, such as scores from written tests or assessments from practical demonstrations.

Documentation may be maintained in a computer-based system but should be available in hard copy upon request, ensuring accessibility for all relevant parties, including employees, management, and safety auditors. Retention periods for training and competency records should be defined, adhering to legal and industry best practice standards.

All employees and contractor workers who participate in, perform, or may be affected by the lock-out/tag-out procedure should receive training before their participation in the energy isolation lock-out/tag-out program, with annual repetition. Retraining will be provided whenever there is a significant change in the energy isolation and lock-out/tag-out program.

Specific training should be provided to each Isolation Authority, including the recognition of expected hazardous energy sources, the type and magnitude of energy potentially released in the workplace, and the methods and means necessary for energy isolation and control. The Isolation Authority should review the qualifications of staff under their control. Staff are deemed qualified only for the specific energy sources for which they are trained, as specified in their training certificates. Qualifications are valid for a limited period and should be renewed according to the requirements mentioned above. Qualifications are obtained based on training by a qualified trainer or training center and are also based on relevant experience in serving or maintaining equipment and installations, as well as holding all necessary certificates up to date per local regulations. Qualifications are renewed periodically based on refresher training and new testing.

12. RACI MATRIX

The roles and responsibilities to implement this standard are outlined below: Activity Description	Section In-charge	Head Operations	Safety	Head Maintenance/ Process
Identification and assessment of site conditions	R	C	I	A
Planning, Preparation, Risk Assessment	R	I	C	A
Assign responsibility for implementing control measures	C	A	I	R
Protective and Rescue equipment plan	A	I	C	R
Ensure Safe Job execution	R	I	C	A
Training and Certification	R	C	I	A
Audit/Inspection and monitoring for compliance	R	A	I	C
Identify Rescue Team	R	I	C	A

RACI chart
R: Responsible: People who are expected to actively participate in the activity and contribute to the best of their abilities.
A: Accountable: The person who is ultimately responsible for the results.
C: Consulted: People who have the specific expertise and can contribute to decision making.
I: Informed: People who are kept informed, but do not necessarily participate in the effort.

13. MANAGEMENT OF RECORDS

The following records shall be retained as follows:

- Equipment specific LOTO procedures.
- LOTO Energy Isolation Record Register.
- Training records.
- Records of Program Audit; and
- Register of lock and tags issued to individual employees and return.

14. LEGAL AND OTHER REQUIREMENTS

JSW site shall access, identify, evaluate, and keep up to date the LOTO requirement as per prevailing law in operation.

15. KEY PERFORMANCE INDICATORS

To ensure conformance to the requirements of this STANDARD, the following Key Performance Indicators (KPIs) shall be identified, communicated, recorded and monitored:

- Section / Department of sites covered under survey for identification of energy source in each equipment.
- Number of LOTO Completions.
- Number of LOTO Violations.
- Number of LOTO Assurance/ Audit Program; and
- Number of trained personnel- Authorized Employees.

Depending on the type of lockout and tagout program, each JSW site shall identify and monitor additional KPIs as appropriate.

16. ASSURANCE

Each Site shall conduct self-assurance program to ensure compliance with this STANDARD as part of its safety assurance program. Third party system audit shall be conducted by Group Safety or external consultants to ensure compliance with the standard.

17. DEFINITION

Term	Definition
Affected Person/Employee	An employee whose job requires him/her to operate or use a machine or piece of equipment on which servicing or maintenance is being performed under lock-out or tag-out, or whose job requires him/her to work in an area in which the servicing or maintenance is being performed.
Authorized Person/Employee	A person who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment.
Capable of being locked out	An energy-isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which, a lock can be affixed, or it has a locking mechanism built into it. Other energy-isolating devices are capable of being locked out, if lockout can be achieved, without the need to dismantle, rebuild, or replace the energy isolating device or permanently alter its energy control capability.
Competent (Responsible) Person	A person with sufficient knowledge, experience and training to manage all aspects of safety on the Control of Hazardous Energy in the systems for which they are responsible. This person ensures there is a safe procedure recorded for all aspects of the Control of Hazardous Energy. This will either be an established local procedure or referenced on a Permit to Work. (Depending on the size and complexity of the operation, there may be a single Responsible Engineer / Competent (Responsible) Person or there may be a number of competent persons responsible for the LOTO programmed in different parts of the organization, all reporting to a single Responsible Engineer).
Contractor / Contract Employee / Contract Worker	An employee of a contracted company engaged or commissioned by JSW to undertake work or provide services, but who are not directly employed by JSW. For example, contractor employees working on JSW operations, persons working for JSW through staff/employment agencies, contract cleaners etc.
Danger Tag	A tag that is placed with intention of warning to the persons that device is under isolation and should not be operated/switched on.
Energized	Connected to an energy source or containing residual or stored energy.
Energy-isolating device	A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: a manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors, and in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit-type devices are not energy-isolating devices.

Term	Definition
Energy source	Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy, including sources of potential energy.
Hazard	Source with the potential to cause harm or hazardous situations, or circumstances with the potential for exposure leading to injury and ill health.
Hazard Identification & Risk Assessment	Hazard Identification & Risk Assessment is done to identify and evaluate the hazards, Risk, and put controls measures for safe execution of activities.
Hazardous energy	Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, nuclear radiation or any other energy that, if not controlled, could cause injury to personnel or damage to property and/or environment. Main categories of sources can be grouped as: • **Electrical hazards** are present when conductors or components that may be electrically energized could cause injury to personnel or damage to property. • **Mechanical hazards** are present when the unexpected start-up of the system, equipment, or machine, or the release of stored energy while adjusting, maintaining, or servicing systems, equipment, or machines could cause injury to personnel or damage to property. • **Process hazards** are present when the unexpected release of gases, liquids, or solids could cause injury to personnel or damage to property. These hazards can exist during such tasks as installation, fabrication, servicing, or maintenance of pipelines, vessels, or associated equipment.
Isolation	Separation of the equipment, machinery, or area where work is to occur from sources of ·hazardous energy or materials in such a way that only a conscious and deliberate act can restore the connection.
Isolation Tag	A card with a tear off stub that is displayed on the source of energy which is isolated.
Job Safety Analysis	Job safety analysis (JSA) is a procedure which helps integrate accepted safety and health principles and practices into a particular task or job. In a JSA, for each basic step of the job, it is required to identify potential hazards and to recommend the safest way to do the job.
Job	A piece of physical work defined by time or other limits that has a clear start and end point.
Lock	Main three types of locking mechanisms can be grouped as follows: • **Discrete:** Locks that are different from one another; each can only be opened by one key. • **Personal:** a discrete lock, individually keyed, issued to an individual for his or her use in securing isolations. • **Series or system:** a group of locks that are opened by a single key and are used in area/ complex lockouts. Various sets of locks may be

Term	Definition
	in use; however, only one key can open any given lock in a particular set.
Locking	Placing a lockout device on a hazardous-energy-isolating device at a point of isolation.
Lockout	Isolation of a source of hazardous energy, including releasing any residual hazardous energy that might be present, and securing an isolation point by locking it.
Lockout device	A piece of equipment that prevents the unauthorized or accidental operation of a hazardous-energy-isolating device.
Lockout Tagout	Lockout is defined as the "Control of Hazardous Energy - In practice, lockout is the isolation of energy from the system (a machine, equipment, or process) which physically locks the system in a safe mode. The energy-isolating device can be a manually operated disconnect switch, a circuit breaker, a line valve, or a block (Note: push buttons/ Emergency stop, selection switches and other circuit control switches e.g. PLC switches & trip devices are not considered energy-isolating devices). The locking device (or lockout device) can be any device that can secure the energy-isolating device in a safe position. Tagout is a labelling process that is always used when lockout is required. The process of tagging out a system involves attaching or using an indicator (usually a standardized label). Note: ONLY the authorized individual who placed the lock and tag onto the system is the one who is permitted to remove them. This procedure helps to make sure the safety of Affected Person, who operates or maintains or works on machinery or equipment, which is subjected to lockout/ Tagout.
Permit to Work	The written or printed document that is issued by the Owner to execute job as per Permit to work procedure.
Stored energy	Hazardous energy that can continue to exist after equipment is isolated (e.g., the hazardous energy contained in spring, flywheels, pressurized fluids or gases, pneumatically controlled device capacitors, or gravity).
Tagging	Placing a specific tag on a lock or point of isolation to identify who placed the lock and when it was placed.
Tagout	Placement of an Isolation Tag which states, "Danger-Do Not Operate" (without a lock).

18. ANNEXURE

18.1 ANNEXURE-1: CHECKLIST FOR ENERGY SOURCE DETERMINATION

DATE: _____ CONDUCTED BY: _____

To determine all energy sources for each piece of equipment, all questions should be answered. Both actual and potential sources of energy need to be considered when responding to the questions. If the question does not apply, write N/A in the blank. Circle "yes" or "no" or fill in the blank.

Location: _____Work Centre: _____

Line: _____Equipment No.: _____

Equipment Name: _____Serial No.: _____

Lockout / Tagout Procedure No. Assigned: _____

1. Does this equipment have?		
A	**Electric power** (including battery)? If yes, Motor Control Center (MCC) or power panel and breaker number_____	YES/NO
	Does it have a lockout device? Battery location: _____	YES/NO
B	**Mechanical power**? Mark each type of energy source that applies:	YES/NO
	1. Engine driven? If yes, switch or key location: _____ Is lockout device installed? If no, method of preventing operation: _____	YES/NO YES/NO
	2.**Spring loaded?** If yes, is there a method of preventing spring activation? If no, how can spring tension be safely released or secured?_____	YES/NO YES/NO
	3. **Counterweight(s)?** If yes, does it have a method of preventing movement? If yes, can it be locked? If no, how can it be secured? _____	YES/NO YES/NO YES/NO
	4. **Flywheel?** If yes, does it have a method of preventing movement?	YES/NO
	If no, how can it be secured? _____	

C	**Hydraulic power**? If yes, location of main control/shut off valve. _____ Can control/shut off valve be locked in "off" position? If no, location of closest manual shutoff valve. _____ Does manual shutoff valve have lockout device? If no, what is needed to lock valve closed? _____ Is there a bleed or drain valve to reduce pressure to zero? If no, what will be required to bleed of pressure? _____	YES/NO YES/NO YES/NO YES/NO
D	**Pneumatic energy**? If yes, location of main control/shut off valve. _____ Can control/shut off valve be locked in "off" position? If no, location of closest manual shutoff valve. _____ Does manual shutoff valve have lockout device? If no, what is needed to lock valve closed? _____ Is there a bleed or drain valve to reduce pressure to zero? If no, what will be required to bleed off pressure? _____	YES/NO YES/NO YES/NO YES/NO
E	**Chemical system**? If yes, location of main control /shutoff valve. _____ Can control/shutoff valve be locked in off/closed position? If no, location of closest manual shutoff valve. _____ Does manual shutoff valve have lockout device? If no, what is needed to lock valve closed? _____ Is there a bleed or drain valve to safety reduce system pressure and drain system of chemicals? If no, how can system be drained and neutralized? _____ What personal protective clothing or equipment is needed for this equipment?	YES/NO YES/NO YES/NO YES/NO
F	**Thermal energy**? If yes, location of main control/shutoff valve. _____ Can control/shutoff valve be locked in "off" or closed position? If no, location of closest manual shutoff valve. _____ Does manual shutoff valve have lockout device?	YES/NO YES/NO YES/NO
G	**Gravitational Energy?** **If yes, location of main control/shutoff device. Is there a device to restrain or control the gravitational energy?** **If no, what will be required to control or restrain the gravitational energy?** _____ **Can the device used to restrain or control the gravitational energy be locked in a position that will prevent the gravitational energy from being released?**	YES/NO YES/NO

		YES/NO
H	**Other Sources of Energy?** **Are there any other actual or potential energy sources?** **If yes, location of main control /shutoff valve. Can control/shutoff valve be locked in an off or closed position? Is there a way to drain or bleed of pressure?** **If no, how can energy be controlled or neutralized?** **Is personal protective clothing or equipment needed to protect employees from the energy source?** **If yes, what equipment is needed? If no, what is needed to lock valve closed?** **Is there a bleed or drain valve to safely reduce system pressure and temperature and drain system?** **If yes, what is the location of the valve?** **If no, how can system pressure and temperature be reduced and drained?** _____ **What personal protective clothing or equipment is needed for this equipment?**	YES/NO YES/NO YES/NO YES/NO YES/NO
	Special precautions not noted in the preceding (i.e., fire hazards, chemical reactions, required cool down periods, etc.): _____	

(Note: If any interruption to a site's power supply is anticipated, it may help to ensure and check that those responsible for Information and Communication System and other key systems are informed of the potential disruption to their activities.)

Recommendations or Comments: _____ Completed by: ___Date: __

Reviewed by: _____Date: _____

Approved by: _____Date: _____

18.2 ANNEXURE-2: EQUIPMENT SPECIFIC LOTO PROCEDURE (SAMPLE)

Description: Boiler #2				Equipment #: 192839	
Location: Boiler Room	Bldg: #1		Revn: 0	Date: N/A	Origin Date: 1/2/2017

5 Isolation Points to be Locked and Tagged	**DANGER** Confined Space. Obtain proper permits and follow confined space procedure prior to entering (including double block and bleed protocol). Shut down adjacent equipment prior to servicing machine.

NEXT AUDIT DUE JAN 2018 | NEXT AUDIT DUE JAN 2019 | NEXT AUDIT DUE JAN 2020 | NEXT AUDIT DUE JAN 2021

North Side View



North Side View



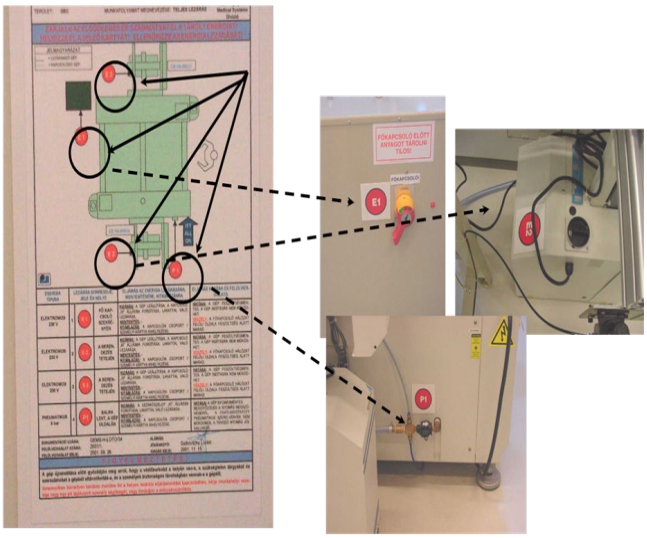
North Side View



ALWAYS PERFORM A MACHINE STOP BEFORE LOCKING OUT DISCONNECTS

ID	Source	Device	Location	Method	Check
E-1	Electrical 480V	Padlock	Isolation point on North side of unit.	Move electrical disconnect to off. Lock out.	Attempt restart at CP-1.
W-1	Feed Water Inlet - 70 PSI	Gate valve device	Isolation point on North side of unit.	Turn valve to closed position. Lock out.	Visually verify zero pressure status.
G-1	Natural Gas Inlet - <7 PSI	Ball valve device	Isolation point on West side of unit.	Turn valve to closed position. Lock out.	Visually verify zero pressure status.
S-1	HP Steam Outlet - 125 PSI	Cable device	Isolation point located above unit.	Turn valve to closed position. Lock out.	Visually verify zero pressure status.
S-2	Condensate Inlet - 125 PSI	Cable device	Isolation point on North side of unit.	Turn valve to closed position. Lock out.	Visually verify zero pressure status.
	Thermal Energy 500 F		Be sure to wait until heat has dissipated from machine until cool to touch before servicing. Wear proper PPE before beginning work.		

All isolation points shall be properly labelled, there shall be a procedure at site level which will help to identify all the isolation points of an equipment. These isolation point shall be labelled as per the P&ID diagram and labelling shall be done as per the P&ID diagram; these tags shall be selected as per the atmosphere conditions of the specific unit to bear the adverse weather conditions. Each isolation point shall match the identification as per the P&ID. Below image is an example of labelling aligned with the P&ID diagram, the site shall develop these demarcations on both equipment and the P&ID.



18.3 ANNEXURE-3: FORMAT FOR LISTING OF ENERGY SOURCE IDENTIFICATION

A. Multiple Energy Source

Department: **Section:**

ENERGY ISOLATION SURVEY SHEET

Equipment Detail			Energy source -Multiple Energy Source					Type of Job	Isolation details of Energy sources & Location of Isolation locks									
									Inst		Electrical		GAS		Fluid			
Name	Tag NO	Location	Inst	Elec	Air, Gas	Fluid	Others		Method	Panel NO	Method	Panel NO/ Tag no	Method	Valve/ U-seal /Flange NO	Method	Pump/ Valve NO	Others	Remarks
Process / Operation Area																		
PT																		

Note:

- In the Method of Isolation, the details of isolation technique (for example breaker to be racked out, closing of valve, switching of pump etc. should be mentioned).
- No column shall be left blank. If some column is not applicable in a case, then “NA” shall be written to ensure that it is not simply a miss but a considered view.

B. SINGLE ENERGY SOURCE

Department: **Section:**

ENERGY ISOLATION SURVEY SHEET

S. N	Equipment Detail			Energy Source	Type of Job	Details of Positive Isolation			
						Electrical			
	Equipment Name	Equipment No, /Tag NO	Location	Electrical		Method of Isolation	Panel NO/ Tag no	Substation or MCC location / Valve No.	Remarks
Process / Operation Area									

Note:

In the method of isolation, the details of Isolation (Like breaker to be racked out, discharging to be done, permanent earthing to be done at specific location, Valve to be closed etc.).

The type of job may be categorized based on the basic philosophy which may affect the method of Isolation method. Like the jobs which may not require or require direct exposure to electrical parts, released energy.

No column shall be left blank. If some column is not applicable in a case, then “NA” shall be written to ensure that it is not simply a miss but a considered view. If the single source energy is electrical then panel no/MCC/substation archmould be provided.

18.4 ANNEXURE-4: SHUTDOWN PROCEDURE CHECKLIST

Machine: **Date:**

1. Affected employees and other are notified before lockout/tagout is performed in their work area.
2. Machine shutdown is performed referring to the shutdown procedure.
3. Energy sources are identified and isolated to shut down the machine.
4. Locks and Tags are applied to the isolated energy sources.
5. Stored/residual energy if any in air supply or hydraulic is dissipated.
6. Isolation and de-energization are verified “Try out "before starting work.
7. Perform LOTO
8. Checklist for release of Lockout & Tagout.
    - Work area is inspected after work is complete.
    - Non-essential items are removed & cleared from the work area.
    - Machine parts and guards are operationally intact.
    - Electrical wiring and connections are properly secured.
    - Affected employees and others are safely positioned.
    - Machine is thoroughly checked before re-energization.
    - Lockout/tagout is released to start the machine.
9. Authorized employee(s) Signature.
10. Verification by “qualified person”:
    - verification tests of isolation and testing equipment – e.g. regarding the use of proprietary two-pole voltage meters, test lamps, or volt meters with insulated probes / fused leads (but not multi-meters or non-contact devices). In addition to training, some guidance on instrument calibration, pre/post use testing and maintenance/inspection,
    - protection from any nearby parts that may still be live - e.g. use of physical barriers or temporary insulation to prevent inadvertent contact.
    - identification of underground cabling
    - earthing / grounding all conductors, capacitors and/or at point of work as a fail-safe measure.

18.5 ANNEXURE-5: INDICATIVE SELF-ASSESSMENT CHECKLIST

SN	Item	Yes	No	Remark
1	Has the site established a documented hazardous energy control programs commensurate with risk levels?			
2	Does the program scope include cover all forms of hazardous energy?			
3	Is a program manager appointed?			
4	Are the duties and responsibilities of employees involved in program management clearly stipulated?			
5	Has the site conducted a comprehensive survey to identify equipment and machines in the workplace that needs to be covered under LOTO JSW program and information documented?			
6	Are all equipment control handles provided with a means for LOTO?			
7	Are there enough tags and locks provided for any reasonably foreseeable repair emergency?			
8	Is information on the LOTO facility in machine/equipment included in procurement procedures?			
9	Has a time targeted action plan been established to implement LOTO for all sources of hazardous energy?			
10	Are clear equipment specific written energy control procedures established?			
11	Are procedures available to concerned employees?			
12	Are all machine and equipment de-energized or disengaged, blocked, and locked-out during cleaning, servicing, adjusting or set-up? operations?			
13	Is it required that only authorized employee to place or remove the LOTO device?			
14	Is the power to the machine isolated from electrical circuit			
15	Does the LOTO procedure require that stored energy (mechanical, hydraulic, air, etc.) be released or blocked before equipment is. locked-out for service/repairs?			
16	Are Authorized employees required to keep their key while LOTO is in use			
17	Is it required that authorized employee to perform “Try out "by attempting to start after full LOTO shutdown?			

19. REFERENCE

References Document	Full Title, Brief Description and Web Links
American National Standard Institution	ANSI/ASSP Z244.1 Lockout, Tagout and Alternative Methods https://www.assp.org/standards/standards-topics/lockout-tagout-and-alternative-methods-z244-1 ANSI/ASSE Z244.2 Control of Hazardous Energy – Lockout/Tagout: Alternative Methods http: ansi.org/RecordDetail.aspx? sku=ANSI%2FASSE+Z244.1-2003+(R2014
Directorate General Factory Advisory Services Labour Institute	The Factory Act, India 1948 http://www.dgfasli.nic.in/welcome.html
Occupational Safety and Health Administration, USA	Occupational Safety and Health Standards -The Control of Hazardous Energy (Lockout/Tagout) (29 CFR 1910.147) https://www.osha.gov
European Directive 2006/42/EC European Standard EN 50110-1	European Machine Directive https://osha.europa.eu/en/legislation/directives/directive-2006-42-ec-of-the-european-parliament-and-of-the-council Operation Of Electrical Installations General Requirements BS EN 50110-1:2023 Operation of electrical installations General requirements (en-standard.eu)
International Association of Oil & Gas Producers	Recommended practice n 577 related to 5. Energy Isolation https://www.iogp.org/wp-content/uploads/2018/11/05EnergyIsolation_IOGP577version1.2.pdf Recommended practice related to 14. Working with Electricity https://www.iogp.org/wp-content/uploads/2018/11/14WorkingElectricity_IOGP577version1.2.pdf
European Standards	EN 50110-1 - Operation of electrical installations - Part 1: General requirements https://standards.iteh.ai/catalog/standards/clc/3d96fce2-163a-426c-a24b-a50a6602d8e8/en-50110-1-2013 BS EN 60204-1:2018 - Safety of machinery. Electrical equipment of machines General requirements https://www.en-standard.eu/bs-en-60204-1-2018-safety-of-machinery-electrical-equipment-of-machines-general-requirements/ UNI EN ISO 14118:2018 - Safety of machinery - Prevention. of unexpected start-up

	https://standards.iteh.ai/catalog/standards/cen/95aad0d5-c360-4bc3-9737-58c6f9864c73/en-iso-14118-2018
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Italian Electrotechnical Committee	https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.147CEI 11-27 Works on electrical installations https://global.ihs.com/doc_detail.cfm?document_name=CEI%2011%2D27&item_s_key=00671629
Oil & gas - ENI procedure	DE-energization, Lockout and Isolation Procedure
HSE UK	https://www.hse.gov.uk/work-equipment-machinery/loler.htm

JSW Group

MANAGEMENT STANDARD: PERMIT TO WORK
JSW/GHS/GS-08

MANAGEMENT STANDARD PERMIT TO WORK

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1. PURPOSE

The purpose of the Permit to Work System at JSW Group and its businesses is to provide a structured and formalized procedure for safely conducting specified operational and maintenance tasks. This system ensures that all activities are executed in a safe, controlled, and coordinated manner, with a clear focus on safeguarding personnel, equipment, and the environment.

Purpose of the Work Permit System:

- **Formal Authorization:** Establish a formal process to authorize the commencement, continuation, and completion of potentially hazardous work within JSW premises, ensuring that work is performed under safe conditions.
- **Hazard Communication:** Ensure that all personnel involved in the activity are formally informed of the hazards and risks associated with the work and understand the necessary precautions to mitigate those risks.
- **Safe Execution:** Outline and enforce specific precautions and procedures to ensure work is conducted safely, protecting personnel, equipment, and the environment from harm.
- **Documentation:** Provide a comprehensive record of authorization, description, and completion of work. This includes verification that all conditions for safe work have been met and that the job has been discussed with the relevant supervisors and workers.
- **Compliance and Coordination:** Ensure work is carried out in a well-coordinated and uniform manner, in compliance with the Permit to Work System and other relevant procedures, emphasizing that adherence to the permit alone does not absolve responsibility for safe work practices.
- **Record Keeping:** Maintain a formal record that documents the authorization process, work details, and completion, serving as a formal agreement to adhere to the prescribed procedures and precautions.

By adhering to these principles, the Permit to Work System at JSW Group aims to enhance safety, ensure effective risk management, and promote a culture of safety within the organization.

2. SCOPE

The Permit to Work (PTW) Standard at JSW Group establishes a systematic approach for managing and authorizing work activities that pose potential hazards across all JSW premises and operations. This standard ensures that work is carried out safely, efficiently, and in compliance with both regulatory and organizational requirements. The scope of the PTW system includes the following:

2.1 APPLICATION OF PTW SYSTEMS

PTW systems are required whenever work activities may adversely impact the safety of personnel, plant, or the environment. They are especially critical for non-routine and high-risk tasks but should not be applied to general visitor management or routine maintenance in non-hazardous areas.

2.2 APPROPRIATE SITUATIONS FOR PTW

PTW systems are most effective and are to be applied in the following scenarios:

- **Non-production work:** Includes maintenance, repair, inspection, testing, alteration, construction, dismantling, modification, and cleaning.
- **Non-routine operations:** Tasks not part of regular operations that may introduce risk.
- **Coordinated work:** Jobs requiring the coordination of multiple teams or individuals to complete safely.
- **Transfer of responsibility:** Work that involves the handover of duties from one team or individual to another, ensuring safe transitions and accountability.

- **Simultaneous or combined operations:** In complex work environments (e.g., mobile drilling units or support vessels), where PTW systems should interface across sites or platforms, including electronic and paper-based systems.
- **Types of Work Requiring Additional Permits or Certificates:** The following types of work activities require additional permits or certificates to ensure safety and compliance:
- **Heat-related work:** Any tasks involving heat generation or usage (e.g., welding, flame cutting, grinding).
- **Sparking or ignition risks:** Work that generates sparks or other ignition sources.
- **Hazardous substance handling:** Work that involves the release or containment of flammable, toxic, or dangerous substances, including pressure systems.
- **Electrical work:** Tasks on high voltage electrical equipment or any electrical work posing a risk of danger.
- **Confined space entry:** Work within confined spaces or tanks, requiring specific safety protocols.
- **Hazardous material handling:** Tasks involving dangerous substances, including radioactive materials and explosives.
- **Well intervention and diving operations:** Including onshore operations near water bodies.
- **Pressure testing**: Jobs that involve pressure testing of systems.
- **Work affecting safety systems:** Tasks that could impact evacuation, escape, or rescue systems.
- **Temporary equipment uses:** Use of temporary equipment such as generators or welding equipment.
- **Work at height:** Any work performed at height requiring additional precautions and safety measures.
- **Work with PPE:** Jobs that require additional personal protective equipment (PPE).
- **Other high-risk operations:** Any operation considered high-risk that warrants additional safety oversight.

The PTW system applies across all JSW sites and is designed to ensure that every high-risk task is carefully planned, executed, and supervised.

The system ensures that only trained and certified personnel are allowed to carry out work under PTW conditions, and that proper risk assessments and safety measures are in place.

This PTW standard aims to mitigate risks, enhance safety protocols, and ensure that all work activities at JSW Group sites comply with the highest safety and operational standards.

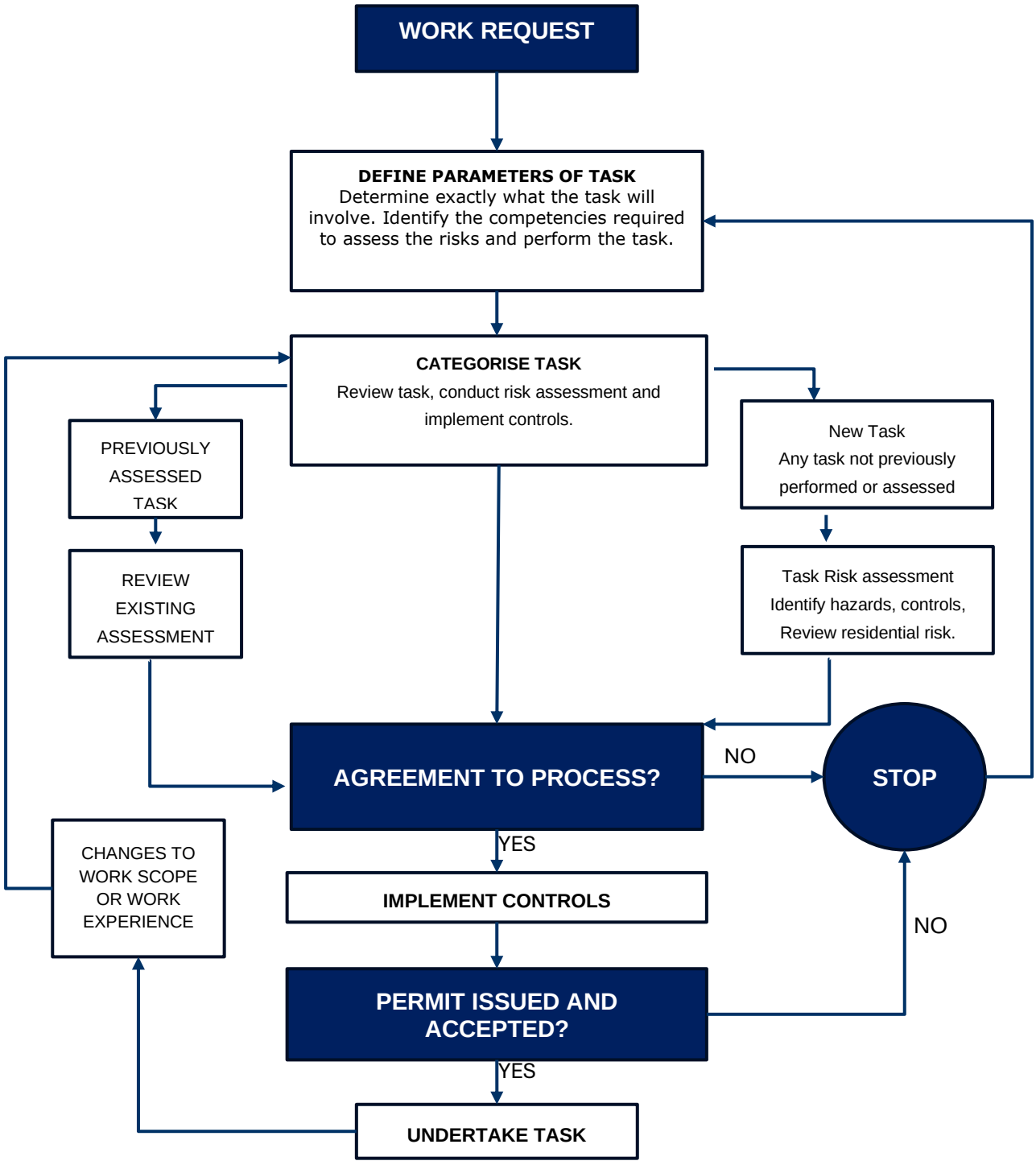
In the Standard, the following verbal forms are used to indicate requirements, recommendations, permissions, or capabilities:

- “shall” indicates a requirement.
- “should” indicates a recommendation.
- “may” indicates a permission.
- “can” indicates a possibility or capability.

3. REVIEW

The Standard shall be reviewed at least every 5 years or when a serious incident or high potential near miss is recorded. The review shall be consistent with local regulations and the requirements of this standard.

4. PROCESS FLOW



PERMIT TO WORK PROCESS FLOW

5. PERMIT TO WORK

5.1 INTRODUCTION

A permit to work is a formal recorded process used to control work which is identified as potentially hazardous, it is also a means of communication between site/installation management, site supervisors and operators and those who carry out hazardous work.

The Permit to Work System serves as a formal mechanism for authorizing specific tasks within designated Work Permit Areas on JSW premises.

PTW Systems shall be considered for the following but not limited to:

- Non-Production Work (e.g.: Maintenance, Repair, Inspection, Testing, Alteration, Construction, Dismantling, Adaptation, Modification, cleaning etc.)
- Non routine operations
- Jobs where two or more individuals or groups need to co-ordinate activities to complete the job safely, and jobs where there is transfer of work and responsibilities from one group to another.

The terms ‘permit-to-work’, ‘permit’ or ‘work permit’ refer to the paper or electronic certificate or form which is used as part of an overall system of work, and which has been devised by a company to meet its specific needs.

A permit-to-work system aims to ensure that proper consideration is given to the risks of a particular job or simultaneous activities at site. Whether it is manually or electronically generated, the permit is a detailed document which authorises certain people to carry out specific work at a specific site at a certain time, and which sets out the main precautions needed to complete the job safely.

5.2 GENERAL REQUIREMENTS

JSW Site activities, projects and managed operations shall ensure that Permit to Work management program is developed in line with this standard. Permit to Work program shall include following but not limited to:

- The site shall maintain a list of processes and equipment owners in different areas who are authorized to ensure the safety of equipment being worked upon.
- The site shall maintain a list of authorized isolators responsible for isolating process equipment in different areas. Responsibilities may include, but are not limited to, isolations for electrical, mechanical, hydraulic, and pneumatic systems.
- The site shall identify and document an authorized list of personnel from various areas/sections who are responsible and accountable for authorizing specific jobs (including any limits to their authority) through the issuance of PTWs. The hierarchy for permit authorization and issuance shall be defined by the site based on associated risks.
- The site shall establish a process to communicate PTW requirements to all contracting partners and their employees, emphasizing the necessity of engaging qualified and skilled manpower and utilizing certified and approved equipment, such as:
    - Certified lifting tools and tackles.
    - Certified welding machines.
- The site shall ensure the availability of all necessary resources to effectively implement the PTW system, including:
    - Tools, tackles, and PPEs.
    - Equipment for isolating and discharging contained energy.

  - Locking arrangements for energy sources.
  - Competent and certified personnel as required.
- The PTW system shall have a validity period in line with local legal requirements. However, in any case, validity shall not exceed a single working day. Provisions for renewal should be in place. If there is a change in ownership for a continuing job, the permit should either be returned, and a fresh one issued, or the original permit renewed upon approval by the Department Head.
- The site shall establish a process to investigate all incidents where activities were conducted under PTW control.
- Each job shall have a separate PTW. No permit shall be combined for multiple jobs, whether at the same site or at different locations. Effective supervision of the permit-to-work system can be diluted in the case of many permits under the control of one person. Site management should have arrangements to identify very active periods (e.g. during plant shutdowns) and assess what steps are necessary to maintain the required supervision, e.g. either by limiting the number of active permits or by providing additional resource for supervision and co-ordination of permits.
- The site shall implement a system to track and monitor:
  - Multiple PTWs issued for a single process or piece of equipment.
  - Different PTWs issued across various locations at the site.
- The site may choose either a paper-based PTW system or an electronic-based PTW system.
- As the PTW system is a formal means of communication among site/installation management, plant supervisors, operators, and those performing hazardous work, the site shall ensure:
  - Each stakeholder has a defined and documented responsibility chart.
  - All stakeholders are well-trained, informed, and aware of the consequences of non-conformance.
- The site shall establish a process for monitoring, periodic audits, and reviews to ensure the continued effectiveness of the PTW system. This includes:
  - Implementing corrective and preventive actions based on audit/inspection findings.
  - Reinforcing positive conformance to the PTW system.
- Based on monitoring and audits, the site shall:
  - Identify gaps and take corrective and preventive actions.
  - Ensure continuous improvement of the PTW system.

6. ROLES AND RESPONSIBILITIES

6.1 SITE HEAD

Site Head shall be responsible for implementing the permit to work system across the site.

Ensure the system is:

- Operating effectively and maintained to meet its objectives.
- Sufficient resources are provided to enable the permit to work system to be properly implemented.
- Audited, reviewed and revised in alignment with management systems.

6.2 LINE MANAGERS

- Ensure all staff and contractors under their supervision understand the Permit to Work system.

- Provide adequate training and clear instructions to staff and contractors.

6.3 PERMIT APPLICANT

- Responsible for obtaining the necessary permits for the job they intend to carry out.
- May need to secure multiple permits if different work groups are involved with the same equipment.
- the permit contains a clear description of the work to be done, its location, start time and duration.
- permits for work activities that may interact or affect other site activity are adequately controlled.
- It is recommended that the Permit Applicant and the Permit Authorizer be different individuals.
- It is recommended that the person identified as permit applicant shall be qualified with 3 years of experience in operating/maintaining the process, have adequate knowledge of activity and shall undergo training on site PTW process, after validation he shall be authorized with clear limits as applicant for type and area of job.

6.4 PERMIT AUTHORIZER

- Ensures permits are issued in a safe manner and in accordance with the Permit to Work standards.
- Ensures all other work that would create a hazard if undertaken at the same time is suspended and made safe.
- Ensures that limitations on the timing and scope of the work are defined as well as actions to be taken in the event of site emergencies
- Ensures all personnel engaged in the preparation of permits, and responsible for the supervision and performance of the work, are identified and competent
- Ensures all personnel (including contractors) working within the permit system have sufficient knowledge and competence to carry out their duties.
- It is recommended that Permit Authorizer shall be qualified with 5 years of experience in operating/controlling the process, have command of process. He shall undergo training on site PTW process, after validation he shall be authorized with clear limits of his authority as authorizer.

6.5 PERMIT HOLDER

- Appointed by the Permit Applicant to manage the specific job at the worksite.
- Ensures that they and the people working with them understand the operation of (and the consequences of non-compliance with) the permit to work systems applicable to the areas in which they are responsible for work.
- Ensures the conditions and precautions specified in the permit are fully understood, implemented and effectively monitored.

6.6 WORK GROUP MEMBERS

- Should have a clear understanding of the Permit to Work system and adhere to the SOPs (Standard Operating Procedures), SMPs (Standard Maintenance Procedures), or SWPs (Safe Work Procedures) provided before starting the job.
- Ensure no work begins on any job requiring a permit until a valid permit has been authorized and issued.
- Follow all safety measures and precautions mentioned in the permit, complying fully with the Permit to Work system requirements.
- Seek guidance from the Permit Applicant if there are doubts, unexpected situations, or unsafe conditions arise.

- Avoid taking shortcuts while performing their tasks.

6.7 INDIVIDUALS (ACTING AS ISOLATION OFFICER, AUTHORIZED GAS TESTER ETC.)

All individuals working at the site should ensure that:

- they are able to demonstrate a good understanding of the permit-to-work systems that are operated in any location at which they may have to work.
- they do not start work on any job requiring a permit until one has been authorised and issued, its content understood, and necessary precautions taken.
- the conditions and precautions specified in the permits issued to them, or for work in which they will be involved, are fully implemented and will continue to be effective throughout the duration of work.
- all the precautions and safety measures that the permits and instructions state they should take are strictly followed.
- if in any doubt, or if any circumstances or conditions change, they stop work, make the work area safe and get advice immediately.

6.8 KEY REQUIREMENTS FOR WORK EXECUTION

Before work can proceed, several critical steps shall be completed:

- **Permit Issuance:** A hard copy of the Permit to Work shall be received, duly signed by both the Permit to Work Authorizer and the Applicant. This ensures formal authorization and documentation of the work.
- **Risk Assessment:** Conducting a Risk Assessment is mandatory. This assessment, which shall be communicated to the engaged workforce before starting the job, is carried out by the Permit Authorizer or Applicant. The Risk Assessment identifies potential hazards and determines the necessary safety measures, including the need for additional certificates (e.g., Confined Space Entry, Work at Heights, LOTO etc.) based on the job's nature. **Refer Annexure 12: Risk Assessment Format.**
- After issuing the PTW, any changes during the job execution require a revalidation of the Risk Assessment. The team shall prepare an action plan to implement the necessary changes, and the unit should update the SOPs and PTW procedures accordingly.
- **Toolbox Talk:** A Toolbox Talk should be conducted to discuss the specific hazards, safety measures, and work procedures. This talk serves to ensure that all workers understand the risks involved and the necessary precautions before commencing the work. **Refer Annexure 11: For Safety Toolbox Format.**
- **Job Safety Analysis:** A Job Safety Analysis Checklist shall be completed to identify and mitigate potential hazards associated with the task. The JSA should address all identified hazards and safety controls, including any required certificates for specialized tasks. The JSA should be reviewed as part of the Permit to Work process and signed off by the Permit Authorizer.
- The Permit to Work shall include all necessary details, such as a description of the work, safety and isolation requirements, estimated time for job completion, and any additional certificates required for the task. The Permit Authorizer shall verify that all necessary information, including certificates, is included in the Permit to Work before it is confirmed and issued.
- **Visual Inspection:** The Permit Authorizer or a nominated representative shall visually inspect the job location and its vicinity to ensure all safety measures, isolation procedures, and Permit to Work requirements (including the presence of required certificates) are being met before the work proceeds.
- **Isolation Procedures:** Effective isolation procedures shall be planned and confirmed, including isolation of all energy sources (mechanical, electrical, hydraulic, etc.). The details of the isolation points and tag or key numbers shall be documented directly on the Permit to Work form. If the work requires specific isolation (e.g., electrical or mechanical), this should also be validated and documented as part of the Permit to Work process.

- **Compliance and Controls:** Any changes or additional isolation requirements shall be communicated and documented. Controls should be in place to prevent premature de-isolation when multiple tasks are involved. Even if the plant is not operational, isolation standards should remain consistent with operational conditions. The inclusion of certificates is part of this verification process, ensuring all required safeguards are in place before the work commences.

7. TYPE OF WORK PERMIT AND CERTIFICATE

The Permit to Work (PTW) System at JSW Group categorizes work into the following type:

- Hot Work Permit
- Cold Work Permit

For specific tasks under these permits, additional certificate such as Confined Space Entry, Work at Heights, or LOTO (Lockout/Tagout) may be required based on the nature and risks of the work.

7.1 HOT WORK PERMIT

7.1.1 Situations Requiring a Hot Work Permit

A Hot Work Permit is required under the following conditions:

- Jobs involving welding, cutting, grinding, brazing, soldering, or jack hammering.
- Use of any equipment or tools that could generate sparks and potentially ignite a fire.
- Use of open flames from torches or other apparatus that produce an open flame.
- Use of non-explosion proof, non-intrinsically safe electrical or electronic equipment.
- Operation of compressors, generators, pumps, welding machines, or similar equipment with internal combustion engines.

7.1.2 Hot Work Permit Requirements

- JSW Sites shall ensure that a Hot Work Permit should be obtained for all activities that involve tools, equipment, or the work itself, which could generate sparks or serve as a source of ignition.
- JSW Sites shall ensure a risk assessment shall be mandatory and should be communicated to all engaged workers before starting the job. The risk assessment should be jointly conducted by the Permit Authorizer and the Permit Applicant, depending on the nature of the risks.
- JSW Sites shall ensure that the Permit Authorizer shall personally inspect the job location and ensure that the area is safe for carrying out the work requested by the maintenance, inspection, or construction applicant. The inspection should confirm the work site is free from flammable materials (combustible liquids, dust, solids, etc.) within 10 meters of the job location.
- JSW Sites shall ensure that the Permit Authorizer should use an explosimeter or portable flammable gas detector to measure the atmosphere at the work site. Any reading other than zero (0% LEL) shall confirm an unsafe condition, and the hot work permit shall not be issued. The results of the atmospheric tests (flammable gases and/or oxygen concentration) should be recorded on the Hot Work Permit document. The Permit Authorizer may, at their discretion, require repeated tests at intervals during the hot work.
- JSW Sites shall ensure that before the hot work begins, the site and equipment (e.g., vessels, piping) shall be prepared to prevent fire or explosion risks. Equipment should be emptied, cleaned, and isolated from all potential sources of ignition by disconnection, blanking, or inserting blinds. If isolation is done via a closed valve, it should be approved by the JSW Safety function.

- JSW Sites shall ensure that all sample points, drains, surface manhole covers, or relief valve outlets within 10 meters of the hot work site should be covered using flame-retardant tarpaulins, wet rags, or metal plates. Open drains or ditches should be dammed and pumped dry, and unit drain outlets should be plugged to prevent flammable gases or vapours from escaping.
- JSW Sites shall ensure that an Authorized Gas Tester (AGT) shall conduct tests for flammable gases (%LEL) before issuing a Hot Work Permit, especially at the Natural Gas Metering Station, Natural Gas Pipeline areas, and any other areas where flammable gases might be present.
- JSW Sites shall ensure that heavy oil deposits, dried vegetation, or other flammable materials within 5 meters of the hot work site should be cleared to prevent fire hazards.
- JSW Sites shall ensure that if the hot work is performed at height, a separate Work at Height certificate should be obtained before issuing the Hot Work Permit. The Permit Authorizer should ensure fire-resisting or flame-retardant tarpaulins or metal sheets are used to prevent the spread of sparks and molten metal. Proper ventilation and air circulation should be ensured, and barricades should be used to prevent direct eye contact with the welding arc.
- JSW Sites shall ensure that if the hot work is inside a confined space, the Permit Authorizer should confirm that the Confined Space Entry certificate is obtained before issuing the Hot Work Permit. The Confined Space Entry procedures should be clearly referenced in the permit document, in accordance with **Confined Space Entry Standard JSW/GHS/GS-06.**
- JSW Sites shall ensure that Water should be arranged for quenching sparks or molten slag, but firefighting equipment should not be used for quenching, as per NFPA standards. A minimum of two fire extinguishers should be available within 8 meters of the work site.
- JSW Sites shall ensure that measures to prevent static, such as grounding or bonding, should be implemented, especially during activities like sandblasting, spray painting, or refuelling.
- JSW Sites shall ensure that during hot work, no other hazardous activities such as opening or breaking process lines or venting flammable materials should occur.
- JSW Sites shall ensure that all permit closures should be documented; verbal cancellation or closure of permits is not allowed.
- JSW Sites shall ensure that for gas cutting or welding inside confined spaces, hoses and gas cylinders should be properly managed and stored to avoid hazards.
- JSW Sites shall ensure that non-flame electric arc welding equipment should be placed in areas free from flammable materials, and welding machines and cables should be inspected and approved by a competent engineer.
- Each plant or business unit should develop its own Standard Operating Procedures (SOPs) for issuing permits. These SOPs should be rigorously followed to ensure compliance with safety standards and address the unique requirements of the specific facility.

7.2 COLD WORK PERMIT

A Cold Work Permit is required for all activities that do not produce sufficient heat or sparks to ignite a flammable or combustible material. These activities include jobs such as excavation by hand tools, erection of scaffolds and barricades, chemical cleaning, and the use of air-driven power tools that do not generate sparks during use. Other examples include the opening of process equipment such as vessels, towers, pumps, compressors, heat exchangers, filters, tanks, blinding (spading), blanking, breaking of flanges and unions, tightening of flanges, cold cutting, and industrial radiography using ionizing radiation sources (excluding X-ray generators).

7.2.1 Cold Work Permit Requirements

- **Risk Assessment:** Prior to starting the job, a Risk Assessment should be conducted, and the results communicated to the workforce engaged in the job. This is mandatory for ensuring safety.
- **Certificates for Specific Work:** Separate certificates should be issued for equipment isolation (LOTO), work at height, confined space entry, and any other specific PTW certificates. These certificate numbers should be referenced in the Cold Work Permit document.
- **Cross-references to Hot Work Permit:** Any condition that may present fire or explosive risks should cross-reference the Hot Work Permit procedure, such as the requirement for isolating flammable materials and conducting gas testing.
- **Note:** If Cold Work involves activities such as welding, cutting, or grinding that could potentially generate sparks or other ignition sources, it would be classified under Hot Work and a Hot Work Permit should be issued instead

  Refer Annexure-1: For Hot Work/Cold Work Permit

7.3 TYPE OF CERTIFICATES

7.3.1 Work at Height Certificate

If the work is to be conducted at a height or adjacent to a pit or trench with a significant differential height, a separate Work at Height (WAH) certificate shall be obtained in addition to any other required certificates, such as hot work or cold work. Please refer to the Work at Height Standard **(Ref No: JSW/GHS/GS-12)** for guidance on issuing a WAH Certificate. Plant or business-specific SOPs shall be developed for permits to ensure all procedures are tailored to the unique requirements of each facility. These SOPs should be followed rigorously to maintain compliance and safety standards **(Refer to Annexure-2: Working at Height Certificate)**.

7.3.2 Confined Space Entry Certificate

A separate certificate for confined space entry shall be obtained whenever the entry into a confined space is required to perform the job. Please refer to Confined Space Entry Standard JSW/GHS/GS-06 for permit required confined space entry and monitoring the space atmosphere before and during entry. Plant or business-specific SOPs shall be developed for permits to ensure all procedures are tailored to the unique requirements of each facility. These SOPs should be followed rigorously to maintain compliance and safety standards **(Refer to Annexure-3 for Annexure & Annexure 13 for Confined Space Entry log and Subsequent Gas test records)**.

7.3.3 Excavation Certificate

An excavation is defined as any man-made cut, cavity, trench, pit, or depression in the earth's surface formed by removing earth. Excavation certificate shall be obtained before starting any excavation work involving digging or soil removal **(Refer to Annexure-4 for Excavation Certificate))**. Plant or business-specific SOPs shall be developed for permits to ensure all procedures are tailored to the unique requirements of each facility. These SOPs should be followed rigorously to maintain compliance and safety standards.

7.3.4 LOTO – Lockout/Tagout (Energy Isolation Certificate)

The Permit Authoriser is responsible for determining whether equipment, vessels, or pipelines need to be positively isolated before work begins or a Permit to Work (PTW) is issued. Before issuing any other permit, a separate Lockout/Tagout (LOTO) certificate shall be issued. Refer to the LOTO Standard JSW/GHS/GS-07 for guidelines on applying for and authorising a LOTO certificate.

Site shall ensure that the reference numbers of all LOTO certificates related to the job are recorded in the Work Permit. Likewise, the certificate numbers should be included in the Permit to Work to maintain proper linkage and tracking.

Plant or business-specific SOPs shall be developed for permits to ensure all procedures are tailored to the unique requirements of each facility. These SOPs should be followed rigorously to maintain compliance and safety standards **(Refer to Annexure-5 for Lock-Out and Tag-Out Certificate)**

7.3.5 Certificates for Lifts with Mobile Crane or Hoists

This certificate applies to equipment such as mobile cranes, pick-and-carry cranes, crawler cranes, powered winches, and manual hoists. It does not cover stationary equipment like overhead cranes, forklifts, or passenger lifts. Each JSW Site should develop tailored SOPs to address specific operational requirements, ensuring compliance and safety. **(Refer to Annexure-6 for Certificates of Lifts with Mobile crane or hoists & Annexure-7 Pick & Carry Cranes Certificate)**

7.3.6 Certificate for Electrical Work

A certificate for electrical work should be obtained before performing any work on electrical equipment in the JSW premises **(Refer to Annexure-8 for Electrical Certificate).** For further guidance on safe operations on Electrical System or in the vicinity Please **refer Electrical Safety Standard (JSW/GHS/GS-11).**

7.3.7 Radiography Certificate (Use of Radioactive Material)

A Radiography Certificate is required for using ionizing radiation sources, such as radioactive materials, for maintenance tasks like weld inspection **(Refer to Annexure-9 for Radiography Certificate).**

- The Radiography Certificate is necessary for:
- Use of radioactive sources, including X-rays and gamma rays
- New installation of nucleonic gauges
- Operation and maintenance of installed radioactive sources
- Radiography of weld joints
- Using radioisotopes for process studies

Permit Applicant:

The Permit applicant should be the Radiological Safety Officer (RSO) of the plant, qualified and certified according to the relevant local legislation and regulatory requirements.

General Safety Requirements:

Radiological Safety Officer (RSO):

The Site Safety Department shall maintain a list of RSOs responsible for daily activities related to nucleonic gauges, density meters, source isolation, and use of radiation survey meters.

Radiation survey meters should be calibrated annually by an authorized agency.

Work Area Barricading:

- Areas where work with ionizing radiation sources is performed should be barricaded and clearly marked with radiation warning signs.
- During dark hours, additional warning lights should be placed near radiation signs.

Access Control:

The Permit Applicant or designated Permit Holder should ensure unauthorized persons do not enter the radiation zone. This includes consideration for individuals who might be above or below the radioactive source.

Post-Maintenance Inspection:

After completing maintenance work with radioactive sources, the Permit Applicant should inspect the area with a radiation survey meter to confirm no radiation threat remains.

Supervision:

Radioactive sources used for non-destructive material analysis should not be left unsupervised. An RSO should always supervise these sources.

Routine Checks:

RSOs should conduct routine checks every six months to verify the availability of sources and the intensity of shielding. The results should be compiled into a report and sent to the relevant authority.

Incident Response:

In case of unusual occurrences (e.g., fire, explosion, mechanical damage) affecting the integrity of the source holder, the incident investigation team should include an RSO.

7.3.8 Certificate for Road Closure

The closure of any road within JSW premises should be authorized through a Certificate for Road Closure **(Refer to Annexure-10 for Certificate for Closure of Roads)**.

This certificate is required for activities that block or restrict road access, including but not limited to:

- Road repairs
- Movement of heavy cranes
- Road painting
- Unloading materials with a crane that may obstruct the road
- Cleanup of spills
- Placing equipment, soil from excavations, or supplies on a road

The Head of the Security Department and the Fire Department should provide clearances after confirming that alternative routes for emergency vehicle movement are available. The Permit Applicant is responsible for obtaining these clearances.

The road closure certificate is valid for a maximum of 7 days and is signed by the permit authorizer every 24 hours. The Permit Authoriser should sign the permit copies daily at the job site to confirm that safe conditions are maintained. If the job extends beyond 7 days, a new certificate should be obtained, with the original clearances attached if the job scope remains unchanged.

8. ESSENTIALS OF PERMIT TO WORK SYSTEM

8.1 DISPLAY OF WORK PERMIT

The Permit to Work (PTW) will be issued in triplicate. The handling and display of the copies are as follows:

First Copy: The Permit Applicant will take the first copy. This copy should be kept with the Applicant throughout the duration of the work and shall remain at the worksite until all work is completed.

Second Copy: The second copy is retained by the PTW Authorizer for records. This copy is used for administrative purposes and should be filed appropriately.

Third Copy: The third copy is provided to the PTW Holder. This copy shall be prominently displayed at the job location. It serves to inform all personnel of the job details, hazards, isolations, and any other necessary precautions.

Post-Completion Handling:

Original Copy: After work completion and final sign-off, the original copy should be retained and filed by the Authorizing Department.

Carbon Copies: The two additional copies should be retained and filed by the Applicant and Isolation officer or contractor, with one copy kept by each.

Protection: All permit copies should be protected from dirt, dust, moisture, and direct sunlight to ensure their legibility and integrity.

8.2 PTW VALIDITY PERIOD

- A Permit-to-Work (PTW) or Certificate is typically valid for one shift only. However, the validity period can be extended for up to two additional shifts with appropriate renewals.
- A new PTW or certificate should be issued if 24 hours have elapsed from the original issue date of the permit or certificate. This ensures that any potential hazards, risks, or changes in the working environment are reassessed and addressed.
- The validity period for certain specialized certificates (e.g., road closure permits) may differ from the standard one-shift validity. Specific procedures and details regarding the validity of these certificates will be outlined within their respective procedures.

8.3 EXTENDING THE VALIDITY PERIOD

- If the work requires continuation beyond the current shift, the Permit to Work or certificate should be extended. The extension should be obtained from an approved Permit Authoriser, who will ensure that the permit remains valid during the continuation of the work.
- The Permit Authoriser should physically inspect the job location to confirm that all safety conditions are still met and that no new hazards have emerged before extending the permit.
- When extending the Permit to Work, the extension details (such as the duration of the extension and any changes in the conditions) should be recorded on both the display copy and the Permit Authoriser's copy of the permit.
- Additionally, atmospheric gas tests (such as checking for oxygen levels, flammable gases, etc.) should be conducted again before extending a Permit to Work related to activities like hot work or confined space entry. The results of these tests should be recorded on the Permit to Work.
- The extension request is to be initiated by the Permit Applicant, but Permit Authoriser should be physically present and perform an inspection to ensure the extension is warranted and the work site is still safe.

8.4 PERMIT HANDOVER

If work is carried over to another shift, e.g. the job takes longer than expected, then a shift handover procedure should be in place. This handover procedure should ensure that the incoming shift is aware of any outstanding permit-controlled jobs, the status of those jobs, and the status of the plant. Work-in-progress should be left in a condition that can be reliably communicated to, and understood by, the oncoming shift. A permit log, permit file or display boards are ways of recording ongoing permits. It is essential that there is good communication between incoming and outgoing authorising and performing authorities and it is recommended that the incoming authorising authority signs to allow the continuation of a permit.

8.5 PERMIT CLOSURE (HAND-BACK)

JSW Site shall have permit closure or hand back procedures in place, and this should include obtaining answers to the following questions:

- Has the work been completed? This should be confirmed by the Permit Applicant
- Has the plant or equipment been returned to a safe condition, by removing isolations? Has this been verified by the Permit Authorizer?
- Has the permit holder acknowledged on the permit that the plant or equipment has been returned to the control of the production staff?

8.6 SUSPENSION OF WORK PERMIT

The issued PTW shall be suspended or revoked in case:

- There is a general alarm situation.
- Operational controls are not functional, e.g. when the permit is for hot work and process fluid or gas sampling should be carried out at the same time, with the possibility of a release of a dangerous substance.
- Waiting for spares.
- There is a change to the nature or scope of the work; and
- There is a conflict with another scope of work. It is important to remember that a suspended permit remains live until it is cancelled. This means that there may still be active isolations under suspended permit.
- Suspended permits shall be kept on the permit recording system. In addition, the condition in which the plant has been left and the consequences for other activities shall be specified. The work shall not be restarted until the permit authorizer has verified that it is safe to do so and has revalidated the permit or issued a new permit. If work is left under a suspended permit, integrity of safety systems or the security of any isolation that has been made is important, and the plant shall not be assumed to be safe for normal or other use.
- In other cases, the permit may be cancelled, so that as far as the PTW system is concerned, the suspended job is treated as if it were new work when it is restarted. This may be the best option if the suspension of work is indefinite, and the plant can be brought to a safe condition.

8.7 PERMIT INTERACTION

It is important to make sure that one activity under a PTW does not create danger for another, even if the other work does not require a PTW. Those involved with the issue of PTW shall be aware of potential interaction, and shall ensure that when a permit is prepared, the work to be carried out, takes account of other activity currently planned or underway. It may be that the interacting activities are covered by separate responsible authorities, in which case close liaison shall be necessary, for example through cross-referencing on the permit, the task risk assessment or in the work pack. Interacting activities may make special demands upon isolation procedures if an isolation is common to more than one job, and isolations shall be clearly detailed on the permit or a supporting cross-referenced isolation certificate.

8.8 CONTROL OVER DISABLING OF MAJOR/CRITICAL SAFETY EQUIPMENT

Major/Critical Safety Equipment refers to equipment, systems, and processes that are specifically designed to safeguard the health and safety of personnel and the environment. Critical safety equipment includes, but is not limited to, the following:

Firefighting Equipment: Tools and systems used to prevent, detect, and control fires.

Safety Showers and Eye/Face Wash Stations: Emergency decontamination units for rapid treatment of chemical exposure to the body or eyes.

Emergency Communication System: Systems designed to provide clear and immediate communication during emergencies.

Breathing Air Systems: Equipment that ensures a safe air supply for personnel working in hazardous environments.

Fixed Toxic Gas Monitors: Continuous monitoring systems for detecting harmful gas levels in the air.

Alarm and Relief Devices: Safety mechanisms designed to alert personnel and mitigate risks during abnormal or emergency conditions.

Environmental Control Equipment: Systems that manage environmental conditions, such as air and water quality, to protect the environment and ensure regulatory compliance.

Critical Process Safety Interlocks: Mechanisms that automatically prevent hazardous conditions by ensuring safe operational sequences in critical processes.

These systems are integral to maintaining safety and compliance in environments with potential hazards, ensuring protection for both personnel and the surrounding environment.

Sites should have procedures in place to control the disabling of major safety equipment, as outlined below:

- **Safety Review:** Before disabling any major safety device, a detailed safety review should be conducted. This review should identify potential hazards and ensure that risk control measures are implemented. The review should be documented using the Permit to Work format to ensure that all stakeholders are informed and that safety protocols are followed.
- **Lockout and Tagout (LOTO):** All disabled safety devices, along with any equipment relying on these devices, should be locked out and tagged in accordance with the Lockout/Tagout (LOTO) standard. This prevents inadvertent operation and ensures that personnel cannot accidentally reactivate or operate equipment during maintenance or repair.
- **Warning Signs and Barriers:** Where necessary, warning signs, barriers, and danger tags should be placed around the disabled equipment to clearly indicate that the equipment is non-operational. These measures serve as visual reminders to personnel that the equipment is disabled and should not be operated until safety is restored.
- **Alternative Protection:** In cases where the process or activity protected by the disabled safety device should continue, it can only do so if an adequate alternative level of protection is provided. The safety review should identify this alternative protection and ensure it is sufficient to manage the risks.
- **Documentation and Communication:** The alternative protection method should be documented and communicated to all affected personnel. This ensures that everyone involved is aware of the new protective measures and understands their role in maintaining safety during the period when the primary safety device is disabled.
- **Timely Repairs and Replacements:** A system should be established to ensure that repairs or replacements of major safety equipment are completed as promptly as possible, minimizing the time that safety equipment is unavailable and reducing the associated risks.
- **Refer Annexure-15: Critical Safety Equipment Disabling Notification**

8.9 AVOIDANCE OF VERBAL INSTRUCTIONS

- If any equipment is required to be temporarily energized, the applicant will apply for AVI (Avoid Verbal Instruction) to authorizer. He shall ensure that all men and material is removed, and it is safe to re-energise the equipment. He shall mention the Equipment description and equipment number and sign the AVI. He shall attach 1st copy of permit along with the AVI. The AVI shall be valid only if respective permit is attached with it and it is valid for only two-hour time period.

- Authorizer shall check 2nd copy of permit and ask respective Authorized isolator (Isolation Officer) to carry out temporary re-energisation. He shall ensure that if more than one permit exists on the same equipment, he shall get AVI from all such Permit Applicant. He shall sign the AVI. He keeps the 1st Copy of PTW from all Authorizer till AVI is in force.
- Respective Authorized Isolator shall carry out re-energisation of the equipment and shall sign the AVI and handover it to Applicant.
- Applicant shall carry out necessary work with energized equipment, after completion of the work for isolating the equipment again, he shall request to Authorizer to isolate the equipment. He shall mention equipment tag no. and sign the AVI. He shall ensure 1st copy of permit is attached with the AVI. The AVI shall be valid only if respective permit is attached with it.
- Authorizer shall direct respective Authorized isolator to isolate the equipment again as mentioned in the Permit. He shall sign the AVI.
- Authorized Isolators shall carry out the isolation as mentioned in AVI & Permit. He shall sign the AVI and handover the AVI & Permit to applicant.
- Applicant shall note the isolation made and close the AVI and display the Permit at job site again and restart the work.

For Example - During crane maintenance, if a trial test reveals a knocking sound that will take 5-10 minutes to address, the situation should be handled formally rather than through verbal instructions:

- **Identify and Document:** Stop the test, assess the issue, and document it in the PTW system, noting the cause and expected delay.
- **Communication:** Ensure the issue and corrective actions are recorded in the PTW to maintain clear, traceable communication.
- **Permit Adjustment:** If necessary, extend or re-validate the PTW after addressing the issue.
- **Formal Closure:** Close the PTW formally once the maintenance and trial are completed.

The key principle is to avoid verbal instructions and ensure all actions and updates are formally documented within the PTW system.

Refer Annexure -14: Avoidance of Verbal Instruction Format

9. TRAINING AND AUTHORIZATION FOR PERMIT TO WORK STANDARD

Effective implementation of the Permit to Work (PTW) system is critical to maintaining a safe working environment. Proper training and authorization are essential for ensuring that all personnel involved in the PTW process are competent and capable of fulfilling their responsibilities. This section outlines the requirements for training and authorization related to the PTW standard.

9.1 TRAINING REQUIREMENTS

9.1.1 General PTW Training

Scope: All personnel involved in the PTW system, including Permit Authorizers, Permit Applicants, Permit Holders, and other relevant staff, should complete general PTW training.

Content: The training program should cover the purpose of the PTW system, roles and responsibilities, PTW procedures, hazard identification, risk assessment, emergency procedures, and documentation requirements.

Frequency: Initial training should be completed before personnel assume their roles, with refresher training conducted at least annually or whenever there is a significant change in procedures or regulations.

9.1.2 Specialized Training

Confined Space Entry: Personnel working in confined spaces should receive specialized training on confined space hazards, entry procedures, and emergency response.

Hot Work: Personnel involved in hot work operations should be trained in fire prevention, the use of fire protection equipment, and safe hot work practices.

Electrical Work: Personnel performing work on energized electrical systems should be trained in electrical safety, lockout/tagout procedures, and the use of personal protective equipment (PPE).

9.1.3 Competency Assessment

Assessment Methods: Competency of personnel should be assessed through practical evaluations, written tests, or on-the-job performance reviews.

Certification: Personnel should hold valid certifications or licenses relevant to their role and the type of work being performed, such as electrical certifications or confined space entry certificates.

9.2 AUTHORIZATION PROCESS

9.2.1 Authorization Criteria

Permit Authorizers: Should be individuals who have completed comprehensive PTW training and have a thorough understanding of PTW procedures, hazard assessment, and emergency response. They should also have demonstrated experience and competency in managing high-risk activities.

Permit Applicants: Should be trained in the specific requirements of the tasks they will be performing, including risk assessment and job safety analysis. They should also be familiar with the PTW procedures and documentation requirements.

Permit Holders: Should be trained and certified in relevant safety practices and procedures. They should be capable of managing and supervising the work site to ensure compliance with the PTW requirements.

9.2.2 Authorization Procedure

Appointment: Designated personnel should be formally appointed to the roles of Permit Authorizer, Permit Applicant, and Permit Holder by their respective department heads or site managers.

Documentation: Appointments and authorizations should be documented, and records should be maintained for audit and compliance purposes.

Authority Limits: Ensure that authorization levels and responsibilities are clearly defined and communicated to prevent unauthorized issuance or management of permits.

9.2.3 Continuous Improvement

Feedback Mechanism: Implement a feedback mechanism to gather input from personnel on the effectiveness of the training and authorization process. Use this feedback to make necessary improvements.

Review and Update: Regularly review and update training programs and authorization procedures to ensure they remain relevant and effective. Include updates to reflect changes in regulations, standards, or best practices.

10. RACI MATRIX

The roles and responsibilities to implement this standard are outlined below: Activity Description	Applicant	Holder	Authorizer	HOD or Line Management	S&FS
Identification and assessment of the site conditions through inspection	A	R	A	I	C
Planning, Preparation, Risk Assessment	R	R	R	A	C
Assign responsibility for implementing control measures	A	A	A	A	C
Implement the Permit-to-work Standard Prohibit working without PTWs through discipline & termination, if necessary				A	C
Train and certify JSW employees on PTW Standard & contractors, as necessary				A	C
Train and certify JSW employees on other safety standards: LOTO, WAH, Confined Space Entry, etc.				A	C
Appoint Permit Authorizer to approve PTWs				A	C
Maintain records of PTWs, as required in this Standard	A	A	A	R	C
Inspect and either approve or reject electrical tools, welding machines, hoses, cables, cranes, hoists, Lifting Tools & Tackles, Pick and carry cranes, rescue equipment, etc.	R	R	R	A	C
Periodically audit the compliance to PTW Standard				A	C
Identify First Aid & Rescue Team				A	C
Ensuring PTW conditions during job execution	A	R	R	I	C

RACI chart
R: Responsible: People who are expected to actively participate in the activity and contribute to the best of their abilities.
A: Accountable: The person who is ultimately responsible for the results.
C: Consulted: People who have the specific expertise and can contribute to decision making.
I: Informed: People who are kept informed, but do not necessarily participate in the effort.

11. MANAGEMENT OF RECORDS

To ensure compliance, traceability, and effective record-keeping, the following processes for the retention and maintenance of permits, certificates, training records, and inspection checklists shall be implemented:

- **Permits and Certificates:**
  Retain records of permits, certificates, and audit checklists for a minimum of three years or until the completion of the project, whichever is later.
- **Electrical Equipment Inspections:**
  Retain inspection records for electrical equipment for the life of the equipment or three years, whichever is longer.
- **Welding Machines Inspections:**
  Maintain records of periodic inspections for welding machines for a minimum of one year.
- **Cables, Hoses, and Torches Inspections:**
  Retain periodic inspection records for cables, hoses, and torches for one year.
- **Cranes, Slings, Lifting Cables, Hoists, and Chains Inspections:**
  Retain periodic inspection records for cranes, slings, lifting cables, hoists, and chains for a minimum of one year.
- **Training Records**
  Retain training records for a minimum of three years or until the employee is no longer employed at the site, whichever is later.
- **Completed Work Permits:**
  Retain completed work permits for a minimum of three years from the date of the permit's closure.

12. LEGAL AND OTHER REQUIREMENTS

JSW site shall access, identify, evaluate, and keep up to date the Work at Height requirement as per prevailing law in operation.

13. KEY PERFORMANCE INDICATORS

JSW sites should adhere to the standards outlined in this document. The following Key Performance Indicators (KPIs) should be established, communicated, monitored, and reported:

- Compilation of jobs exempted from the Permit to Work (PTW) system.
- Register of authorized PTW Authorizers, PTW applicant, Permit Holder and isolation officer.
- Record of any deviations from the PTW system, duly authorized.
- Count of PTWs identified as deviating from the requirements specified in the permit.
- Incidents involving accidents, injuries, and near misses in activities governed by the PTW.
- Number of training programs conducted for PTW Authorizer, Applicant, Holder etc.

14. ASSURANCE

Each site shall conduct self-assurance program to ensure compliance with this STANDARD as part of its Safety assurance program. Third party system audit shall be conducted by Group Safety or external consultants to ensure compliance with the standard.

15. DEFINITIONS

Term	Definition
Authorized Isolator (Isolation Officer)	Authorized isolator means any company employee/contractual employee identified and authorized by Site/Department head for carrying out isolation. Authorized isolator shall be different for different discipline like Electrical, Instrumentation, Mechanical and Process. Authorized isolator shall be responsible for carrying out isolation. It is recommended that Authorized isolator should have 3 years work experience in his functional area.
Certification	A verification process, which documents that a person has the necessary training, skill, and/or experience and the ability to perform designated roles and tasks.
Cold Work	All work, other than hot work, entry into confined spaces, excavation, heavy lifts, or working on electrical power distribution equipment, that does not specifically pose an unsafe condition under normal conditions. It is an activity that does not generate enough heat or cause sparks that could ignite a flammable substance.
Competent Person	A competent person is defined as an individual who has the necessary skills, knowledge, training, and experience to assess the risks associated with the work and ensure the correct safety measures are in place. The competent person can be the Operation Shift In charge, Owner of Operations, or another individual formally designated as an authorized by the Head of Department (HOD). For this standard, the authorizer should be a JSW employee who has been specifically trained and designated by the HOD to perform PTW authorization duties.
Confined Space	Includes reactors, columns, column skirts, vessels, pipelines, storage tanks, spheres, bullets, coolers, bins, silos, sumps, trenches, pits, sewers, furnaces, underground service lines, boiler drums, condensers, flue ducts, HVAC ducts, false ceilings, and floors, where a deficiency of oxygen (<20.0%) or the presence of toxic/flammable gases is likely and/or the space is not designed for human occupancy in normal circumstances.
Confined Space Entry	Entry of personnel into confined space, as described above, including the insertion of body parts, such as head, hands/arms, feet/legs, through the manhole or other openings.
Excavation	Refers to digging, road cutting, removing soil, chipping, grading, and excavation work involving the removal of earth to a depth of 30 cm or more, either using self-powered mechanical equipment or manual digging with tools such as a shovel, hoe, or pickaxe.
Fire Watcher	A Fire Watcher is an individual responsible for monitoring areas at risk of fire and taking immediate action to extinguish any flames, but only if the fires are manageable with the available equipment. If the Fire Watcher assesses that the fire exceeds the capability of the equipment to control, they should promptly raise the alarm to alert others and initiate emergency response procedures.
Gas Testing	• It is a compulsory gas level check, i.e., Oxygen content inside confined spaces prior to and during the work, H2S and Carbon Monoxide gas level check for confined spaces and hot works, and Lower Explosive Limit (LEL) in percentage for hot works.

Term	Definition
	• It has to be carried out by AGT (Authorized Gas Tester) from the Issuing Authority before handing over the area to the Executing Authority. • After handing over the area, the Executing Authority is to use a portable gas detector to monitor the gas continuously.
Heavy Lift	A load of more than five tonnes requires a Heavy Lift Certificate.
Hot Work	Includes any work involving welding, burning, soldering, brazing, blasting, gas cutting, grinding, or chipping by spark-producing tools, as well as the use of certain power-driven tools, non-flame-proof electrical equipment, or machines with internal combustion engines. This also includes any other work likely to produce sufficient heat capable of igniting flammable gases.
Lock Out / Tag Out (Energy Isolations)	Positive isolation of equipment connected to any source of power, such as electricity, mechanical energy, chemicals, hydraulic, pneumatic, or potential energy (e.g., because of elevation or gravity), for the purpose of performing work on or inside the equipment.
Major Safety Equipment	An equipment, processes and systems specifically designed to protect the safety and health of personnel and the environment.
Permit Authorizer	Permit Authorizer means company employee designated & authorized by Site/Department Head with relevant job experience who will issue work permit for respective area. Authorizer should be knowledgeable of the hazards and safety requirements for the equipment and process, and who is trained in Work Permit processes and shall be responsible to get physical isolation of all hazardous energy sources to provide safe work environment to Permit Applicant. It is recommended that Authorizer should have 5 years work experience.
Permit Applicant	The person who applies for a Permit, or Certificate as necessary, and completes the work described in the work permit and approved by the Permit Authorizer. They are responsible for ensuring that a Permit Holder is appointed and that the Permit Holder is present at all times when the work is under way. If the Permit Applicant serves as the Permit Holder for one job, then they shall not be the Applicant for any other job. The Permit Applicant should have attended a training course on this Permit to Work Standard. The Permit Applicant should be a JSW employee, and it is recommended that Applicant should have 3 years of experience in operating/maintaining the process.
Permit Holder	A person appointed by the Applicant to be in charge of one job. They are responsible for ensuring that the group of workers at the job site strictly follows the safety precautions and requirements mentioned in the Permit to Work or Certificate. The Permit Holder may be a JSW employee or a Contractor. The Applicant may also serve as the Permit Holder. However, if the Applicant becomes the Permit Holder, then they shall not be the Applicant for any other job. The Permit Holder should have attended a training course on this Permit to Work Standard.

Term	Definition
Restricted Areas	Refers to enclosures for electrical transformers, high-voltage electrical facilities, pipelines containing poisonous gases, acid/alkali pipelines, storage areas, electrical motor control cabinets, spaces surrounding electrical power lines, and equipment holding radioactive sources. It also includes any space or enclosure clearly marked as a "Restricted Area - No Unauthorized Entry."
Risk Assessment	A process used to assess the risks associated with any activity by identifying the hazards and evaluating the control measures before starting the job. Examples include Hazard Identification Risk Analysis (HIRA) and Job Safety Analysis (JSA).
Shoring	A method of protecting employees from cave-ins by excavating the sides of an excavation so that they are inclined away from the excavation to prevent cave-ins. The angle of inclination required varies with factors such as soil type and environmental conditions.
Work Permit	The written or printed legal document that is issued to establish safe working conditions for workers involved in potentially hazardous jobs. The document specifies the work, the location of the job, the time allowed for the work to occur, the potential hazards, as well as the precautions and procedures to be followed while doing the job.
Work Request / Notification	It is used to notify the maintenance department about an abnormal or exceptional situation(s) in technical objects at the plant. It is also used for planned maintenance activity and to notify planners.
Work at Height	Elevated working positions where the risk of a fall from height exists and where there is no physical protection, such as handrails, to prevent falls. Types of work covered include working from all types of ladders, scaffolds, chimneys, mechanical lifts, cranes, heavy earth-moving equipment, inside confined spaces, sloped roofs, side sheeting, painting, areas where there are no overhead tie-off points, or when working within 1.8 meters of the edge of a flat roof, erecting steel, installing/replacing roofing, and in pipe racks. This does not include normal work on low stepladders, loading platforms with fixed handrails, or similar locations.
Stand-by Person	A person trained in the use of Breathing Apparatus and appointed by the Permit Applicant or the Authorizing Signatory to standby at the point of entry into the confined space and communicate with the occupant.

16. ANNEXURES

16.1 ANNEXURE - 1: PERMIT TO WORK (HOT WORK & COLD WORK)

PERMIT TO WORK

(FRONT PAGE)

PART – A

Hot Work		Cold Work		Permit No.

Application And Work Description (Filled by Permit Applicant):
Planned Work Schedule: Date: From_____ To_____ Time: From_____ To_____
Plant_____ Location_____
Work Description_____
Permit Applicant Sign: _____ Name: _____
Authorisation for Shut down/Projects: Sign: _____ Name: _____

PART – B

1	Safety Measures Taken	Remarks (Yes / NA)	2	Potential Hazard & Special Precautions	Remarks (Yes / NA)
i	Equipment is free from Flammable/ Hydrocarbon/ Toxic Gases				
ii	Equipment Properly drained, cleaned				
iii	Water seal has been made				
iv	Bleeders have been opened				
v	Nitrogen purging has been done				
vi	Radioactive sources protected				
vii	Mechanical Ventilation (Blower)				
viii	Scaffold/Ladder/Grating/Platform				
ix	Spill Kit/Containment				
	Cylinder/Actuator resting position				
	Others_____				

Permit Applicant Name: _____	Signature: ___	Permit Applicant Name: _____	Signature: _____

3. PPE, Fire Precaution, Gas, Test & Associated certificate to be filled by Permit Applicant

3A	PPE & Others	Remark (Y/N)	3B	Fire Precaution & Gas Tests		3C	Certificates	Certificate nos.
	Eye Protection			Competent Fire Watcher			Toolbox talk	
	Face protection			Fire Extinguisher			Confined Space Entry	
	Ear protection			Pressurizes Fire Hose			LOTO	
	Leg protection/Apron			Fire Tender			Electrical	
	Head protection			Screen of Areas			Scaffolding	
	Body protection			Explosive Test			Working at Height	
	Full Body Safety Harness			Carbon monoxide test			Excavation	
	BA Set/ ELBA			Oxygen test			Heavy Lift	
	Dust Mask			Toxic Gas test			Road Closure	
	Safe Means of access						Radiography	
	Enclosures						Hydra/Fauna	
	Scaffolding							
	Roof Ladder							
	Gas Cutting Set							

Part - C

Permit Applicant Contact no.: _____
Name: _____ Sign: _____

Permit Holder Contact no.: _____
Name: _____ Sign: _____

Permit Authorizer Date: From _____ **TO** _____ **Time: From** _____ **TO** _____
Permit Validity Sign _____ **Name** _____ **Contact No** _____

Part - D

4A	**Permit Return- Work Complete**		**4B**	**Permit Return Work not complete**	**Permit cancellation**
4.1	**Permit return by Permit holder: Work complete**		**4.1**	**Permit Return by Permit Holder: Work not complete**	
	Work Site & Equipment affected left in safe condition. Sign: _____ Name: _____ Date: _____ Time: _____			Work Site & Equipment affected left in safe condition. Sign: _____ Name: _____ Date: _____ Time: _____	
4.2	Permit Return by **Applicant**: Sign: _____ Name: _____ Date: _____ Time: _____		**4.2**	Permit Return by **Applicant**: Sign: _____ Name: _____ Date: _____ Time: _____	
4.3	Permit Return by **Authorizer**: Sign: _____ Name: _____ Date: _____ Time: _____		**4.3**	Permit Accepted by **Authorizer**: Sign: _____ Name: _____ Date: _____ Time: _____	

Part - E

Renewal - 1

Permit Applicant	Cont. no.: _____	**Permit Holder**	Cont. no.: _____
Sign: _____ Name: _____		Sign: _____ Name: _____	

Permit Authorizer Date: From: _____ To: _____ Time: From: _____ To: _____
Permit Validity Sign: _____ Name: _____ Cont. no.: _____

Certificates	Working at Height		Confined Space		Electrical		LOTO		Heavy Lift	
Tick Mark	Radiography		Excavation		Road Closure		Scaffolding		Hydra/Farana	

Renewal - 2

Permit Applicant	Cont. no.: _____	**Permit Applicant**	Cont. no.: _____
Sign: _____ Name: _____		Sign: _____ Name: _____	

Permit Authorizer Date: From: _____ To: _____ Time: From: _____ To: _____
Permit Validity Sign: _____ Name: _____ Cont. no.: _____

Certificates	Working at Heigh		Confined Space		Electrical		LOTO		Heavy Lift	
Tick Mark	Radiography		Excavation		Road Closure		Scaffolding		Hydra/Farana	

Extension for Road Closure

Date	Applicant			Holder			Authorizer		
	Sign	Name	Cont. no.	Sign	Name	Cont. no.	Sign	Name	Cont. no.

	Portable CO monitor																				

***RISK ASSESSMENT IS MANDATORY FOR ALL TYPES OF PERMITS**

Safe limit of gases/vapours

Gas	Safe Concentration for 8 Hours (PPM & % Volume)	Flammable Limit	
		Lower	Upper
Oxygen	19.5-23.5 % Volume		>23,5%
Carbon Monoxide	50 PPM	12.5%	74.2%
Hydrogen	-	4.0%	75%
LPG	1000 PPM	2.2%	9.9%
Ammonia	25 PPM	15%	23%
Chlorine	1 PPM	-	-

Important Instructions

1. Permit is valid for one shift, and it can be extended for two shifts (Permit Validity 24 hrs Max) except for Road Closure, which is valid for seven days and is signed by the Authorizer every 24 hours.
2. Permit is not valid in the event, if condition in the immediate area become Hazardous from condition not existing when this permit was issued/or in the event of any Emergency/Fire.
3. The authorized person should issue permits only.
4. All working instructions & protocols are strictly to be followed.
5. If not completed within the valid time period, re-approval is required.
6. Permit should be returned by the applicant to permit authorizer after job completion.
7. Agencies should coordinate for safety when working together.
8. No job should be attempted without a permit.
9. Workers should be briefed about imminent dangers before starting.
10. Persons working at heights and confined spaces should be medically fit.
11. Certificates are required for activities like Excavation, Working at Height, Scaffolding, etc.
12. Confined Space Entry results should be periodically recorded.
13. Risk assessment is mandatory for all permits.

Emergency contact numbers

Emergency Team	Mobile	Extension
Fire Service		
Medical Centre		
Security		
Utility		
Energy Management		
Transport		
Environment		
Human Resource		
Centralized E&A (LVPD)		

Note: The emergency contact numbers shall be updated in accordance with the requirements of each specific site.

16.2 ANNEXURE - 2: WORKING AT HEIGHT CERTIFICATE

WORKING AT HEIGHT CERTIFICATE

Yellow Permit Applicant / Holder, White – Works Site, Green – Authoriser Copy
THIS IS NOT A PERMIT TO WORK

Certificate No._____

Section: 1 To be filled by Permit Applicant		**Permit No.**			
Date of Issue		Permit Valid From ..... To ..... If Permit / Holder changed, then their Name & Signature should be Incorporated in the format.			
Applicant's Name		Sign.		Dept.	
Location					
Description of work					

Action Taken by Permit Holder : Please tick the relevant action taken in the box provided				
Sr.No.	Safety Checks for Compliance	Yes	No	NA
1	Risk Assessment has been carried out for the job & attached with this permit (MANDATORY REQUIREMENT)			
2	Contractor & their work men have been fully briefed about the risk associated with the job			
3	Whether Safe access to work is provided			
4	Work platform provided with guard rails			
5	Adequate fall protection arrangement made (Double Lanyard Harness, Fall arrestor, life line, Safety Net)			
6	Are the workmen medically fit for working at height job			
7	Is the work area away from the vicinity of moving objects			
8	Protection against objects falling from above height			
9	Whether area below, where the height work being performed is cordoned & unauthorised entries are restricted			
10	Work at more than one elevation at the same segment is restricted			
11	Other specified precautions			

Name of the Permit Authoriser	Department	Signature	Date	Time

Section : 2 Acceptance (Permit Holder)	
I understand the work which is to be carried out and the method of work to be used to ensure that it is carried out safely. No work will be carried out other than the work authorised by this permit.	Name Date & Time Signature

Extension / transfer of Permit		All checks reviewed & found OK to extend permit / Remarks				Remarks
Date	From	To	Permit Holder Signature	Permit Applicant Signature	Permit Authorised Signature	

Section : 3 Completion (Permit Holder)	To be completed by the Permit Holder after completion of the work & handed over to Permit Applicant/Authoriser
Permit Holder Signature Date & Time	

Section-4: Cancellation: I declare that this permit is now cancelled. No further work at height is allowed until a new permit is issued.

Permit Applicant	**Permit Authoriser**	**Date**	**Time**	**Remarks**

Note:	1. This permit Applies only to work in the location described. Any further height work should have another permit issued for prescribed validity.
	2. This permit only applies to the person to whom it is issued. If work has to be continued by someone else, this permit should be returned to authorizer for cancellation and another permit issued.

16.3 ANNEXURE - 3: CONFINED SPACE ENTRY CERTIFICATE

CONFINED SPACE ENTRY CERTIFICATE

Yellow Permit Applicant / Holder, White – Works Site, Green – Authoriser
THIS IS NOT A PERMIT TO WORK

1. APPLIED BY PERMIT APPLICANT (To be filled by Applicant)

Sign …… Name…… Date ……	Plant …… Location …… Equipment ……	Certificate No. Permit No. ……
Description of Confined Space:	Work Description:	Equipment/Tools/Chemicals used for this Work:

2. TYPE OF HAZARDOUS WORK

Combustion Hazards
Welding _____
Burning _____
Open flame _____

Spark Producing
Chipping _____
Grinding _____
Drilling _____

Electrical _____
Rotating space _____
Task-generated _____

__ Toxic material_____
__ Corrosive material_____
__ Biological agents_____
__ Chemical and jet clearing
__ Disconnect and blank

__ Spilled material_____
__ Flammable material_____
__ Electrical Close clearance
__ Fall prevention
__ Hazardous materials from drains, sumps

__ Adjacent Processes_____
__ Hot Equipment or process _____
__ Radioactivity
__ Tightening joints under Pressure
__ Welding fumes and heat

__ Working on unguarded. equipment
__ Other_____
_____
_____
_____

3. SAFETY PREPARATIONS

Personal Safety
__ Protect against _____ by _____
__ Fresh air blower
__ Fresh air mask
__ Escape air pack
__ Dust respirator
__ Coveralls
__ Safety Shower
__ Acid suit
__ Acid hood
__ Face shield
__ Chemical goggles
__ Rubber gloves
__ Rubber boots
__ Ear Protection
__ Other barrier Clothing
__ Evacuation instructions
__ Two escape routes
__ Lifeline harness
__ Chemically resistant lifeline
__ Lifeline belt/wristlets
__ Fire Alarm box
__ Escape ladders
__ Mechanical extraction device

Communications:
__ Telephone __ Radio __ Other
__ Location/type of additional assistance (third alternate) _____
Remarks
_____

Space Preparation
__ Isolate
__ Lockout/tag out
__ Disconnect and blank
__ Post work signs
__ Rope off work area
__ Erect barricade
__ Block roadway
__ Protect against external hazards

Electrical Precautions
__ Lock out circuits
__ Pull fuses
__ Spark containers and shields
__ Welding arc protection
__ Ground fault interruption
__ Proper grounding

Equipment Cleaning and Draining
__ Steam_____
__ Fill and drain_____
__ Remove deposit_____
__ Visual Inspection_____
__ Neutralize contents_____

Fire Safety
__ Specify fire watch in "Remarks"
__ Area alarm no._____
__ Fire hose laid out
__ Water hose running
__ Keep area wet
__ Cover sewer openings
__ CO2 Extinguisher
__ Dry powder extinguisher
__ Other_____

4. Any other Observations: _____
Person carrying out the test Name: _____ Sign: _____

5. CHECKLIST	Items to be checked by Area in-charge before confined space entry can proceed			
1.	a. The above equipment has been isolated from all sources of dangerous liquid gases and fumes by Insertion of spades by removing a section of pipe work and blanking open end of the circuit	Yes	No	NA
1	b. Equipment has been isolated from all sources of electrical and mechanical power			
	Equipment free of all dangerous materials. All flushing /inert gas purging completes, all liquid drained and ventilation atmosphere restored in confined space			
	Equipment surrounding area checked and safe from hazard arising from other work/operation			
	Lifeline, breathing apparatus and resuscitation equipment available			
	Adequate access and escape routes are provided			
	Fresh air supply equipment installed and operational. vessel sufficiently cooled for access			
	Procedure and rescue plans formulated and discussed with permit holder, personnel entering vessel and stand by personal. vacation exercise conducted where stated as required on permit			
	Stand by personal appointed			
	Fire Extinguishers / Fire Hydrant line available?			
	All persons engaged for working provided required training?			

Name of the area in-charge: _____ Sign: _____ Date: _____ Time: _____

6. GAS TESTING

RESULT OF TEST	GAS	LIMIT	RESULTS
	OXYGEN	19.5-23.5% VOL	%
	HYDROCARBONS	0% LEL for Hot work	%
	CO	50 PPM (0.005%)	PPM
	NH3	25 PPM	PPM
	TEMPERATURE		°C
	DUST	10mg/Cu.M	mg/Cu.M
	Any other fumes		

Confined Space Tested (Please refer to the Confined Space Standard for further details on testing values.)
I have tested this space for the above gases, with the results shown.
GAS TESTER: Name_____ Signature_____ Date_____ Time_____

7. TEST HAVE BEEN CARRIED OUT IN THE ABOVE-MENTIONED CONFINED SPACE AND ENTRY IS PERMITTED AS INDICATED BELOW.
Recommendation for Periodic Checking _____ minutes/Hrs (Subsequent gas testing reports shall be recorded)

Entry into the confined space is permitted with / Without Breathing Apparatus.
From Date_____ Time_____ Until Date_____ Time_____

Entry wearing Breathing Apparatus subject to the following conditions.

i. An observer should be positioned outside the confined space.

ii. Where practicable, each man is wearing belt or harness with lifeline attached and that the observer positioned outside is holding the free end of the lifeline and is capable of pulling out the men.

8. PERMIT APPLICANT	9. PERMIT HOLDER
I understand all the above safety precautions. I will ensure that work only take place when all these safety precautions are complied with.	
Name: Sign: Date: Time:	Name: Sign: Date: Time:

PERMIT AUHTORISER:
I certify that the above results indicate that the confined space covered by this certificate is safe to enter.
NAME: SIGN: DATE: TIME

RETURN OF PERMIT TO WORK

The work planned inside the confined space is completed / incomplete / not taken up. The confined space and the equipment therein are left in safe condition. The permit to work Permit No: _____ issued based on this certificate shall be closed.

PERMIT APPLICANT	PERMIT HOLDER	PERMIT AUTHORISER
Name:	**Name:**	**Name:**
Sign:	**Sign:**	**Sign:**
Date: Time:	**Date: Time:**	**Date: Time:**

16.4 ANNEXURE - 4: EXCAVATION CERTIFICATE

EXCAVATION CERTIFICATE

Yellow Permit Applicant / Holder, White – Works Site, Green – Authoriser Copy

THIS IS NOT A PERMIT TO WORK

1. APPLIED BY PERMIT APPLICANT (Applicant has to take clearance from all the concerned Departments)

Sign ……. Name…… Date …….	Plant ……. Location …… Equipment ……	Certificate No. Permit No. …….

2. DETAILS OF EXCAVATION Limits of excavation to be shown on as built drawing attached to this certificate

Dimensions of Excavation		**Duration of Excavation**	
Length	_____Mtrs	From	
Width	_____Mtrs	To	
Depth	_____Mtrs	Extension	
Nature of Excavation		**Actual Timeline of Work**	
By Hand		Stared on	
By Machine		Completed on	

3. DETAILS OF EXISTING UNDERGROUND SERVICES NEAR EXCAVATION

4. DEPARTMENT APPROVAL (Department to be consulted to be specified by responsible Executive)

I have examined the drawings of the proposed excavation, and of adjacent underground services, I confirm that the excavation may proceed, subject to any comments noted below.

DEPARTMENT	REMARKS/CONDITION/OBSERVATION	SIGNATURE	NAME	DATE
TELECOM/I.T.				
ELECTRICAL/ INSTRUMENT				
CIVIL				
ENVIRONMENT, HEALTH & SAFETY				
UTILITIES				
OTHERS				

HEALTH & SAFETY REQUIREMENTS

Requirements	Yes	No	Requirements	Yes	No
Fire Extinguisher nearby			Warning Signs		
Warning light during night			Barriers		
Fire engine nearby			Dust/Gas mask		
Excavation traffic board			Ear defenders		
Remove debris/arrange are			Safety goggles		
Hazardous item available			Face shield		
Breathing Apparatus			Probing		

5. PRECAUTIONS

5.1 Cable detector to be used over proposed route _____

5.2 Pilot Trenches to be hand-dug to locate services _____

5.3 Excavation may be carried out by mechanical.
Means of after pilot trenches are completed,
But no closer than 1 mtr of service.

5.4 Any excavation involving removal of trees or _____
plants shall obtain requisite permission from the H&S Department

6. PERMIT AUTHORISER	7. PERMIT HOLDER
I Authorised the Excavation work specified above to be carried out, subject to the nominated safety precaution and conditions being maintained during the validity period of the permit(s) to work. Specified in the certificate. Sign:…….. Name …… Date:…….. Time ……	I understand all the above safety precautions: I will ensure that work only takes place when all these safety precautions are complied with. Sign:…… Name……... Date:…… Time ……

16.5 ANNEXURE - 5: LOCK-OUT TAG-OUT CERTIFICATE

LOCKOUT TAGOUT CERTIFICATE

Yellow Permit Applicant/Holder, White – Works Site, Green – Authoriser

THIS IS NOT A PERMIT TO WORK

FRONT PAGE

1. APPLIED BY PERMIT APPLICANT (Applicant should take clearance from all the concerned Departments)

Sign ……. Name…… Date ……	Plant …… Location …… Equipment to be isolate……..	Certificate No……..			
			For renewal of 7 days	**Sign Mech/Auth**	**Sign Elec/Auth**
		Permit No.			
		Permit No.			
		Permit No.			
		Permit No.			
		Permit No.			

2. ELECTRICAL ISOLATION

	Controls	**Padlock No.**	**Tag no.**	**Remarks**
2.1	Switched Off			
2.2	Main Fuses removed			
2.3	Control Fuses			
2.4	Padlocking			
2.5	Breakers			
2.6	Other Precautions			
2.7				
2.8				
2.9				

I hereby confirm that above isolation and precautions have been taken, the equipment has been proven isolated by test and all concerned/ affected individuals has been adequately informed.

LOTO Performer Name_____ Sign_____

Date_____ Time_____

Name of the Isolation Officer

Name_____ Sign_____

Date_____ Time_____

3.0 MECHANICAL ISOLATIONS

	Control (Mechanical, Pneumatic, Hydraulic, etc.)	Padlock No.	Tag No.	Remarks
3.1	Switched off			
3.2	Main Fuse removed			
3.3	Control Fuses			
3.4	Pad locking			
3.5	Breakers			
3.6				
3.7				
3.8				
3.9				
3.10				

I hereby confirm that above isolation and precautions have been taken, the equipment has been proven isolated by test and all concerned/affected individuals has been adequately informed.

LOTO Performer

Name…….
Sign……

Date…….
Time…….

Name of Isolation Officer
Name…….
Sign……

Date…….
Time…….

4.0 COMPLETION OF WORK

I hereby confirm that the task detailed in section1 above is completed, the personnel and equipment withdrawn, and the isolation may now be removed by a completest person.

Applicant: Name …… Sign ……
Date…… Time……

5.0 CONFIRMATION OF DE-ISOLATION

I hereby confirm that the isolation detailed in section 2/4 has been removed and the system energized.

a. Authorised person: Sign……. Date…….. Time……
b. Authorised person: Sign……. Date…….. Time……
c. Isolation Officer: Sign……. Date…….. Time……

6.0 LONG TERM ISOLATION

I hereby confirm that the task detailed in section 1 above is not completed and the equipment has been entered as a “Long Term Isolation”, I have placed the equipment isolation keys and a copy of this certificate in the “Long Term Isolation Box”,

a. Permit Applicant: Sign…… Date ……. Time……
b. Area Authoriser: Sign…… Date ……. Time…….
c. Isolation Officer: Sign…… Date ……. Time…….

- Note: When the isolation of the equipment is for more than 7 days It will be considered as long term isolation and Authorizer should be section head. A copy of LOTO LONG TERM Isolation protocol shall be placed at isolation point.

- *Permit numbers to be mentioned on daily basis in existing LOTO certificate for renewal up to7 days if the activity breaks/gaps within 7 days new certificate to be obtained.
- LOTO performer: A JSW employee or JSW associate/out-sourced employee trained and authorized in the lockout/tag out procedure to perform isolations.
- LOTO authorizer: Should be JSW in-charge employee trained and authorized in the lockout/tag out for Electrical/Mechanical.

16.6 ANNEXURE - 6: HEAVY LIFT CERTIFICATE

HEAVY LIFT CERTIFICATE

Yellow Permit Applicant / Holder, White – Works Site, Green – Authoriser

THIS IS NOT A PERMIT TO WORK

Permit No._____ **Certificate No.** .....

Location _____ Date _____ Time _____

Lift Information	
Description of Load	
Weight of Load	
Dimensions	
Equipment & Load Information	
Crane	
Type	
Model	
Competent Person Test Certificate Validity	
Crane Information	
A. Maximum Operating Radius	
B. Main Boom Length	
C. Jib Length	
D. Jib Offset	
E. Attachments (Luffing Jib, Super Lift)	
F. Counter Weight required	
G. Vertical Clearance between Boom Hook & Load	
Competency of Crane Operator (Mention the Details)	
Driving License :	
Medical Fitness :	
Certified (OEM) Training:	
Crane Operator Name:	Sign
Site Conditions	
H. Obstructions	
I. Distance from Power Lines	
J. Ground Stability	
K. Underground Utilities	
L. Wooden Stoppers or Mats needed?	

Calculations		
M. Lifting Capacity		
N. Weight of Load		
O. Total Weight of accessories		
P. Total Weight of Lift (N+O)		
*Authorised Engineer	Name	Sign

*Authorised engineer should undergo Permit to Work, Lock out and Tag out, Working at Height, Confined Space Entry Trainings.

16.7 ANNEXURE - 7: PICK AND CARRY CRANES (F-15) CERTIFICATE

PICK AND CARRY CRANES (F-15) CERTIFICATE

(Pick & Carry Crane)

Yellow - Permit Applicant/ Holder; White - Works Site, Green - Authoriser Copy

THIS IS NOT A PERMIT TO WORK

1. Department _____ Certificate No. _____

2. Section / Location _____ Permit No. _____

3. Pick and carry cranes Work _____ Name of the working Agency _____

Job Duration: Start Date _____ Time From _____ To _____ End Date _____

Sl. No.	Activities (Sequence of Work)	Hazards	Safety Precautions	Persons Responsible Name	Condition of tools/Tackles required Ok/Not Ok	Reference to document/ Criteria and remarks
1	General Check to be done before starting the Pick and carry cranes crane		Competent Person Test Certificate			
			Operator Fitness(a) OEM Training(b) License (c)			
			Inspect the boom for any damages or defects			
			Before starting the Pick and carry cranes crane, check all routine pre-operation are done			
2	Handling of Materials by Pick and carry cranes	Toppling of New generation Pick and carry cranes	Proper handling of Pick and carry cranes will be done as per Pick and carry cranes manufacturer chart			
			Pick and carry cranes Movement area (40 mtrs within fabrication yard) will be clear & 8M width road will be provided			
			Flagman will be provided			
			Pick and carry cranes to be placed on level ground			
		Fall of Materials	Overloading of Pick and carry cranes will not be allowed while working at site			
			Tested slings & D Shackles should be used			
		Hit by Pick and carry cranes to men & materials	No oblique pulling to be done with Pick and carry cranes			
			No man & Materials will stand within movement area of Pick and carry cranes			
			Proper guards will be provided for front and rear wheel to avoid accident			
		Hit by crane to fuel & Oxygen cylinders	Storeroom of Oxygen & Fuel cylinders will be provided			
			Oxygen cylinders should not be kept within crane movement area			
		Failing of crane brakes	Fitness proof of vehicles will be provided for work			
			VT-trained person will be engaged to operate crane			
		Pick and carry cranes operations suddenly stopped in load lifting & shifting conditions	Foreman will be provided for supervision while lifting of materials within 40 mtrs in fabrication yard			
			After unloading the lifting material, crane operations will be stopped			
		Collision of Pick and carry cranes	Minimum 6mtrs distance to be maintained from crane working zone			
			Pick and carry cranes should not travel near the crane while working			

Permit Applicant Signature _____ Permit Holder Signature _____ Permit Authoriser Signature _____

16.8 ANNEXURE - 8: ELECTRICAL CERTIFICATE

ELECTRICAL CERTIFICATE

THIS IS NOT A PERMIT TO WORK

Yellow Permit Applicant / Holder, White – Works Site, Green – Authoriser Copy

Hot Work / Cold Work Permit – Permit No._____ **Certificate No._____**

A) Plant / Area: _____ **Equipment Tag No._____**

Location of the job:

Details of the job: _____

_____

Name of the contractor: No. of Workers:

B) Clearance by Operations

Clearance from operations dept. is hereby granted for carrying out the above job.

Name	Signature	Date	Time

C) Precautions taken (Tick mark which are applicable, strike out whichever not applicable)

Normal Supply	Alternative Supply	
__	__ Switches put “Off”	__ Earth Continuity checked
__	__ Power Fuse removed	__ Use electrical gloves rated 11/33 kV
__	__ Control/space heater fuses removed	__ Other _____
__	__ Breaker racked out	
__	__ Do not Operate tags provided, Tag No._____	
__	__ Termina; / Cable earthed and short-circuited	

D) Special Instruction:

_____

_____

E) Applicant & Authoriser: Certify that the precautions are fulfilled and work site plus equipment are ready and safe for the Job.

Permit is valid up to ____ hrs. on_____ unless extended as per Section F

	Designation	Name	Signature	Date	Time
Applicant	Certified Electrical Person				
Authoriser	Certified Electrical Person				
Holder	Certified Electrical Person				

F) Extension of Validity (to be renewed every shift – max validity – 24 Hrs.)

Conditions checked and the permit is re-validated as under:

	Applicant		Authorised by		Extended up to	
	Name	Signature	Name	Signature	Date	Time
Extension 1						
Extension 2						

G) Job Completion and closure of certificate: Job is completed, and we have inspected the site & found the area cleared of men and materials. Temporary earths also removed.

Certificate is hereby closed.

	Name	Signature	Date	Time
Applicant				
Authoriser				
Holder				

16.9 ANNEXURE - 9: RADIOGRAPHY CERTIFICATE

RADIOGRAPHY CERTIFICATE

Yellow Permit Applicant / Holder, White – Works Site, Green – Authoriser

THIS IS NOT A PERMIT TO WORK

1. APPLIED BY PERMIT APPLICANT (Applicant has to take clearance from all the concerned Departments)		
Sign …… Name…… Date ……	Plant …… Location …… ……	Certificate No. Permit No. ……

2. REASON FOR RADIOGRAPHY						
3. SITE PREPARATION						
1. Is adequate warning given to persons in the area prior to and during radiographic work		5. Are other plants informed?				
2. Is evacuation of all non-radiography personnel from the unsafe area done		6. Are other work permits withdrawn?				
3. Are safety features, warning signs and barriers errected to secure area		7. Does the information given to truck scales?				
4. are the licensed persons carrying out the job equipped with personal dosimeter/survey meter		8. Source/Strength			Curie	
		9. Safe distance		Meters		

4A. GENERAL INFORMATION :

RADIATION SOURCE :

1. X-RAY APPARATUS : MAKE_____

TYPE_____

MAX. TUBEVOLTAGE _____KV

2. RADIOACTIVE SUBSTANCE

SEALED	UNSEALED

TOTAL ACTIVITY_____ HALF LIFE_____

ISOTOPE _____

TYPE OF RADIATION

ALPHA	BETA	GAMMA	NEUTRON

4B. Required PPE							
Respiratory		**Eye, Head, Hearing**		**Body, Hand, Foot**		**Mandatory**	
Self contained BA		Face shield		Heat protective clothing		Safety shoes	
Fresh air mask		Google/spectacles		Gloves		Safety helmet	
Full/Half face gas mask		Ear defenders		Safety harness		Protective coverall	
Dust Mask							

4C. SPECIAL PRECAUTION TO BE TAKEN:

_____

_____

Caution: In case of emergency, the radiation source shall be immediately retracted into its protection container and its protection container and the radiography team shall evacuate the area with radiation source in its exposure protection container.

5. PERMIT AUTHORISER	**6. PERMIT HOLDER**
I Authorised the radiography test specified above to be carried out, subject to the nominated safety precaution and conditions being maintained during the validity period of the permit(s) to work. Specified in the certificate. Sign:…….. Name …… Date:…….. Time ……	I understand all the above safety precautions; I will ensure that work only takes place when all these safety precautions are complied with. Note: Part A&B to be filled by the Radiation Protection Supervisor Only Sign:…… Name…….. Date:……. Time ……

16.10 ANNEXURE - 10: CERTIFICATE FOR CLOSURE OF ROADS

CERTIFICATE FOR CLOSURE OF ROADS

Yellow Permit Applicant / Holder, White – Works Site, Green – Authoriser

Permit No._____ **Certificate No.**_____

A) Plant/Area: _____ **Equipment Tag No.** _____

Location of the job: _____

Details of the job/reason for closure _____

_____

Name of the contractor: _____ No. of Workers: _____

B) Precautions taken (Tick mark which are applicable, strike out whichever are not applicable)

__ Alternate route for the traffic arranged, please specify _____

__ Temporarily barricade using caution tapes.

__ Physically barricades using pipes/rods.

__ Warning signs installed at 50M, 100M & 150M (road diversion, men at work, night lamp, etc.)

C)Clearance by Other Departments

1. Fire Department

Alternate route indicated is __ Okay. __ Not Okay

If not Okay, suggestion for alternate route:

_____

2. Security Department

Alternate route indicated is __ Okay. __ Not Okay

If not Okay, suggestion for alternate route:

_____

	Name	Signature	Date	Time
Fire Dept.				
Security Dept.				

D) Additional Precautions / Special Instruction:

_____

_____

E) Authoriser & Applicant: Certify that the precautions are fulfilled and work site, equipment are ready and safe for the job

Permit is valid up to _____ hrs, on _____ unless extended as per Section F.

	Designation	Name	Signature	Date	Time
Applicant					
Authorised by					
Permit Holder					

F) Extension of Validity (to be renewed every day – Max validity – 7 days.)

Conditions checked, and the permit is re-validated as under:

	Extended by Applicant		Authorised by Authoriser		Extended up to	
	Name	Signature	Name	Signature	Date	Time
Extension 1						
Extension 2						
Extension 3						
Extension 4						
Extension 5						
Extension 6						

G) Job Completion and closure of permit: Job is completed, and we have inspected the site & found the area cleared of men and materials. Temporary earths also removed.

The certificate is hereby closed.

	Designation	Name	Signature	Date	Time
Applicant					
Authorised by					
Permit Holder					

16.11 ANNEXURE - 11: SAFETY TOOLBOX TALK

SAFETY TOOLBOX TALK				
Date & Time:		**Shift:**	**Permit No.:**	
Location:		**Department/Section:**		
Sr. No.	**Points Discussed/ Instructions Given**			
1				
2				
3				
4				
5				
6				
7				
8				
Attended by:				
Sr. No.	**Name**	**Designation**	**E No./Gate Pass No.**	**Signature**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
Toolbox Talk Performed by Name & Designation			_____ **Signature**	

16.12 ANNEXURE - 12: RISK ASSESSMENT FORMAT

Permit No._____

No._____

Yellow Permit Applicant / Holder, White – Works Site, Green – Authoriser Copy

THIS IS NOT A PERMIT TO WORK
RISK ASSESSMENT FORMAT

Section/ Dept.:	**Activity:**

S. N.	Basic Job Steps	Potential Hazards	Consequence	Current Control Measure

16.13 ANNEXURE - 13: CONFINED SPACE ENTRY LOG & SUBSEQUENT GAS TEST RECORDS

Permit No._____

CONFIRMED-SPACE ENTRY LOG & SUBSEQUENT GAS TEST RECORDS

Confined Space Identification Number: Unit/Location:

All entrants and attendants have been instructed about potential hazards, safety precautions, and specified protective emergency equipment.

1. Confined-Space Entry Log

Name (all persons entering or attending)	Date	Time in	Sign	Time out	Sign

1. Confined-Space Entry Log

DATE	TIME	RESULT OF GAS TETS				SIGNATURE OF TESTER
		CO	O2	NH#	HYDROCARBON	

16.14 ANNEXURE -14: AVOID VERBAL INSTRUCTION (AVI) FORMAT

Avoid Verbal Instructions (AVI) *(Valid only if presented along with Applicant copy of work permit)*
To be filled and ensure by Applicant **Plant/Area:** **Dept/Sect:** **General work Permit no.:** **Description of work:**
To: Authorizer, I have physically ensured that all manpower is removed. Please temporarily energized the equipment. **Tag No:** **Equipment description:** **LOTO Tag no.:** **Name of Applicant:** **Sign:** **Date:** **Time:**
To: Electrical & Instrument Auth. Isolator: **Please temporarily energized equipment as above** **Name of Isolator:** **Sign:** **Date:** **Time:**
I have energized the equipment as stated above **Name of Auth. Isolator:** **Sign:** **Date:** **Time:**
Closure of AVI
To Authorizer, **Please isolate the equipment tag no:** **Name of Applicant:** **Sign:** **Date:** **Time:**
To: Electrical & Instrument Auth. Isolator: **Please carry out isolation of the equipment no.** **Name of Isolator:** **Sign:** **Date:** **Time:**
To Authorizer, I have isolated the equipment tag no. **Name of Auth. Isolator:** **Sign:** **Date:** **Time:**
Noted that equipment is isolated again, AVI is cancelled. Work can be start now. **Name of Applicant:** **Sign:** **Date:** **Time:**

16.15 ANNEXURE -15: CRITICAL SAFETY EQUIPMENT DISABLING NOTIFICATION

Critical Safety equipment Disabling-Notification			
Sr no.: Section: Department: Detail of critical safety Equipment being disabled:			
Person coordinating disablement: Contact no.: Purpose:			
Duration of disablement: Date: Time: From_____ To_____			
Alternate protection during Disablement			
1			
2			
3			
4			
Specific instruction during Disablement (Additional Precautions)			
1			
2			
3			
4			
List of affected employees (Please write names and sign)			
1		4	
2		5	
3		6	
Note: All affected employees need to be firmly notified about disabling if critical safety equipment. Signed copy by all affected person should be attached with Safety review (SWP) document.			

17. REFERENCE

References Document	Full Title, Brief Description and Web Links
1. Occupational Safety and Health Administration (OSHA)	OSHA is a part of the United States Business Unit of labor to ensure safe and healthful working conditions for workers by setting and enforcing standards by providing training, outreach, education, and assistance. Electrical - Overview | Occupational Safety and Health Administration (osha.gov) Electrical - Standards | Occupational Safety and Health Administration (osha.gov) eTool : Construction - Electrical Incidents | Occupational Safety and Health Administration (osha.gov) Electrical - Training | Occupational Safety and Health Administration (osha.gov)
2. Health and Safety Executive	The health and safety executive are Britain's National regulator for workplace health and safety dedicated to protecting and prevent people and places. Electrical standards and approved codes of practice - Electrical safety (hse.gov.uk) Guidance on permit-to work systems - A guide for the petroleum, chemical and allied industries
3. ANSI - American National Standards Institute	As the voice of the US standards and conformity assessment system, the American National Standards Institute empowers its members and constituents to strengthen the US marketplace position in the global economy while helping to assure safety and health of consumers and the protection of the environment. Electrical Safety Archives - ANSI Blog NFPA 70E-2018 - NFPA 70E Standard for Electrical Safety in the Workplace®, 2018 edition (ansi.org)
4. NFPA – National Fire Protection Agency	NFPA stands for the National Fire Protection Association, a global nonprofit organization dedicated to eliminating death, injury, property, and economic loss due to fire, electrical, and related hazards. NFPA develops codes and standards, conducts research, training, and education, and provides information and advocacy on fire safety. NFPA 70E Standard Development
5. European Standards	

References Document	Full Title, Brief Description and Web Links
▪ 2014/35/EU Directive Electrical safety: low-voltage electrical equipment	Directive - 2014/35 - EN - Low Voltage Directive - EUR-Lex (europa.eu)
▪ IEC 60364 “IEC Electrical Installation Guide”	IEC 60364-1 - Low-voltage electrical installations - Part 1: Fundamental principles, assessment of (iteh.ai)
▪ EN 50110 “Operation of electrical installations “	EN 50110-2:2023 - Operation of electrical installations - Part 2: National annexes (iteh.ai)
▪ EN 61010 “Safety requirements for electrical equipment for measurement, control and laboratory use “	EN IEC 61010-2-061:2021 - Safety requirements for electrical equipment for measurement, control and (iteh.ai)
▪ EN 60335 “Household and similar electrical appliances “	EN 60335-1:2012/A1:2019 - Household and similar electrical appliances - Safety - Part 1: General (iteh.ai)
▪ EN 60204-1 “Safety of machinery - Electrical equipment of machines “	EN 60204-1:2018 - Safety of machinery - Electrical equipment of machines - Part 1: General (iteh.ai)
▪ EN 61029 “Safety of transportable motor-operated electric tools”	EN 61029-1:2009 - Safety of transportable motor-operated electric tools - Part 1: General (iteh.ai)
▪ EN 50160 “Voltage Characteristics of Public Distribution Systems	

JSW Group

MANAGEMENT STANDARD:
CONVEYOR SAFETY STANDARD
JSW/GHS/GS-09

MANAGEMENT STANDARD CONVEYOR SAFETY STANDARD

Management Standard Title:	**Conveyor Safety Standard**	**Date of Revision**	10.12.2024
Document	JSW/GHS/GS-09	**Revision**	01

Document Issue and Revision History

Date	Revision Number	Change Summary
10.12.2024	01	Cross-references have been included. Section 8.3 aligned with Machine Guarding Standard

Prepared by	KNV Kiran Kumar
Signature	
Position	Group Head Safety

Authorised by	G S Rathore
Signature	
Position	COO & WTD

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1. PURPOSE

The Conveyor Safety Standard (hereinafter referred to as 'STANDARD') is intended to provide the framework for preventing worker exposure to conveyor by reducing the frequency of under conveyor clean up, conveyor maintenance, removing jams etc. and to enable designers, manufacturers, suppliers, user employees of conveyor and conveyor system to minimize the risk to health and safety where conveyors are used.

This standard describes the practices and procedures essential to minimize existence of hazards related to power transmission moving parts (motor part, transmission parts, gears etc.), moving loads, moving sub-assemblies (switch mechanism, pushers etc.), proximity to unrestricted access and throughways passing over or under equipment, conflicts between repeated stoppages and production requirements, stoppages from causes unknown to operators and other workers not located near the conveyor resulting in situations that may lead to unwarranted actions, falling loads.

2. SCOPE

This Standard applies to all JSW Companies and subsidiaries, managed sites, corporate offices, research and development facilities, new projects, merged and acquired entities. The requirement outlined here applies to all JSW company employees, contractors and shall remain applicable for entire life cycle of an establishment, offices, manufacturing, and project sites wherein personnel will be required to undertake operation and maintenance activities in conveyor system.

The Standard sets out the minimum safety requirements for the design, installation, and guarding of conveyors and conveyor systems. It includes requirements for users and service providers of inspection, maintenance, training, and implementation of safe work practices.

This standard is not intended to apply to platform elevators, moving stairways, or conveyors specifically designed for conveyance of people.

In the Standard, the following verbal forms are used to indicate requirements, recommendations, permissions, or capabilities:

- "shall" indicates a requirement.
- "should" indicates a recommendation.
- "may" indicates a permission.
- "can" indicates a possibility or capability.

3. REVIEW

The Standard shall be reviewed at least every 5 years or when a serious incident or high potential near miss is recorded. The review shall include the evaluation of the following:

- Recommendations from OEM.
- Feedback from users.
- Review of incident reports and recommendations of incident investigations.
- Audit findings.
- Changes to industry standards, laws, and regulations.

4. PROCESS FLOW

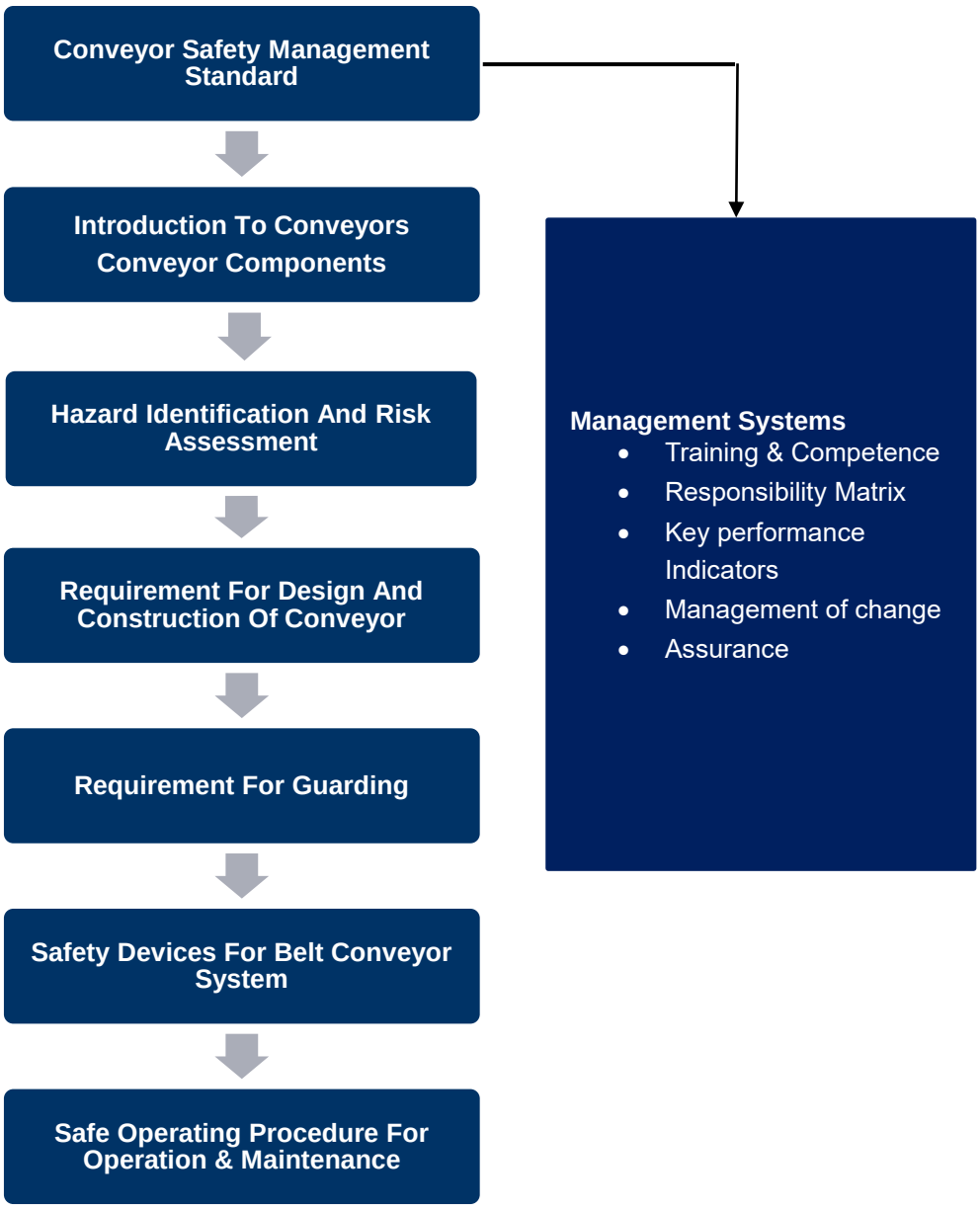


Figure-1 : Conveyor Safety Management Program

5. INTRODUCTION TO CONVEYORS

Conveyors are mainly characterized by their length that can vary from some meters to several kilometres. A large part of accidents occurs in drums areas (drive or tail drum), near a roller or near the drive mechanism zone.

Most accidents occur during cleaning or maintenance operations. Conveyors are linked to many hazards related to:

- Power transmission moving parts.
- The belt itself and its motion with other equipment's (mainly drums and rollers).
- Moving loads.
- Moving sub-assemblies (e.g.: devices that change the direction of the load).
- Proximity to circulation areas, throughways passing above or under conveyors.
- Conflicts between stops (e.g.: to clear chokes) and production requirements.
- Stoppages due to causes unknown from operators located far from theequipment and that can lead to unsafe behaviors.
- Fall of the conveyed load.
- Fall of return rollers.
- Removing material stuck between the belt and pulley.
- Correcting the belt sway while in operation.
- Removing pulley lagging while the system is running.
- Crossing the conveyor from both above and below.

5.1 CONVEYOR COMPONENTS

The important conveyor components are defined and illustrated below:

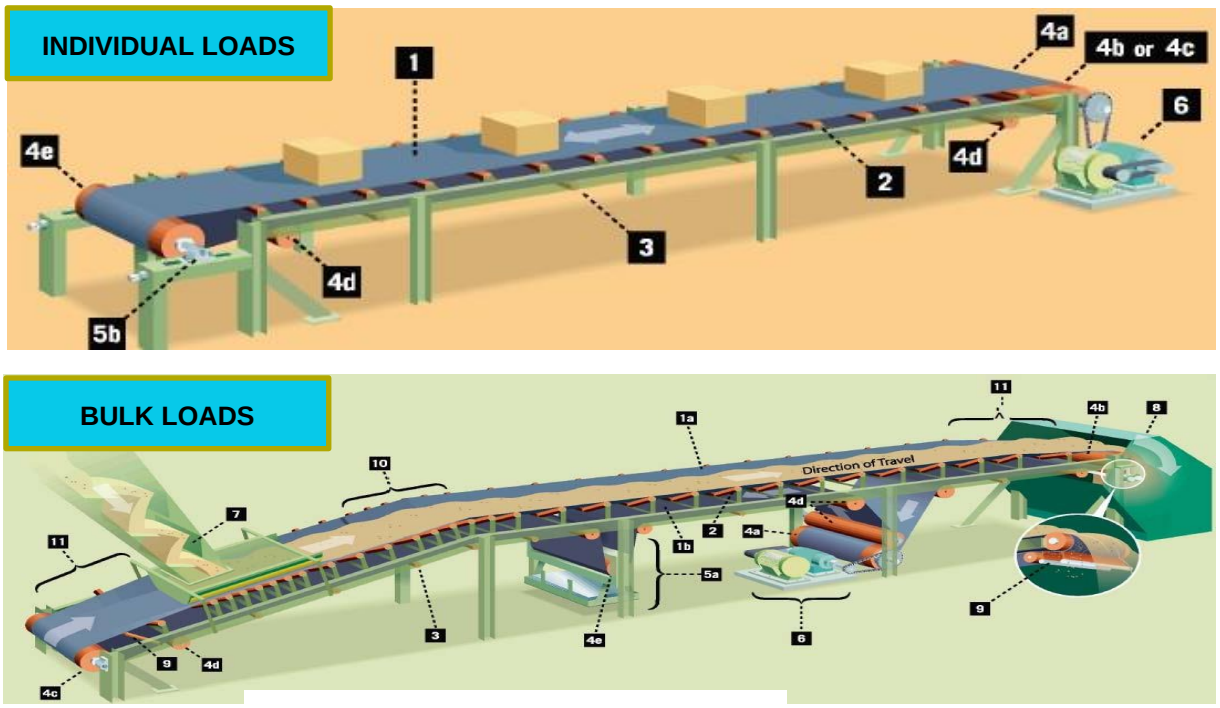


Figure-2 : Conveyor Components

1. **Belt**
   - **1a.** Upper strand.
   - **1b.** Lower strand.
2. **Load carrying rollers.**
3. **Return rollers.**
4. **Drums**
   - **4a.** Live drum.
   - **4b.** Head drum.
   - **4c.** Tail drum.
   - **4d.** Snub drum.
   - **4e**. Tensioning drum.
5. **Tension System**
   - **5a**. Gravity System
   - **5b**. Manual or self-adjusting system.
6. **Power transmission on moving parts**
7. **Loading System**
8. **Unloading mechanism**
9. **Belt and drum cleaner**
10. **Curved Zone**
11. **Transition Zone**

5.1.1 Belt

Function: Convey or transport material.
1a. Upper strand (generally the load-carrying strand).
1b. Lower strand (generally the return strand).

5.1.2 Load Carrying Rollers

Function: Support the belt. Some load-carrying rollers may also be impact-reducing, self-aligning, or able to change the inclination of the belt.

Depending on rollers, there are two shapes of belts.



Troughed Belt



Flat Belt

Figure-3 : Type of Belt Depending on Rollers

5.1.3 Return Rollers.

Function: Support the belt. Some return rollers may also be self-aligning or able tochange the inclination of the belt.

5.1.4 Drums

Function: Drive a belt or change its inclination. There are several types of drums:

4a. Live drum - drives the belt by being itself driven by a motor.

4b. Head drum - returns the belt to the lower strand (and may also serve as a livedrum).

4c. Tail drum - returns the belt to the upper strand.

4d. Snub drum - aligns the entering or exiting strand with the lower strand orensures the required arc of contact with the live drum.

4e. Tensioning drum - maintains proper belt tension by using a take-up system.

5.1.5 Tension System

Function: Ensure proper belt tension. Types of tension systems:

5a. Gravity system - a guided counterweight pulls the tensioning drum to providethe required tension.

5b. Manual system - adjustment screws provide the required tension.

5.1.6 Power transmission moving parts.

Function: Produce and transmit the required energy to the live drum for moving orrestraining the belt. Many combinations are possible:

- A geared motor is mounted directly to the live drum shaft.
- The motor and speed reducing units are connected by couplings.
- Chains or belts are used between the motor and the live drum shaft.

5.1.7 Loading System

Function: Guide and control the load feed on the belt. There are many possible systems hoppers, chutes, automatic loaders, etc.

Hoppers usually contain the following parts:

7a. Hopper assembly - Guides, contains,and sometimes controls the bulk loadfeed.

7b. Skirt board - Centres the load on the belt or redirects the load. The skirt is bolted on to it.

7c. Skirt - Stops loose material from leaking off the belt and holds fine material.

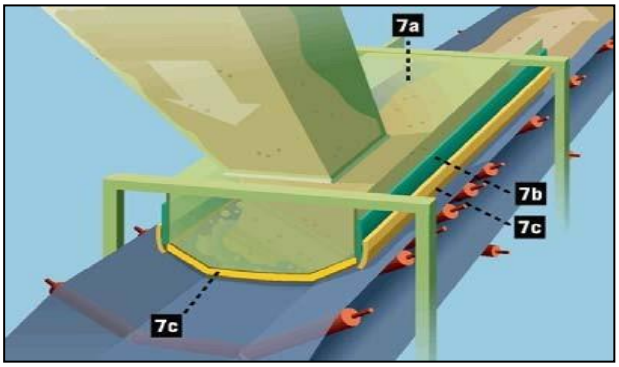


Figure-4 : Loading System

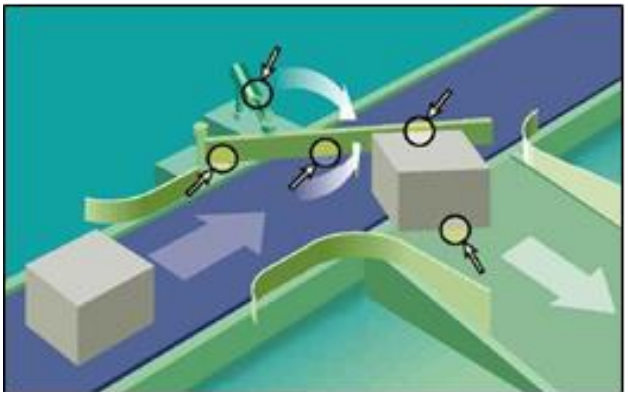


Figure-5 : Conveyor Moving Part Hazards

5.1.8 Unloading Mechanism

Function: Guide the load exiting the conveyor. Various devices may be used:chutes, slides, packagers, etc.

5.1.9 Belt and Drum Cleaner

Function: Remove material accumulation from belts and drums. These are often scrappers and brushes.

5.1.10 Curved Zone

This is the area of the conveyor where the belt is vertically curved.

5.1.11 Transition Zone

Conveyor area where the profile of the belt changes from troughed to flattened and vice versa.

5.1.12 Switch Mechanism

Function: Change the load direction.Various devices may be used like bumpers, pushers, ejectors etc.

6. HAZARD IDENTIFICATION AND RISK ASSESSMENT

The site shall carry out a detailed hazard identification and risk assessment (HIRA) as per HIRA (JSW/GHS/GS-17) prior to performing any operation and maintenance activities. There are four main sources of hazards in conveyor systems, but they are not limited to:

- Power transmission moving part hazards.
- Conveyor moving part hazards.
- Confinement zone hazards.
- Moving sub-assembly hazards.

6.1 POWER TRANSMISSION MOVING PART HAZARDS

These hazards are associated with the power transmission parts between the motorand the live drum.

They include grooves.

(1) pins

(2) bolts

(3) sharp edges

(4) in-running nips incoupling systems, like chains

(5) pulley belts

(6) or sprockets.

(7) Dragging or crushing with rotating parts or pinch points can result in serious injuries.

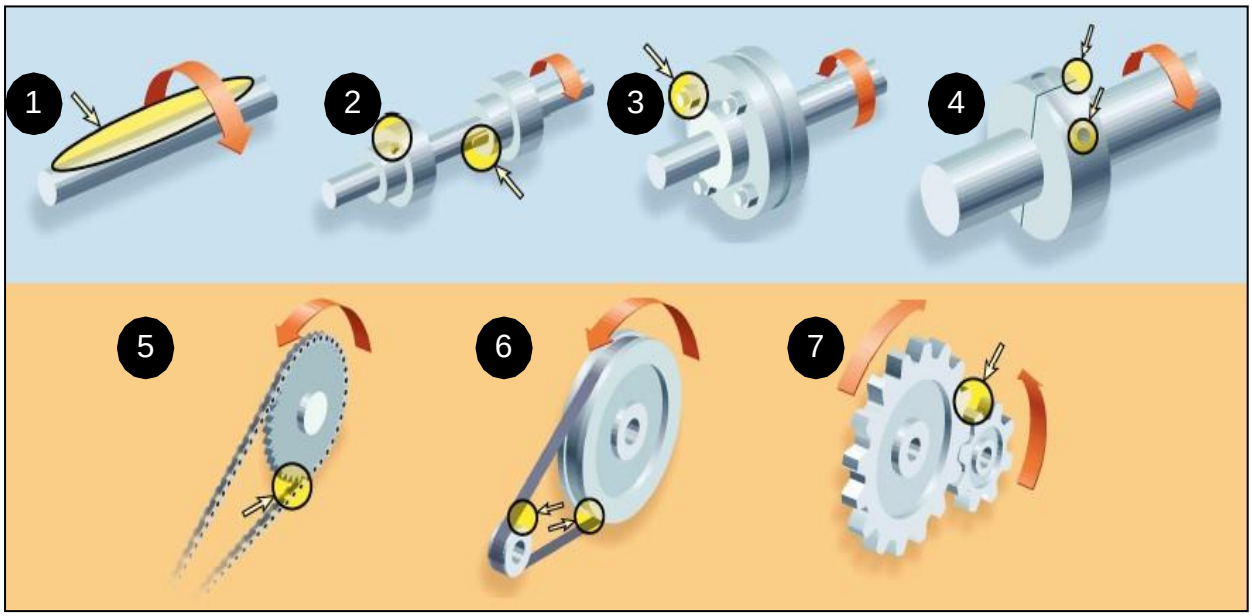


Figure-6: Hazards Due to Power Transmission Moving Parts

6.2 CONVEYOR MOVING PART HAZARDS

They are associated with the moving conveyor belt and in-running nips near rollers and drums, and with falling return rollers dislodged from worn fasteners.

These hazards can result in injuries from being dragged into in-running nips, in abrasion and friction burns from contact with the belt, and injuries from being struck by a ruptured belt or a falling roller.

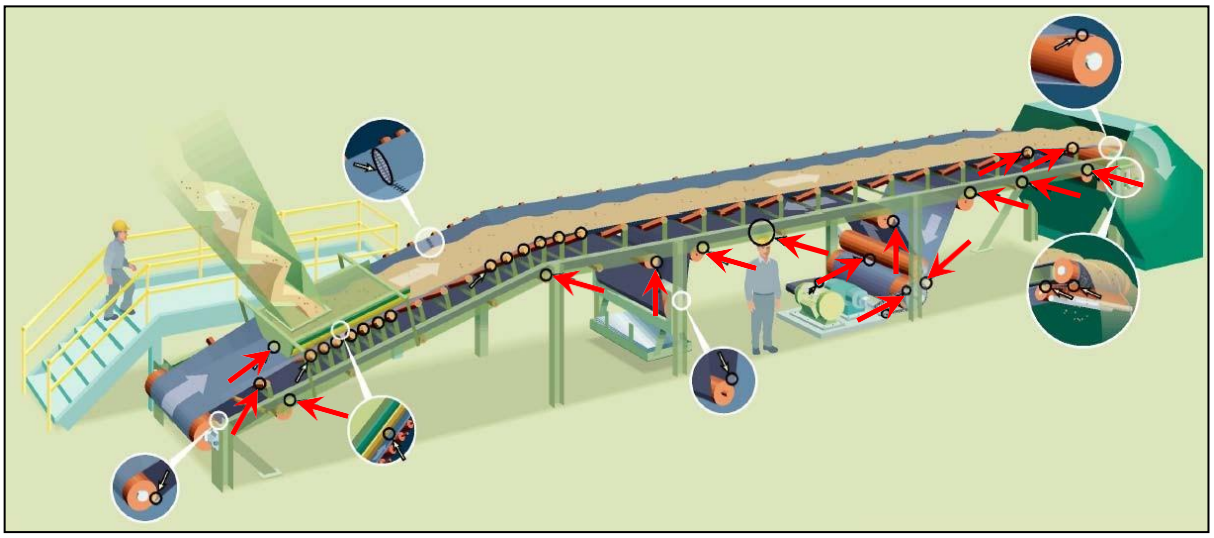


Figure-7: Typical Mechanical Hazard

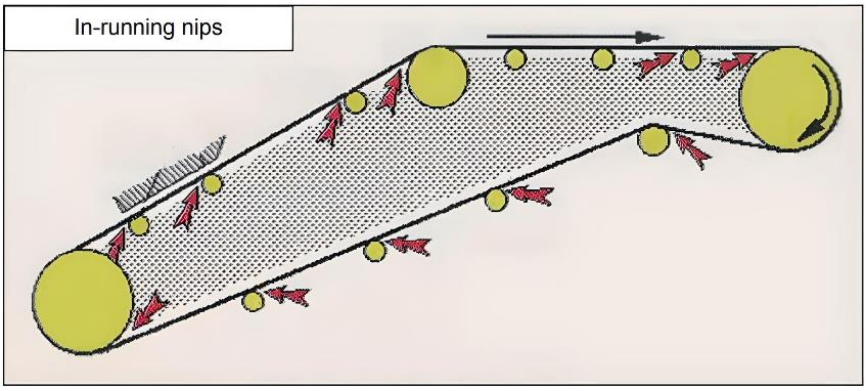


Figure-8: In Running Nips

6.3 CONFINEMENT ZONE HAZARDS

These are hazards of injuries resulting from being crushed between the load and fixed object (e.g.: hoppers, skirtboards, or skirts). Injuries can also be caused by falling loads or impact with loads.



Figure-9: Hazardous Confinement Zone

6.4 MOVING SUBASSEMBLY HAZARDS

These are hazards of injuries resulting from being crushed between the load and moving sub-assembly. Mainly with equipment that re-orient the load.



Figure- 10: Hazardous Zone in Moving Subassembly

6.5 RISK ASSESSMENT AND RISK REDUCTION

Site shall ensure that, once hazards have been identified, they should be eliminated or controlled by applying and implementing the appropriate control measures. It is necessary to carry out a risk assessment to determine which hazards to address first and what are the most effective methods to control them.

A detailed risk analysis shall be conducted aimed at identifying the various risks of mechanical origin (crushing, shearing, dragging, jamming, entanglement, entrapment, etc.) associated to the four main sources of hazards as mentioned above.

This risk analysis should be renewed periodically, and the resulting corrective and preventive actions should be implemented accordingly.

7. REQUIREMENT FOR DESIGN AND CONSTRUCTION OF CONVEYOR

7.1 GENERAL REQUIREMENTS

Site shall ensure, in addition to the requirements of this Standard, that conveyors and conveyor systems shall be designed and constructed consistent with the relevant requirements of AS 4024.1, IS 11592 (2000), ASME B20.1-2021, BS EN 12882:2015 and BS EN 1366-7:2004.

Safety features necessary for the safe operation of the conveyors and conveyor systems shall be included at the design stage.

The following specifications are taken into consideration in design and construction phase of conveyor and conveyor systems:

1. Throughput
2. Maximum load capacity
3. Conveying Speed
4. Trough Size
5. Trough Material
6. Conveyed material size & bulk density.
7. System location.

European Directives require that machinery certification (CE marking) is obtained following a process, both at design and construction level, which includes the following activities:

1. Undertake a risk assessment.
2. Demonstrate conformity to the Essential Health and Safety Requirements set in European Directive (EU Directive 2006/42/EC: Machinery, Annex I), or against the requirements of applicable harmonized safety standards set in European regulations.
3. Compile technical documentation.
4. Complete an EC Declaration of Conformity
5. Affix the CE mark on machinery.

CE marking process is required to be implemented also when machinery is functionally connected, so the operation of one machine affects previous or subsequent machines, the machines in the group (set of machines) are coordinated by a common control system. CE marking shall be affixed for the whole set of machines. Otherwise, if two or more machines are physically connected but each one maintains independent functioning, it does not fall into the category of a set of machines and therefore no CE marking for the whole set of machines is required.

The machinery manufacturer oversees duties of CE marking. The person who created a whole set of assembled machines (according to definition above mentioned) is framed as the manufacturer of a new machine and therefore is required to implement the CE marking process.

The “manufacturer” according to European Directives is the natural or legal person who designs and/or manufactures a machine, or whole set of machines (as above mentioned) and is responsible for the conformity of the machine or set of machines, with European Directives for the purpose of placing it on the market with his own name or trademark.

7.2 DESIGN AND CONSTRUCTION

7.2.1 Selection of Materials

All materials used in the manufacture of conveyors shall comply with the relevant IS, or AS or BS EN standards or on the advice of professional and experienced engineering consultants.

7.2.2 Design Requirements

The design and construction of a conveyor shall take into full account the magnitude, incidence, conditions and manner of all loading, forces likely to be applied to the conveyor and expected conveying speed.

The slope and characteristics of the conveying system shall be designed to prevent hazardous unintentional sliding of the conveyed material under operating conditions, with reference to the deviation of conveyed materials and their subsequent fall in unsafe conditions with respect to the working environment where conveyors are installed.

Design and construction of conveyors should also consider hazard to operators that are associated to potential falling of conveyed materials from elevated surfaces. To prevent risks associated with the fall of materials onto conveyors, an Industrial Hygiene assessment should be conducted to identify dust, noise, and chemical hazards etc. A Fall Impact Statement should be prepared, detailing potential fall hazards, impacts on safety and health, and the necessary control measures, such as guarding, dust suppression, and PPE requirements etc.

7.2.3 Stopping Devices

7.2.3.1 Stopping Devices

Conveyors should be designed to ensure that they will stop in the shortest practicable time consistent with safety when the driving energy is disconnected and that they remain stopped until the energy is restored.

7.2.3.2 Anti-Runaway Device

Any conveyor which can run away because of gravity shall be provided with device(s) which will automatically prevent run away. Where a belt, chain drive, fluid coupling or similar device is interposed between the motor and the driven shaft, the anti- runaway device shall be installed to prevent runaway in the event of a failure of the interposing device. More than one anti-runaway device may be required on a chain conveyor.

Where a hazard to people exists from the failure of an anti-runaway device then two automatically operated devices shall be provided to prevent run away. Each device shall be capable of holding the load independently. These devices should be monitored for wear and effective operation.

Each anti-runaway device shall be rated to stop and hold at least 150% of the maximum load applied by the conveyor.

7.2.3.3 Prevention of Hazardous Movement

Where an electromechanical brake is provided on a conveyor which may run away or run back, and a non-direct drive is used, e.g. a fluid coupling, brakes shall not be released until the torque has been applied to the main driving shaft of the conveyor. They shall be applied automatically if the power fails, or the operating control is returned to the ‘off’ or ‘stopped’ position.

7.2.4 Lubrication Points

Where bearings or other parts are inaccessible or are in a danger zone and require lubrication, the lubrication point should be in a position which is both accessible and outside the danger zone. The lubrication points should be located outside the alignment of the carrying mechanism of the conveyor and should be accessible without the removal of any guard.

7.2.5 Take-up and Counterweights

7.2.5.1 Take-up

All components of a take-up which can move during operation shall be guarded.

Where a take-up device can operate automatically, fixed distance guarding should be provided to prevent access to all components of the tension carriage or balance weight.

Where there is access at the bottom of the gravity take-up, protection shall be provided to eliminate the hazard from descent of the weight due to failure of a component. Provision for the removal or disposal of spillage in this area shall be provided.

Suitably worded signs warning of the stored energy hazard of the take-up system, shall be visible at each point of access to the take-up system and rope system.

7.2.5.2 Access to Take-up

The means of accessing the take-up for the counterweight should be adjustable to enable belt maintenance and repair. Additionally, the system design should include provisions for releasing or securing stored energy.

7.2.5.3 Control of Take-up

The manual control for the take-up shall be accessible from outside the guarded area.

Where automatic control of the take-up is provided, then isolation of the automatic operation and selection of a manual operation should be provided.

Manually operated tension devices shall not be capable of freewheeling under any condition.

Where take-ups are remote or on a different level from the main drive, an emergency stop facility shall be provided at the take-up.

7.2.5.4 Wire Ropes for Take-up and Counterweights

All wire ropes used for take-ups and counterweights of conveyors shall have a minimum safety factor of 4.5, relevant to the maximum static load that can be applied by the tension system. The minimum dynamic factor of safety should be 2.25.

7.2.6 Hinged Section

Hinged sections of a conveyor or conveyor system used for the purpose of creating a passageway shall be designed so that when the hinged section is opened while the conveyor is in operation, it only stops the adjacent upstream conveyor.

7.2.7 Raising and Lowering System

Conveyors which include an articulated or mobile part which is raised and lowered, shall befitted with devices for automatically immobilizing these parts in the event of loss of power.

The raising or lowering system shall be designed to prevent accidental movement or kickback when operated.

The system controls shall be located so their operation is clear of the underneath of the conveyor.

Stops or limiting devices shall be provided to prevent movement of the articulated or mobile part beyond its designed limits.

7.2.8 Dust Generation and Control

Where dusts are present or may be generated due to the operation of a conveyor, measures shall be taken to minimize the generation and control the presence of dust. The following recommendations should apply:

(a) Scrapers should be provided where material may be drawn into a pulley to the belting contact area. The scraper should divert the material clear of the contact area.

(b) Means should be provided at the discharge point of a conveyor to minimize carry back of material.

(c) For areas of a conveyor which may generate significant dust, (e.g. transfer points or areas of high air velocity) means should be provided to collect or suppress the dust. These means may include, but are not limited to, the following:

  (i) Water sprays.

  (ii) Dust cover hoods or local extraction systems.

  (iii) Dust collections systems.

(d) Horizontal areas on which dust can accumulate should be minimized.

7.3 ACCESS TO CONVEYORS

Means of access to the conveyor and its controls for the purpose of working, operating, inspecting, maintenance or servicing shall be provided. Operation of the conveyor shall be from floors or platforms, not from stairways or ladders. Regular work or servicing should not be undertaken from ladders.

In the design of access provided for the operation and maintenance of the conveyor or conveyor system, alternative means of exit shall be provided for personnel in the case of fire, based on the results of fire risk assessment regarding the workplace where the conveyor or conveyor system is located.

Where access to either side of the conveyor is required, crossovers or underpasses shall be provided at appropriate intervals including at the head and tail end, at the drive and other transfer points along the conveyor.

Where access is required along an operating conveyor, a minimum working clearance of 600 mm (900 mm in case the access is part of an emergency evacuation corridor system) coupled with a minimum headroom of 2.1 m shall be provided down one side of the conveyor. The non-walk side of the conveyor should have sufficient clearance to allow any spillage of material to fall clear of the conveyor. Adequate clearance shall be provided between the material being conveyed and the roof.

7.4 OPERATING CLEARANCE

Adequate clearance shall be provided to prevent inadvertent contact between the conveyed material and any part of the conveyor system, including installed equipment or structures. Where it is possible to manually overload a conveyor to a point where adequate load clearance is not maintained, a load gauge should be installed at the loading points.

7.5 MAIN ISOLATING DEVICE

If a job involving maintenance, repairing, cleaning, servicing, adjusting, or setting up operations (including the energy-isolating device itself) cannot be accomplished with the prime mover or energy source disconnected, such tasks shall be performed under the following requirements:

- The Person In-Charge shall designate a qualified person who will maintain exclusive control over the machine/equipment activation points (e.g., control panel, remote control unit, circuit breaker, switches) for the entire duration of the job.
- If remote isolation is necessary, the isolation device should be clearly identified and controlled by a qualified person at the remote location.
- A communication system shall be established between the remote isolation point and the worksite to ensure clear and continuous coordination.
- The remote isolation device should be locked out and tagged out to prevent unintended re-energization.
- The qualified person shall ensure that all executing personnel are always in their clear sight or in direct communication with them for the duration of the job and are beyond the reach of machine/equipment parts that may move or actuate, causing exposure to hazardous energy/material.
- If the qualified person needs to leave the operating station, the equipment/machine shall be de-energized until the qualified person resumes control.

7.6 PRE-START WARNING SYSTEM

Where an otherwise uncontrolled hazard may arise when a conveyor or conveyor system starts, an automatically operated prestart warning system shall alert people to the fact that the conveyor is commencing operation, and a potential danger exists. The system shall be in the form of an appropriately timed visual or audible warning given prior to the conveyor starting.

7.7 EMERGENCY STOP CONTROL

Controls shall be provided to stop the conveyor or conveyor system in an emergency. These stop controls shall be of the manually operated, automatic lock-off manual reset type. The circuit in which emergency stopping controls are provided shall be designed fail safe and otherwise protected from faults that may defeat the operation of the facility.

Emergency stop controls shall be capable of being operated with minimal effort without danger to the operator and shall be provided where the operating control is clearly visible and readily accessible even for inaccessible conveyors.

Emergency stop controls shall be provided as follows:

(a) For conveyors not greater than 2.5 meter in length and located less than 2.5 meter above the floor, walkway or platform, a single stop control at the middle of the conveyor.

(b) For conveyors greater than 2.5 meter in length and located less than 2.5 meter above the floor, walkway or platform at the head, tail, drive and at intervals not exceeding 30 meters along the length of conveyor.

(c) For conveyors positioned more than 2.5 meter from the floor, walkways, or platforms at accessible locations at interval not exceeding 100 meters along the length of the conveyor.

(d) At positions adjacent to the conveyor at which conveyor can be started.

(e) At every permanent working station.

7.8 PULL CORD REQUIREMENTS

Pull cord shall not be used as substitutes for guards. Where used as an emergency stopcontrol a pull wire activated device shall comply with following requirements:

(a) Breaking, slackening or removal of the pull cord shall activate the device.

(b) Where electrical continuity is monitored in the pull wire—
I. the slackening requirement of Item (a) need not apply; and
II. the conveyor shall stop in the event of the pull wire being broken or removed.

(c) The force required to operate the pull wire activated device shall not exceed 70 N when applied midway between supports and at right angles to the axis of a pull wire with less than 300 mm movement and 230 N along the axis of the wire.

(d) The design and distance between pull wire supports shall be such that the wire moves freely when pulled and does not become disengaged from the support.

(e) Materials used for pulling cord shall be of adequate strength, be protected against environmental conditions and be suitable for handling without the need for additional protection being worn by operators.

(f) The switch shall be activated when the pull wire is pulled in any direction.



Figure-11: Pull Cord System

7.8.1 Location of Pull Cord

Pull cords should be in such a manner that they are:

(a) clearly visible.

(b) readily accessible from all areas of access to the conveyor.

(c) located external to the vertical line of any nip or shear point and no further than 1 meter from the nip or shear points.

(d) at least 900 mm above the access floor.

(e) generally, not more than 1500 mm above the access floor.

(f) where all nip or shear points are greater than 1500 mm above the access floor the pull cord requirement of item may be raised provided the pull wire is lower than all nip or shear points; and

(g) where it is possible for a person to be inadvertently on a moving conveyor, an emergency stop

should be provided and be located no closer to the conveyor discharge than the maximum stopping distance of the conveyor. The emergency stop should be accessible from the conveyor.

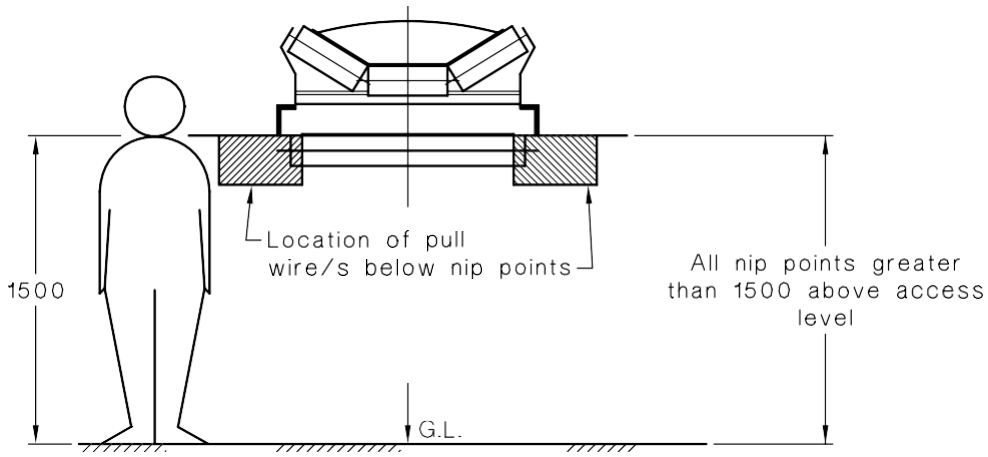


Figure-12: Preferred Location

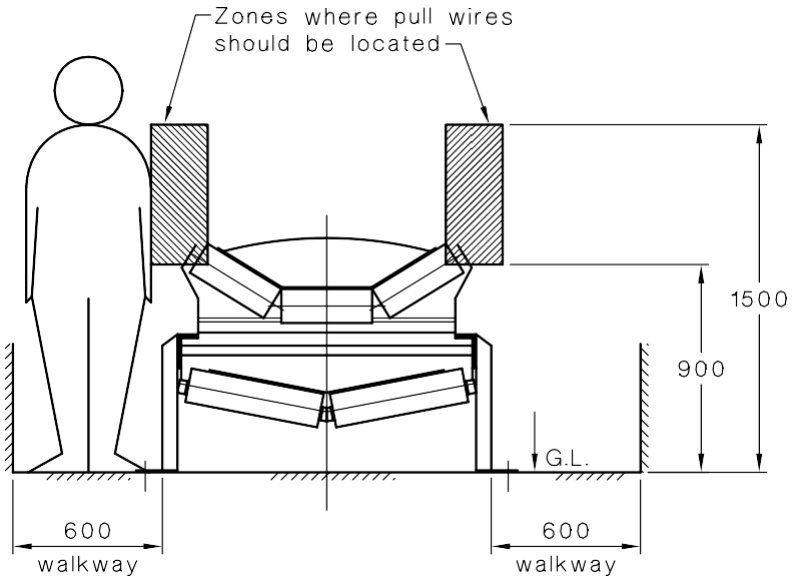


Figure-13: Location Where Nip Point Higher Than 1500 Millimetre (Dimensions in Millimetre

7.9 PROTECTION OF CONTROLS

Where any hazard may exist due to inadvertent or unauthorized operation of any control, then sites shall be incorporate in the design of the controls to prevent such operation. For the purpose sites shall provide include covers over controls, locked enclosures, and key operated switches.

7.10 PROTECTION FROM OVERLOAD

Overloading of a conveyor or conveyor system shall be prevented by provision of suitable energy limiting devices. These devices include but are not limited to:

(a) electrical overload limiters.

(b) fluid couplings.

(c) shear pins; and

(d) pressure relief valves.

Where a shear pin is used, a description of the size and type of material of the shear pin shall be placed at an appropriate point on the conveyor to facilitate proper replacement.

All fluid couplings shall be protected from overpressure and over-temperature.



Figure-14: Protection from Overload - Fluid Coupling

7.11 FIRE SAFETY

7.11.1 Fire Risk

Where the operation of a conveyor or conveyor system could create a fire hazard, the design of the conveyor or conveyor system shall include items to minimize the risk.

There are two important areas to consider for conveyor system:

- Fire prevention.
- Automatic fire detection and suppression.

7.11.2 Fire Prevention

Site shall ensure the following to minimize risk of fire:

- Conducting regular belt examination.
- Removing all accumulation of combustible materials along the conveyor belt.
- Correcting potential sources of fire such as seized roller, overheated bearings, or belt misalignment.
- Installing water sprinkling system or high expansion foam units along the belt line if the operation of the conveyor, or conveyor system, could create a fire hazard that can be extended to conveyed materials and surrounding working environment.
- Patrolling belts, inspecting rollers frequently, particularly after the belts have been stopped, and removing dirt build up on the return idlers and tail sections.

7.11.3 Fire Detection

A fire condition within a conveyor system may be:

- A Static fire – On a stationary conveyor belt or within the conveyor mechanism/housing.
- A moving hazard – hot or burning product imported onto a travelling belt conveyor.

In the conveyor structure any product which falls from the moving belt, or an accumulation of settled product dust, is a potential hazard. A mechanical fault in the bearing of a roller or the friction between a seized roller and the belt will result in buildup of a heat which can be sufficient to ignite the belt.

Site shall ensure that a Linear Heat Detection (LHDC) for static fire protection and Infra-red heat detectors for moving fire protection shall be equipped along the conveyor system.

Being a sealed cable wire the LHDC is not prone to water and dust problems.

LHDC shall be installed above the centre of the belt at a height of 1 to 1.5 meter and to protect the underside of the conveyor, LHDC shall be mounted above the return roller on each side.



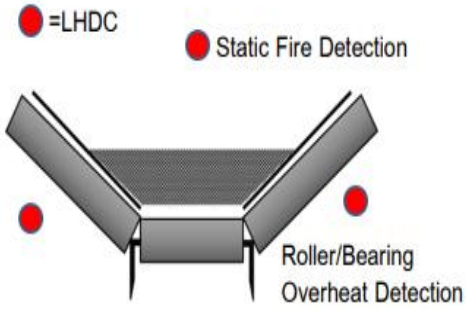


Figure-15: Linear Heat Detector Control for Upper and Underside of Conveyor

The LHDC should always be mounted by clips or thermal spacers such as to be in air flow. It should not be mounted directly to steelwork which would act as heat sink and retard response.

Fire Detection on Moving belts

Site shall monitor infra-red, black body emissions through infra-red detectors which works on the principle of Planck's Law. Planck's Law defines the spectrum and level of infra-red emissions for a black body at any given temperature.

The detector when mounted above the conveyor at a height of between 1.0 and 1.5 meters, should be able to cover the full width of the belt with its optical system. The system should also detect glowing product of up-to 300 mm diameter and less.

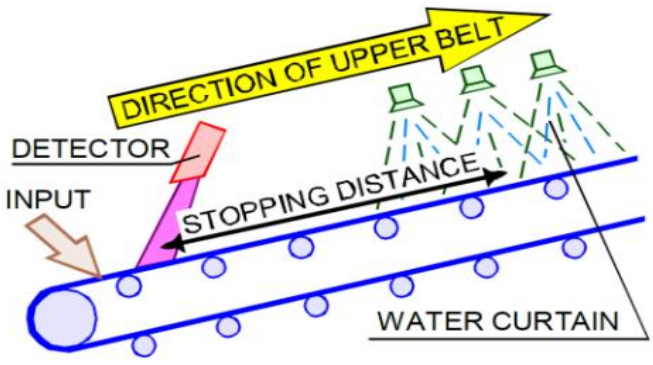


Figure-16: Infra-Red Detector Mounting on Moving Belt

- The infra-red detector should be mounted at the start of each conveyor including transfer towers and loading points, such that on detecting a fire the belt could be stopped.
- Where the fire would be with in a water spray deluge curtain.
- Before it can discharge the fire to another belt or silo etc.

7.11.4 Lubricants

Oils and lubricants should be effectively contained. Accumulated spilled oils and lubricants should be controlled sufficiently to minimize any potential fire hazards. In case of a fire, powder fire extinguishing system or CO2 fire extinguishing system (for contained and segregated locations) should be installed. Risks of asphyxiation shall be evaluated in case of use of CO2 as extinguishing agent.

7.11.5 Accumulation of Combustible Material

The accumulation of combustible material resulting from the operations of a conveyor shall be controlled to prevent contact with the moving parts of the conveyor. This may be achieved by the installation of easily maintained scrapers, loading point skirting, shedder plates and self-shedding covers over components located beneath the conveyor.

In addition, sufficient space shall be provided under moving parts for the removal of accumulated material. Generally, for bulk materials handling belt conveyors, not less than 300 mm should be provided for this purpose but, in no case shall this clearance be less than 150 mm.

8. REQUIREMENT FOR GUARDING

Guards shall be designed and provided to prevent access to danger zones unless the danger zone is guarded by location or position. Guards shall be included in the design of the conveyor or conveyor system and shall not in themselves create a hazard.

All guards shall be secured in position so that they cannot be removed without the use of tools unless an interlocking device is provided to automatically stop the conveyor in the event of the removal of the guard (e.g. mobile safeguards located where personnel are expected to operate close to hazardous zones and fixed guard could result as an obstacle to their operations).

Fixed guards should be designed so that it is not necessary to remove them for servicing or inspection purposes.

A comprehensive survey of all conveyors, including Take-Up, Tail, and Drive Ends, shall be carried out by personnel at a minimum of Section Head level to ensure that appropriate guarding or safety devices are installed to prevent inadvertent or accidental contact with moving parts. This survey shall follow the format and guidelines provided in the JSW Machine Guarding Standard (JSW/GHS/GS-10).

Purpose of the Survey

Safety Compliance: Ensure all moving parts of conveyors, including Take-Up, Tail, and Drive Ends, have proper guarding.

Inspection and Inventory: The survey results can be used for monthly inspections and maintaining inventory records of safety devices.

Documentation

Maintain survey records using a format consistent with the Machine Guarding Standard (JSW/GHS/GS-10).

- Document identified issues, corrective actions, and completion status.
- These records shall be reviewed during monthly inspections.

8.1 DESIGN AND CONSTRUCTION OF GUARDS

Guards shall be designed, constructed, and used that they will:

(a) Provide positive protection.

(b) Prevent access to the danger zone during operations.

(c) Cause the operator no discomfort or inconvenience.

(d) Operate automatically with minimum effort.

(e) Not interfere with efficient operation of machines.

(f) Be suitable for the job and machine.

(g) Not weaken the structure of machine.

(h) Preferably constitute a built-in feature.

(i) Provide for machine oiling, inspection, adjustment, and repairs.

(j) Be constructed strongly enough to resist normal wear and shock.

(k) Be durable, resistant to fire and corrosion and easily repaired.

(l) Withstand long use with minimum maintenance.

(m) Not constitute a hazard of injury by themselves such as splinters, pinch points, shear points, sharp corners, rough edges, or other sources of accidents.

(n) Protect against operational contingencies not merely against normally expected hazards.

(o) Protect inadvertent contact with hot or hazardous fluids from fluid couplings or torque converters.

8.2 MATERIALS

Guards shall be made from solid materials, mesh, or equivalent construction. Sheet metal guards should be no less than 1.5 mm thick. Mesh guards should have a wire gauge of at least 1.5 mm, or 3 mm wire gauge for mesh sizes of 50 mm square and larger (for further details, refer to the JSW Machine Guarding Standard (JSW/GHS/GS-10)).

The preferred material for guards, under most circumstances, should be metal. The framework of guards should generally be made from structural sections, pipes, strapping, bars, or rods. Panelling materials should typically include solid sheet metal, expanded or perforated metal, or wire mesh.

8.3 STRENGTH

The safety distances specified in section 8.4 shall be maintained when loads are applied as follows:

(a) A force of 450 N at a point on the guard applied over a square area of 50 mm x50 mm.

(b) For guards which can be climbed or rested upon, a mass of 75 kg placed on the guardand a simultaneous horizontal force of 220 N applied to points selected to establish the strength of the guard. The required clearances from the danger zone shall be maintained when a force of 450 N is applied at point on a guard over a square area of 50 mm x 50 mm.

8.4 REACH DIMENSION AND GUARD PLACEMENT

The design and construction of guards and their subsequent location shall be such that the safety distance from any nip point, shear point or crushing point to the nearest point of access is in accordance with JSW Machine Guarding Standard (JSW/GHS/GS-10).

Typically, the safety distances are as follows:

(a) For square mesh with opening size up to and including 9 mm, guards shall be at least 25 mm from the nip or shear point.

(b) For square mesh with opening above 10 mm and up to 50 mm, guards shall be at least 200 mm from the nip or shear point.

(c) For fence type guards the maximum distance between the underside of the fence and the floor shall be 200 mm. The location of the nip or shear point may reduce this dimension.

(d) Height of Guards - Except as provided for specific installations, the minimum height of guards should be 2.60 m from the floor or platform level.

(e) Floor Clearance - If practicable without permitting exposure to moving parts, guards should clear the floor by about 15 cm to prevent interference with cleaning around machines.



Figure-17: Adequate Protection



Figure-18: Openings are Too Big

Guard placement is required to consider unsafe escape of moving materials from the conveyor belt. The loading openings of the inclined floors (chutes) should be surrounded by parapets at least one meter high, except for the section strictly necessary for introducing the load, provided that the upper edge at the beginning of the inclined surface is at a height of at least 50 cm from the floor level. The same plans should be equipped with lateral defences to prevent the moving load from escaping and terminal front defences to avoid the load fall.

8.5 TYPE OF GUARDS

There are three types of guards which are as follows:

- Fixed Guards:
  - a) Surrounding fixed guards
  - b) Barrier guards (fixed distance)
  - c) In-running nip fixed guards
- Interlocking guards
- Interlocked guards with guard locking.

8.5.1 Fixed Guards

A fixed guard is a guard that can be removed only by using a tool or that is permanently set in place (e.g. by welding). Guards may be easily opened with tools or keys. When keyed latches are used, responsible person for controlling and distributing keys or tools should be assigned by the section or department head.

a) Surrounding Fixed Guards

Because of openings required for belt and load passage, surrounding fixed guards only partially surround the danger zone. In conveyor belts, these fixed guards are designed on two main shapes:

- Partial cages (used mainly for head and return drums).
- Side screens.

Guards should extend beyond in-running nips between belts and rollers to make them inaccessible from above, below and from the ends.

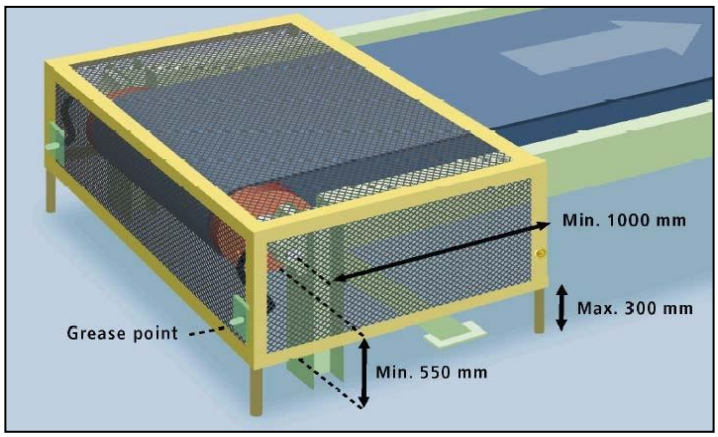


Figure-19: Surrounding Fixed Guard (Partial Cage)

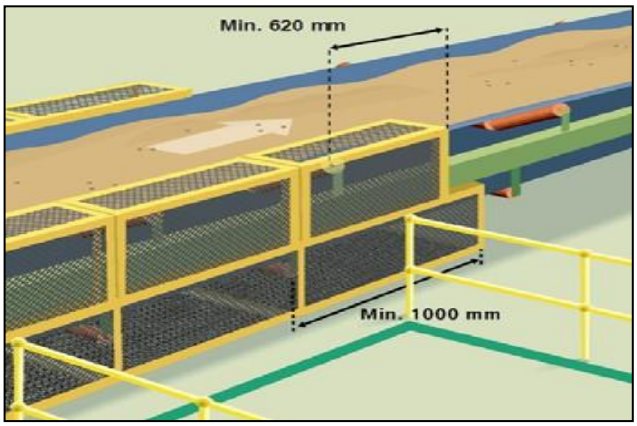


Figure-20: Surrounding Fixed Guard (Side Screen)

b) Barrier Guards

Barrier guards do not surround danger zones but restrict or prevent access by their size and separation from the danger zone.

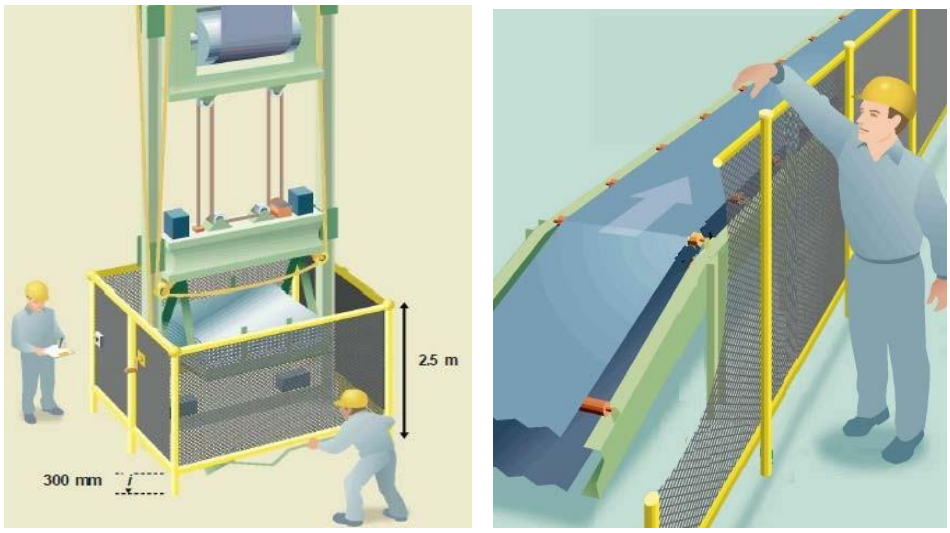


Figure-21: Examples of Barrier Guards

c) In-Running Nip Fixed Guards

A fixed guard can be placed near in-running nips in order not to allow access to this zone. In-running nip fixed guards can be firm fitting or made with deflectors and side plates.



Figure-22: Example of In-Running Nip Fixed Guards

8.5.2 Interlocking guards

A guard equipped with an interlocking device should have the following characteristics:

- Stop the machine as soon as it is slightly opened.
- Make impossible to start the machine if it is not in place.
- Not restarts the machine once it is fully restored to its place.

This type of guard may only be used if the hazard disappears before a worker canaccess the danger zone (low-inertia conveyor with rapid stop).

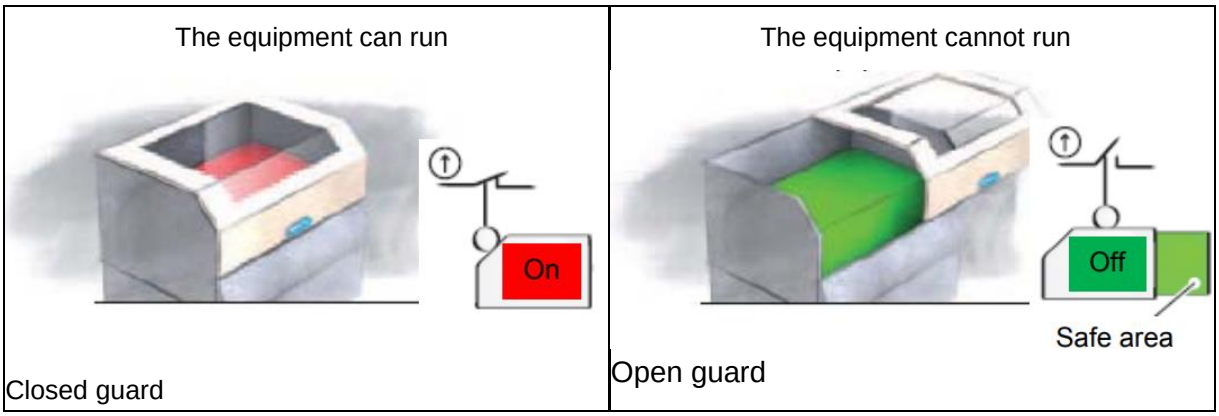


Figure-6: Principle of Interlocking Guard

8.5.3 Interlocked Guards with Guard Locking

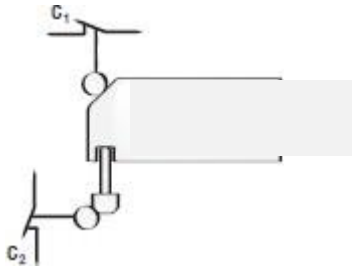
An interlocked guard equipped with a locking device should have the followingcharacteristics:

- Remain locked in place as long as the machine is moving.
- Make impossible to start the machine if it is not in place andreactivated.
- Not restarts the machine once it is restored to its place and reactivated.

Table-1 : Principle of Interlocked Guard with Guard Locking



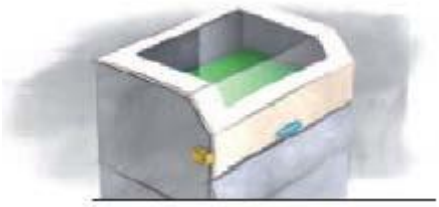
The equipment can run Closed and blocked guard.
Impossible to unblock



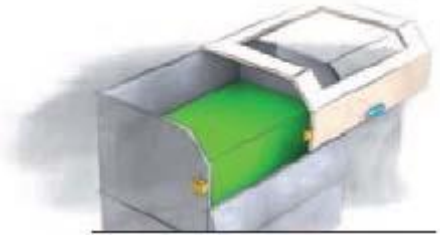
Blocked guard



The equipment cannot run
Closed and blocked guard.
Possible to unblock



The equipment cannot run
Closed and unblocked guard.
Possible to open



The equipment cannot run

Open guard

This type of guard may be used when it's possible to access the danger zone before the hazard has disappeared (large-inertia conveyors and long-to-stop conveyors).

Table-2 Examples of Guarding Method for Conveyors

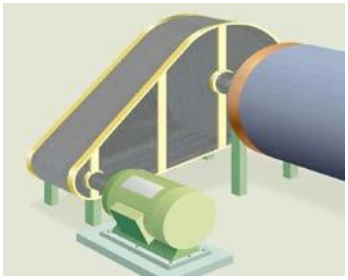
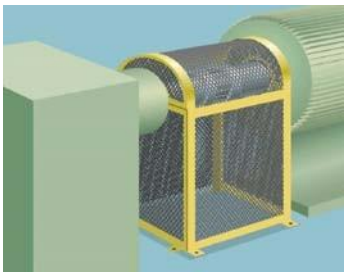
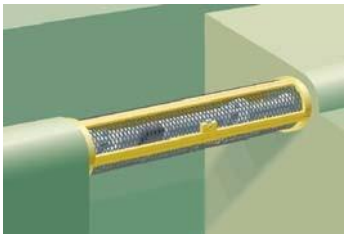
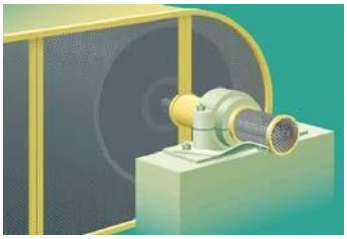
	For Pulleys and Power transmission belts
	For Couplings
	For Shafts
	For Shaft ends
	Guards for hopper

Table-2 Examples of Guarding Method for Conveyors

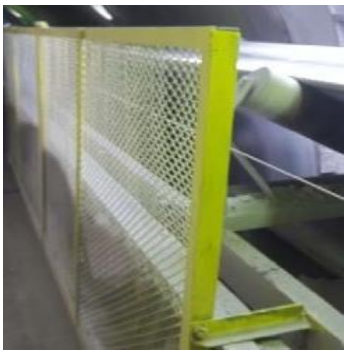
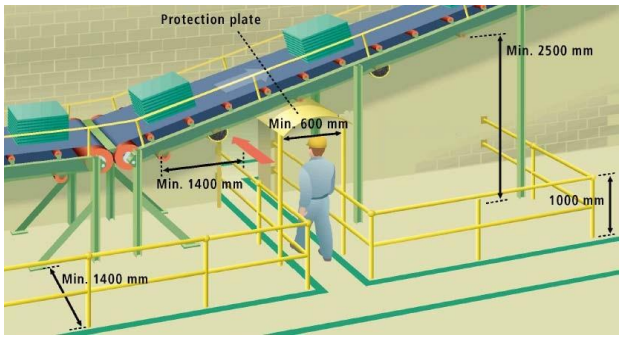
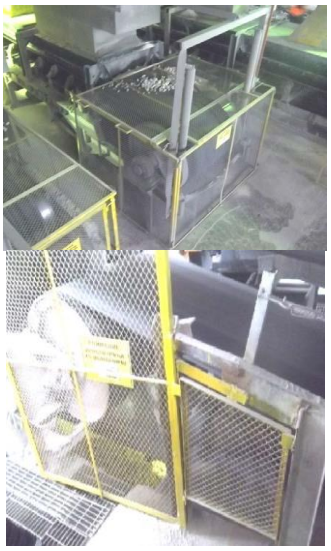
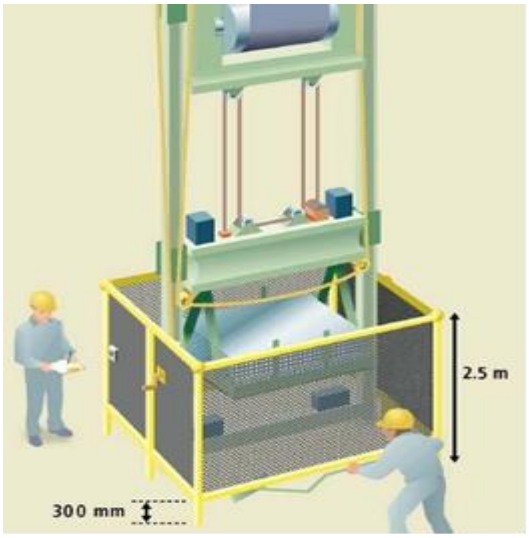
	Surrounding guards
	Barrier Guards
	Fixed guard for return roller
	Throughway under conveyor

Table-2 Examples of Guarding Method for Conveyors

	Surrounding guards for drum
	Guard for counterweight

9. SAFETY DEVICES FOR BELT CONVEYOR SYSTEM

9.1 BELT SWAY SWITCHES

The Belt Sway Switch functions in detecting any deviation or sway in the conveyor belt and providing an auto-alarm and sending out signal to stop the conveyor to avoid the damage to the conveyor belt and prevent scatter of conveyed materials because of the belt distortion. The Belt Sway Switch is necessary in the safe conveying system, widely used in the belt deviation detection of the belt conveyor.

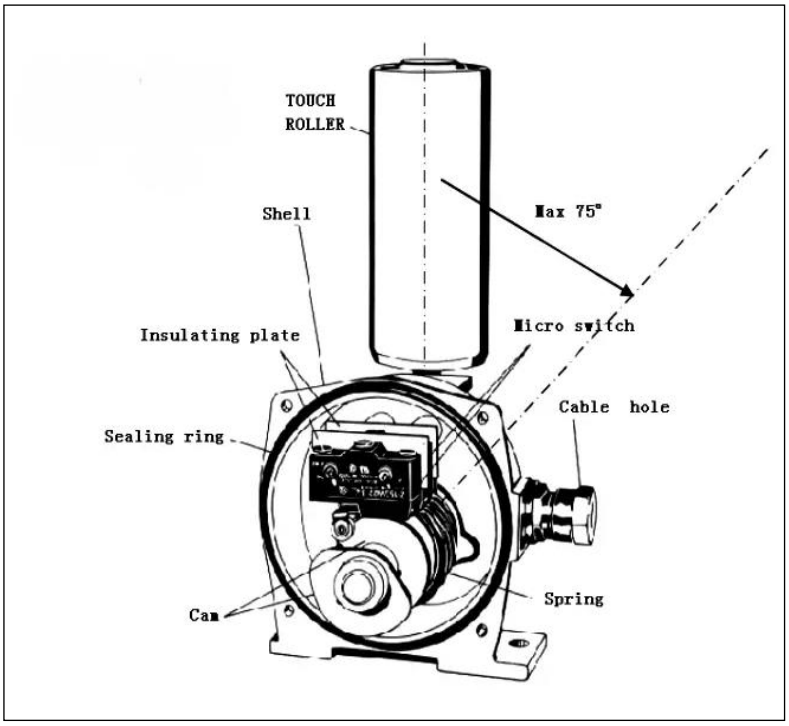


Figure-24: Structure of Belt Sway Switches

9.2 ZERO SPEED INDICATOR

Electronic Speed Monitor is used to monitor speed of conveyors, crushers, rolling mills, agitators, mixers, stirrers, screw conveyors, and other industrial machinery. This device actuates relay contacts at preset speeds. Using these contacts desired control action such as zero speed protection under speed protection/ over speed protection can be achieved.



Figure-25: Zero Speed Switch

9.3 PULL CORDS

The pull cord switch is an emergency switch used to stop the belt conveyor instantly when an incident occurs or during normal corrective maintenance, personnel can pull cord at any position along with the belt to stop the belt conveyor.



Figure-26: Pull Cord Switch on Belt Conveyor

9.4 BELT DRIFT SWITCHES

The Belt drift Switch is designed for heavy duty application and used for drift monitoring of conveyor belt installations. The belt drift switches are used to protect the installations from damage or destruction in the event of belt drift and are positioned in pairs on both sides of the conveyor belt.



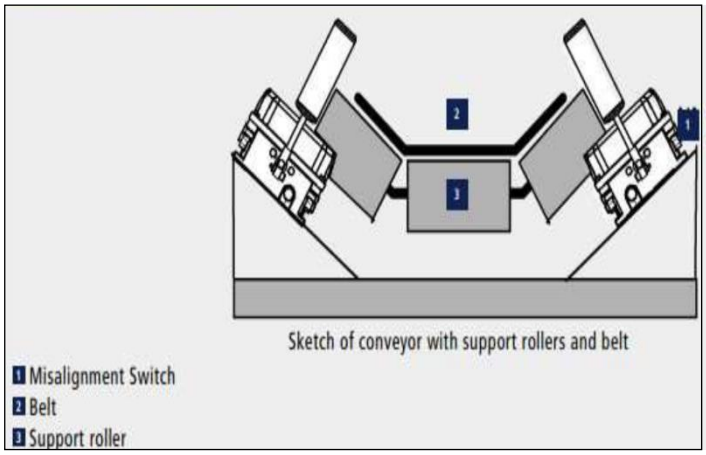


Figure-27: Belt Drift Switch

9.5 BOOT LEVEL SWITCH

Boot level switch is used to sense the boot level in the bucket elevators, sensing/clogging of material in screw conveyor and various other applications. The pressure of the material on membrane/diaphragm operates a micro switch inside the unit & the contact of switch is used for control action.

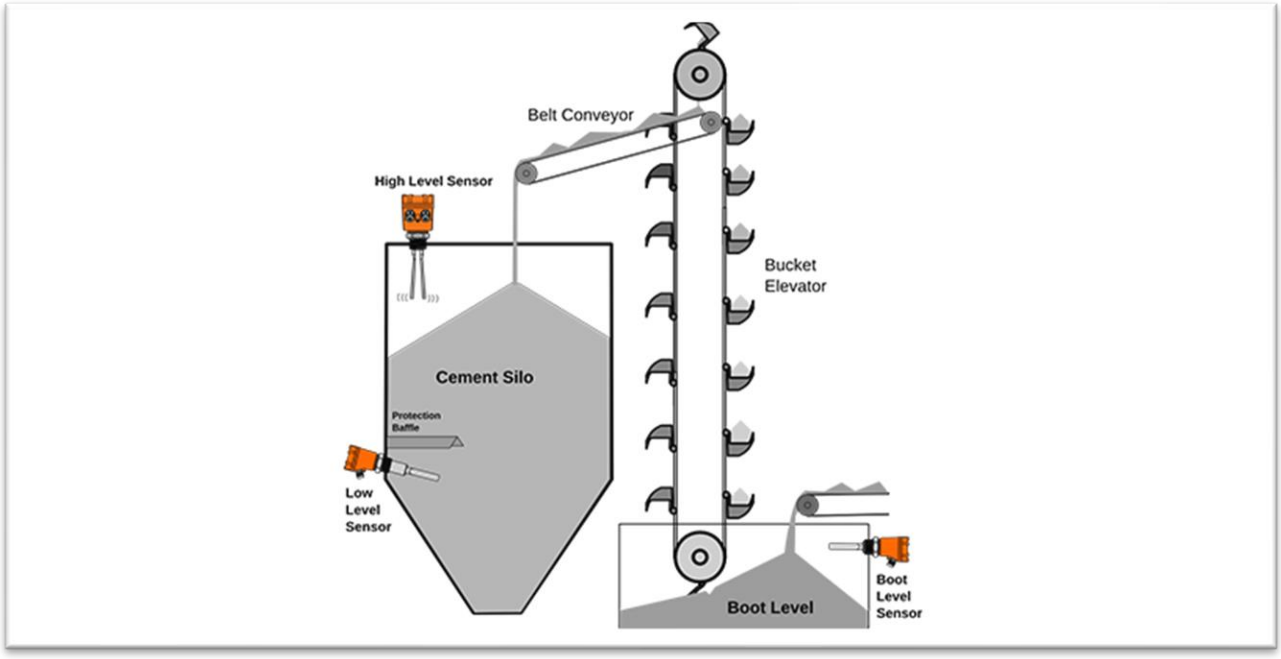


Figure-28: Boot Level Switch

9.6 RIP DETECTOR

It is a cable operated damaged belt detector that looks for punctures, tears, or protrusions through the conveyor belt and provides a means of automatic shutdown to limit the amount of damage to the conveyor belt.

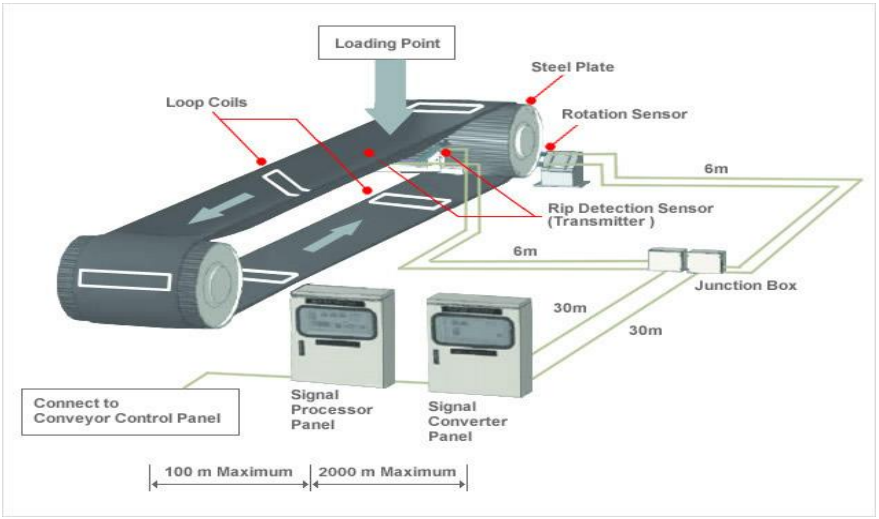


Figure-29: Conveyor Rip Detector

9.7 PROXIMITY SENSORS

A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal.

Proximity sensors are also used in machine vibration monitoring to measure the variation in distance between a shaft and its support bearing.

In addition to above site shall also ensure that:

- All conveyors' guards should be fixed bolted with interlocks.
- Audible start-up warning system supported by a visible warning system for a minimum of 30 seconds signal time when the entire length of the conveyor is not visible from the starting controls. Wherever applicable the Audible siren should be placed at multiple locations so that siren is audible for the entire group of conveyors.
- Conveyor shall not automatically restart upon resetting of any of the emergency control.
- Lighting - Suitable lighting of conveyor systems, equipment and machinery shall be provided. For guidance recommendations of IS: 3646 (Code of Practice for Interior Illumination) and EN 1837:2020 to be implemented.
- Fire protection: Adequate fire protection facilities shall be provided as per IS 1641(Code of Practice for Fire Safety of Buildings) and BS EN ISO 19353: 2019.
- A clear access platform or floor space of at least 600 mm width on both sides shall be provided for the maintenance of every driving mechanism. For all new installations, it should be 1000 mm platform on both the sides.
- Where walkways are provided on both sides of a conveyor and where convenient access to either side of the conveyor may be required by employees (as per risk assessment) that regularly works in the area, crossovers shall be provided at appropriate intervals and at the head and tail ends of the conveyors where no other crossing is available. Safe means of access shall be provided at crossovers.
- All chutes should have a chute jamming sensor.
- Sequence interlocks shall be provided at start of every conveyor.
- Surveillance Camera should be installed and taken in control room for tail end and head end of the drives (proper location of surveillance camera shall be identified according to local legislation pertaining to security and privacy related to workers; in some countries the positioning of camera shall be agreed with workers' representatives for safety or Union organizations at work).
- All starting and stopping devices shall be clearly indicated and easily accessible. It is recommended that they be painted to a specified pattern.
- It is recommended that all lubrication points be painted to a specified pattern. If, for lubrication purposes, it is necessary to remove or to open guards, lubrication shall only be carried out with the equipment rendered inoperative:
- A logbook shall be kept for each appliance and/or for each installation.
- Counterweight tension devices shall be guarded up to a height of 2.5 m at points accessible to personnel.
- Guards shall prevent access to the space directly below the counterweight.
- 360 Degree Guarding extending to 2.5 meters should be done on both side of the conveyor where there is a cross over or a possibility of material falling over conveyor from upper platform.
- The conveyor feeding shall be regular, avoiding over-loading. The feeding points shall not be changed, particularly not their position, or increase the flow, without previously consulting the manufacturer/constructor.
- All shuttle conveyors should be protected by distance guards/fixed guards with interlocks for complete track length.
- Clear operating instructions concerning the loading of the appliances shall be prominently displayed adjacent to the loading positions.
- No inspection hole shall be opened while the appliance is in operation.
- Normal and emergency stopping devices shall be made known to all personnel and be easily accessible; all areas giving access to them shall be kept clear of obstacles. Their proper working shall be periodically checked.
- It shall be strictly forbidden to cross over or under an appliance except at the points specially provided for the purpose.

- Overhead gantry, portion of road and rail crossings, walkways, galleries, workplaces under the overhead conveyors used by the personnel, shall be protected by means of suitable covering such as plates/steel sheet covers to prevent falling of the material/objects over such areas/personnel.
- In the case of gangways inclined more than 5 degrees, a suitable non-slip surface to avoid slippage/skidding shall be provided with uninterrupted vertical sheeting on the side remote from the moving appliance.
- Properly designed ladders, walkways and platforms including handrails and toe boards should be ensured.
- Lighting signals and safety signage shall be provided wherever necessary.
- Precautions regarding Conveyor Cleaning and Housekeeping: - Significant risks are present: many accidents occur during cleaning activities when individuals are working on moving, unguarded conveyors or when the conveyor starts-up unexpectedly. The risk of entanglement is very high and once caught – the victim will suffer a violent injury or death. Workers shall:
  - Never use a shovel or other tool to remove build-up on a running conveyor.
  - Never clean running conveyor drums or pulleys.
  - Never try to dislodge rocks from pulleys while the conveyor is running.
  - Never cross under or over a conveyor unless at a designated and properly guarded crossing
  - Cleaning on or around conveyors shall not be performed unless the power to the conveyor is off, locked-out / tagged-out / tried-out (LOTOTO), and machinery components are blocked against motion.

9.8 PROVISION OF BELT CATCH ARRANGEMENT WITH BELT WATCH SYSTEM

JSW sites shall ensure the installation of a Belt and Catch Arrangement combined with a Belt Watch System that includes Central Control Room (CCR) indication, message alerts, and alarm capabilities to enhance conveyor safety. The system shall:

Belt and Catch Arrangement:

- Ensure that conveyors are equipped with a belt and catch arrangement to prevent the belt from slipping, falling, or misaligning.
- This arrangement shall include physical measures, such as catch pans or guardrails, to contain the belt in case of failure, preventing material spills and reducing risks to personnel.

Belt Watch System:

- Continuously monitor the condition of the conveyor belt, detecting issues such as misalignment, slippage, or damage.
- The system shall be integrated with the Central Control Room (CCR) to provide real-time indications, messages, and alarm signals, alerting operators immediately to any abnormalities.
- The system shall also trigger appropriate corrective actions, such as an automatic conveyor shutdown, to prevent further damage and ensure safety.

This provision shall be implemented as part of the conveyor safety device system to prevent accidents and ensure continuous monitoring and early detection of belt-related issues.

10. SAFE OPERATING PROCEDURES

10.1 SAFETY PRECAUTIONS DURING MAINTENANCE WORK IN A CONVEYOR BELT

Site shall ensure following safe practices while performing maintenance activities on conveyor system.

Working on Conveyor drive

1. Stop the conveyor belt when it is empty. Never stop the belt in load.
2. Do the positive isolation of all the electrical power sources of conveyor system and any other hazardous energy.
3. Before changing/replacing of any component of the drive (coupling, gearbox, or motor), do the positive isolation of potential energy source (take-up unit) of the belt by holding it with a pair of suitable chain blocks. To hold take up, lift it by 6-8 inches to take GTU load by chain blocks. It is also desirable (although not a should) to place the 'I' beam/channel at correct position under the gravity take up. Internal inspection of gearbox components should be done through the provided inspection cover only and its top cover should not be opened at site.
4. Whenever the gearbox or/and motor is required to change, the factor of safety for the gearbox should not be less than 2.0 (Attention should be given at design/selection phase)
5. The oil level in fluid coupling should be maintained as per mentioned quantity in its manual. The slip in fluid coupling should be less than 3%.
6. In the pin-bush and gear couplings, the minimum gap between the flanges should be maintained as per the recommended value according to their size. All the moving/rotating components of the drive should be covered by standard safety guards.

Counterweight

1. Stop the conveyor belt when it is empty. Never stop the belt in load.
2. Do the positive isolation of all the electrical power sources of conveyor system and any other hazardous energy.
3. Spillage material accumulated on counterweight should be removed on regular interval.
4. A counterweight and its pulleys suspended above the floor or ground, in an area where an employee could walk, shall have an enclosure around the area of impact or a catch pan under the counterweight of such strength and design to hold the counterweight and pulley from dropping to the ground, floor or platform.
5. The concrete slab type counterweight should be replaced by box type closed counterweight.
6. The rope of the counterweight should be checked on regular interval for its strands condition and bulldog grip looseness.
7. When, two wire ropes hang the counterweight, the wire ropes should be of opposite hands. This will avoid twisting of counterweight about its vertical axis.
8. Precautions included in the manual of counterweight or conveyor shall be implemented.

Chute (Receiving or Discharge Chutes)

1. Stop the conveyor belt when it is empty. Never stop the belt in load.
2. Do the positive isolation of all the electrical power sources of conveyor system, including any hazardous energy, as per the safety standard.
3. Before starting any job in receiving chute, power of the preceding belt or feeding device should be isolated. Similarly, before starting any job in the discharge chute, power of the succeeding belt should be isolated. In addition, the chute should be checked for loosely held material inside and cleaned before entering.
4. The side skirt rubber should not be kept in contact with the belt. This may create longitudinal groove on belt top cover and increase friction also.
5. The inside space between side skirt boards (left and right sides) should be two third of belt width.
6. Never use metal plate or piece of belt as a side skirt it may damage the belt.

7. An inspection cover/window should be given in chute at the non-impact-wall. The inspection window can be used for dislodging the jammed material on impact walls or inspection of inside condition of chute.
8. To protect the mother plate of a chute, the hard-faced liner or wear resistant liner plate should be fixed at the impact zone of chute walls.
9. Before executing the welding or gas cutting job in chute, the belt below the chute should be covered by a fire-resistant cloth.
10. There should be proper clearance between the pulley (discharge pulley or tail pulley) end face and the inside wall of the chute.
11. Precautions included in the manual of conveyor shall be implemented.

If the dust content in the material handled is high, a dry fog or vacuum cleaning system should be installed at the receiving chute.

Belt joint (Vulcanized or Mechanical)

1. Stop the conveyor belt when it is empty. Never stop the belt in load.
2. Do the positive isolation of all the electrical power sources, and any other hazardous energy, of conveyor system.
3. Fix the jam angle with deck plate/stringer at a sufficient free length (3 m to 5 m from the joint), towards head end of the conveyor belt.
4. To pull the loose belt, it should be clamped with a pair of angles (also called as pulling angles) at 3 to 5 m from the joint & towards tail end.
5. Pull the belt from the pulling angles with the help of suitable chain blocks & slings.
6. Clamp the belt with a pair of jam angles and hold it with deck plate/stringer. This should be at a suitable distance from the pulling angles & towards tail end of the conveyor belt.
7. Before applying the adhesive, the joint surface should be cleaned thoroughly, and the surface should made free from moisture.
8. In case of mechanical joints of belt, proper selection of fastener and bolt tightening should be done.
9. If there is pocket formation at joint or the edge of the joint is found uprooted, it should be repaired immediately.
10. Precautions: In case of short length belt where tilting of belt is not possible, exact length of belt to be spliced to avoid the dressing.
11. Precautions included in the manual of conveyor shall be implemented.

Pulley

1. Pulley should be checked for its lagging condition (if lagging is present), axial shift and its bearing condition on regular intervals.
2. Weld-joint condition of the disc with hub and shell of the pulley should be checked at every six months.
3. Entrapment of material between tail pulley and return-side belt should be avoided by fixing an inclined plow/scrapper on the belt at return-side.
4. If the bearing temperature of the pulley is found above 70 Deg C, the grease quality, quantity, and radial clearance of bearing should be checked. Always close the greasing points after completion of greasing.
5. The tail pulley of a conveyor belt should be guarded as per the safety standard.
6. Ceramic lagging on bend pulley should be avoided as it increases the friction and overall tension in the belt. If lagging is required, preferences to rubber lagging should be given.
7. Precautions included in the manual of conveyor shall be implemented.

Idlers

1. The jammed or damaged idlers should be replaced immediately, as they have high potential of damaging the belt (specially the belt joint).

2. The space between two idlers should be maintained as per standards, based on belt width and bulk density of material. For example, for a belt of width 1200 mm and carrying material of bulk density 1.2 t/m3 the distance between two troughing idlers should be 1.0 m and that for return flat idlers should be 3.0 m.
3. Chute distance between two idlers to be 0.5 m to avoid belt sag which should not be more than 2%. The minimum distance between two troughing-trainer idlers should be 15 m and that for return trainer should be 30 m.
4. For better control on belt sway, the 'tru-trac' idlers can be used, such as, in return side, fix the idler. (i) at 4.0 m away from the tail pulley. (ii) At about 2.0 m towards head end from the bend pulley of GTU and (iii) In return side, at 4.0 m away from the head pulley

Deck Plate

1. Deck plate should be given below the troughing belt. It prevents spillage material from getting trapped between the rotating pulleys and the belt and ensures design approvals before adding a deck plate.
2. The locations where the conveyor gallery is passing over the road or working area, the deck plate below the return belt should be provided.
3. For repairing or fixing of a deck plate, the safety standard on welding and gas cutting should be used.

Belt Safety Switches (ZSS, Belt Sway Switch, Pull Cord)

1. Regularly clean the Zero Speed Switch (ZSS) to ensure optimal performance. A Zero Speed Switch (ZSS) is a safety and monitoring device for conveyor belt systems and other machinery. It detects whether the equipment is moving or stationary, preventing accidents by identifying unexpected stops due to blockages, belt slippage, or drive failures. The ZSS uses various sensing technologies, such as electromagnetic, proximity, optical, or mechanical sensors, to monitor motion and send signals to halt operations if needed. This protects equipment from damage and integrates with automated systems for maintenance alerts. Commonly used in conveyor systems, rotating equipment, and bulk material handling, ZSS devices are installed on conveyor shafts and require regular maintenance to ensure functionality.
2. The length of lever of 'belt sway switch' should be in the range of belt during belt sway.
3. The 'pull cord switch' with LED indicator should be used. (Material No. 0380A0145 and 0713A0010)
4. Before repairing or changing of belt safety switches, Stop the conveyor belt, when it is empty.

Never stop the belt in load. Do the positive isolation of all the electrical power sources of conveyor system as per the safety tagging system.

Belt Changing Job.

1. New belt roll should be put on a fabricated & heavy stand and roll shaft to be locked from top on supporting points. The stand should be sufficiently heavy or to be anchored with nearby structure. This is required to avoid tilting of stand while the belt is being changed.
2. Belt changing area should be barricaded by safety ribbon and a safety observer should be deployed throughout the job.
3. Stop the conveyor belt when it is empty. Never stop the belt in load.
4. Positively isolate all electrical power sources and any other source of hazardous energy for the conveyor system in accordance with the LOTO Standard (JSW/GHS/GS-07).
5. Job should start after getting clearance in Permit to Work. Belt conveyor should be put under local mode for belt changing activity. Power cut off number may be given after complete belt changing).
6. Position the belt position (where the job should do) at a suitable place and stop the conveyor belt.

7. Do the positive isolation of all the electrical power sources of conveyor system, and any other source of hazardous energy (including preceding and succeeding conveyors), as per the safety tagging system.
8. Before starting any activity in conveyor belt, do the positive isolation of potential energy source (take-up unit) of the belt by holding it with suitable chain blocks. Lift the Take-up by 6-8 inches.
9. Take-up should be lifted and held with two numbers of suitable and tested chain blocks. Selection of chain block to be done as per the table 1.

Table-3: Chain Block Selection

Belt Width (mm)	Belt Length (m)	Chain Block Size (Ton)
Up to 800	Up to 600	2T + 2T
1000	Up to 300	2T + 2T
	Above 300 - up to 600	3T + 3T
	Above 600 - up to 1300	5T + 5T
1200-1600	Up to 300	2T + 2T
	Above 300 - up to 500	3T + 3T
	Above 500 - up to 800	5T + 5T

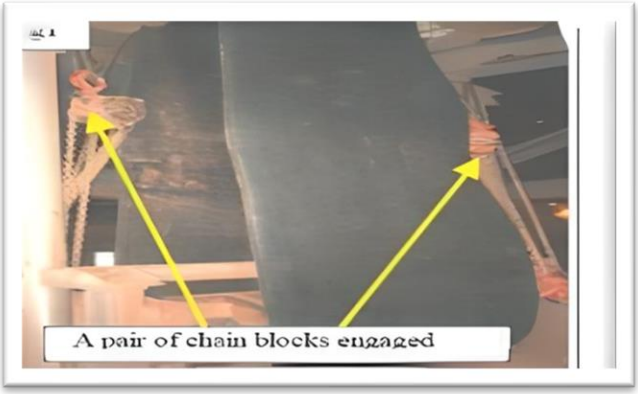


Figure-30: Pair of Engaged Chain Block

10. It is also desirable (although not a should) to place the 'I' beam/channel at correct position under the gravity take up, to avoid the free fall of take up.
11. Before cutting of old belt, it should be clamped properly with conveyor deck plate by 2 nos. of jam angles on both side of the cutting position.



Figure-31: Clamping of Belt

12. To avoid slip or damage of conveyor belt, a rubber piece should be inserted in between the jam angle & conveyor belt.
13. The other end of old belt, which is supposed to be pulled out, should be clamped with holding T shape plates.
14. Release the jam angles and pull the old belt manually or by some external pulling device (Like winch).
    For Winch Safety:
    - Automatic cutoff for overload protection.
    - Digital amperes display on the winch machine.

    The new belt to be pulled from reel by inching drive with local switch.

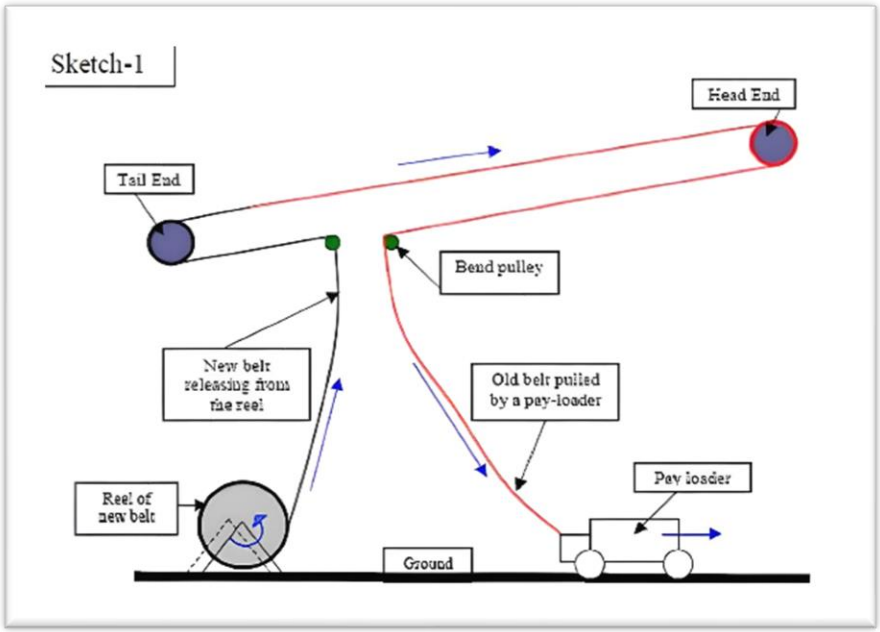


Figure-32: Pulling of Belt

15. The speed of pulling device should be very slow max. 15 meter/min.
16. If belt is longer (more than 250M and at height), three persons should coordinate through Walky-Talky/Mobile Phone. One with local switch operator, second with the pulling device and the third along with joint movement.

17. If belt gallery is at more than 15 m height from ground, when about 5 to 8 m of new belt remains in the wooden reel, pulling of belt to be stopped.
18. Belt to be held in gallery at any point to avoid any movement in the belt.
19. Open/un-wrap the new belt from reel and hold the free end of the new belt with 'T' shape plates & wire rope. The rope length should be more than the height of gallery from ground.
20. Wrap the rope with a fixed and robust structure.
    - Holding of the belt in gallery to be released. Now pulling the belt and releasing rope to be done simultaneously.
    - The old belt should be pulled slowly and after complete replacement of old belt, both ends of new belt to be joined with plate fasteners (Refer Fig 6) and the joint to be positioned in required place for vulcanizing by using belt drive.

Belt Width (mm)	Minimum No. of Fasteners	Distance between Two Clip-Fasteners
800	10	Approx – 75 mm
100	12	Approx – 75 mm
1200	16	Approx – 75 mm
1400	20	Approx – 75 mm



Figure-33: Fasteners Specifications

21. After all these activities performed & complete belt changing, power cut off clearance to be taken and positive isolation locking to be done properly. (Follow Safety tagging system).
22. If there is excess new belt before cutting, it should be hold with rope and other end of rope should be fixed / anchored with robust structure at upper level.
    After vulcanizing, idlers to be set in their position release the take-up and put tension on the belt.
    Once again inspection to be done to see "Is any jam angle left intact with belt? ". If not, Job completion clearance to be given.

10.2 SAFE OPERATING PROCEDURES FOR BELT JOINTING (HOT VULCANIZATION)

Safe Procedures

1. Release to be taken from the Control room and from the operation Department.
2. Take the work permit from relevant authority.
3. Risk assessment should be prepared, and it should be explained to all concerns before starting of the activity.

4. Isolate the system electrically and adopt the LOTO system as per LOTO Standard (JSW/GHS/GS-07), also considering any source of hazardous energy.
5. Make sure that Breaker is in switch off condition.
6. Engage the emergency switch and Pull chord at working place.
7. Lift the counterweight up to 5 meters with the help 10MT chain pulley block of suitable capacity to remove the tension of the belt.
8. Provided physical stopper to arrest the counterweight.
9. Clamp the belt at the required level.
10. Belt Clamps should be checked & certified by site engineer.
11. Make sure the belt clamps holding the belt properly.
12. Clamp to be tightened as per the torque suggested by the clamp manufacturer (160 N/M)

Preparation of Working Surface

Prepare a working surface at least 3 meters long on both sides of the vulcanizer. The Material used (Ex. square timber panel) for working surface should be sufficient strength and stability to ensure that there is no danger of their breaking or turning over. Make sure that there is sufficient space and suitable power source.

Splicing of Belt:

Belt splicing is a specialist job and is associated with very specific dangers that should be controlled:

1. Access to the area to be spliced is often in an elevated position. Use lifelines and harnesses.
2. Adhesives used to splice the belt are toxic. Use the appropriate protective equipment as per the PPE standard (JSW/GHS/GS-05), including PVA gloves and A3P3 respirators.
3. Apply adhesives in well-ventilated areas or if not possible, provide fresh air supply by use of a fan.
4. The use of mechanical clips to join or repair tears in conveyor belts should be considered a temporary repair and should be replaced with a glued and/or vulcanized conveyor belt splice as soon as possible.

Buffing (Grinding)

1. Grinding machine shall be ensured that the handle and body of the machine intact.
2. The machine should be provided with wheel guard.
3. Only Depressed Grinding wheel shall be used for grinding operation.
4. Each wheel shall be run up to its maximum operating speed on the machine under no load conditions for about 30 seconds before commencing the work.
5. The machine operator shall ensure that the machine is provided with wheel guard and hold the machine away from his body during this test run, as the wheel may break if there is any damage.
6. During Grinding operation excessive force shall not be used, as it would lead to wheel breakage. The wheel shall be held at angle between150 to 300.
7. Handheld grinding machine having its body made of nonconductive material is preferred.
8. It shall be ensured that the body of the machine is earthed if it is made of conductive material.
9. Power supply for the machine shall be through ELCB / RCCB of 30 mA sensitivity.
   Adequate personal protective equipment (PPE) shall be used in accordance with the PPE standard (JSW/GHS/GS-05) and the results of the risk assessment (e.g., face shields, eye protection goggles, etc.).

11. MANAGEMENT OF CHANGE

Modifications to conveyor guards need to be addressed through JSW Management of Change Standard (JSW/GHS/GS-16)

Any installation or modification of conveyor guarding, or interlocks should trigger:

- Review of applicable procedure and control.
- Update of procedures and controls where they are found to be no longer valid or ineffective.

- Communication about the change to all relevant workers and supervisors, both line operators, maintenance staff and third-party operators. Example of subtle changes include, but may not be limited to:

  a) Physical, electrical or software bypass of safety interlocks in place to protect people.

  b) Temporary connection of redundant power sources that could affect means of isolation.

  c) Alteration to the positions of emergency stop buttons, cords, or the access routes to them.

  d) Alteration to the normal location of the people performing tasks that affect conveyor operation.

  e) Alteration to the current position of conveyors.

  f) Alteration to nip positions or to the potential number of nips present.

12. EMERGENCY RESPONSE AND PLANNING

JSW Site shall prepare and maintain a comprehensive emergency response plan specific to conveyor safety operations. This plan should address potential risks and hazards associated with conveyor systems and include:

- **Entanglement incidents** where workers may get caught in moving parts of the conveyor.
- **Conveyor belt fires** caused by overheating, friction, or flammable materials.
- **Material spillage or equipment malfunction** leading to injuries or disruptions.
- **Electrical shocks or failures** during conveyor operation or maintenance.
- **Structural failures or collapses** of conveyor systems or supporting structures.

The emergency response plan should detail the necessary requirements, actions, and mitigation measures for each identified scenario. It should ensure clear and precise procedures for emergency preparedness and response, including:

- **Emergency stop protocols** and locations of stop controls for conveyors.
- **Rescue and first aid procedures** for injured personnel.
- **Fire-fighting measures** and evacuation plans in case of conveyor fires.
- **Coordination with local emergency services** for major incidents involving conveyors.
- **Training and drills** to ensure personnel are prepared for conveyor-related emergencies.

This plan should be regularly reviewed and updated to address changes in equipment, processes, or identified risks to ensure continuous safety and compliance.

13. TRAINING

13.1 OPERATOR AND MAINTENANCE WORKER TRAINING

Site shall ensure, all operators and maintenance workers who work on or near conveyors should be informed of the hazards they may encounter and receive training about preventive measures and associated work procedures. All safety procedures and instructions should be documented in written.

13.2 OPERATOR TRAINING

Only trained and authorized persons should be allowed to start up, operate and interrupt the normal operation of a conveyor. Safety training specific to the workstation should be organized to all persons required to work on a conveyor. Operators' instructions should include:

- Conveyor start-up
- Normal shut-down and emergency stop devices (their locations and how to operate them)

- Required checks before starting a conveyor after an emergency shut-down oraccidental stoppage.
- Actions to do to avoid conveyor overload.
- Cleaning.
- Sampling and re-integration.
- Line clearing.
- Reaction to malfunction.

Moreover, operators should be trained in LOTO (JSW/GHS/GS-07) standard.

13.3 MAINTENANCE WORKER TRAINING

The conveyors should be included in the preventive maintenance program of the site. Maintenance operatives should be trained on LOTO procedures. Moreover, maintenance operatives should ensure that guards and deterrent devices are back in place when maintenance tasks are completed.

13.4 TRAINING RECORDS

Training materials should remain visual and include an on-site practical session. Training material should be updated in case of accident/incident, in case of change of machinery or significant change of parts of machines or in case a new risk appears.

At the end of the training, an individual test should be performed to assess the knowledge of attendees and ensure that the training has been understood.

Training documentation (material and attendance sheets) should be easily available. Trainings outputs should be recorded in a training matrix detailing who (name of the person) has been trained to what (topic of the training). This matrix should be available at site level.

14. RACI MATRIX

Table- 4: Responsibility Matrix

Activity Description	Section In-charge	Maintenance Head	Operation Head	Site Safety Head
Implementation of conveyor safety standard	R	C	A	I
Planning, Preparation, Risk assessment	R	A	I	C
Implementation of safety devices in conveyor system	C	R	A	I
Implementation of machine guarding in conveyor	C	R	A	I
Training to identified target audience	R	C	A	I
Inventory Register, Audit/Inspection and monitoring for compliance	R	C	A	I

Note:

R	= Responsible	expected to participate in the activity and contribute the best of his/her abilities
A	= Accountable	ultimately responsible for the results
C	= Consulted	contributes towards decision making
I	= Informed	kept informed but need not participate in the effort.

15. MANAGEMENT OF RECORDS

All records related to **conveyor guards**, **safety devices**, and **conveyor system procedures** should be retained until the conveyor is decommissioned and removed from service, in line with the site's record management system or requirements. These records should be managed according to the following:

Records to be maintained for effective conveyor management include:

1. **Comprehensive Conveyor Inventory**
    - A list of all conveyors, including specifications, model numbers, installation dates, and operational status.
2. **Conveyor Layout and Integration**
    - Detailed diagrams showing conveyor locations, configurations, and their integration with other systems.
3. **Scheduled Maintenance Records**
    - Documentation of scheduled maintenance, including inspection dates, tasks performed, and corrective actions taken.
4. **Repair and Replacement Logs**
    - Records of repairs or replacements made to conveyor components (e.g., belts, motors, rollers), with reasons and actions taken.
5. **Condition Monitoring Records**
    - Documentation of continuous or periodic condition monitoring (e.g., vibration, temperature, or load monitoring) and analysis for conveyor systems.
6. **Training Records**
    - Documentation of training sessions for operators, maintenance personnel, and safety teams, including topics such as safe operation, troubleshooting, and emergency procedures.
7. **Incident and Near Miss Reports**
    - Detailed reports on any incidents, near misses, or injuries involving conveyors, including root cause analysis and corrective actions implemented.

Record Retention and Custodianship:

Record Type	Location/Custodian	Retention Time
Conveyor System Inventory and Diagrams	Department Head	Lifetime of the equipment
Maintenance, Repair & Monitoring Records	Maintenance Department	Lifetime of the equipment
Training Records	HR Department	Until employee leaves
Pre-commissioning Inspection Records	Maintenance Department	Lifetime of the equipment
Monthly Inspection Records	Department Head	3 years
Incident, Near Miss, and Injury Records	Health & Safety Department	5 years or as per regulations

General Retention:

- All records related to conveyor systems should be retained for a **minimum of five years** or as required by local legal and regulatory requirements.

16. LEGAL AND OTHER REQUIREMENTS

JSW site shall access, identify, evaluate, and keep up to date the Conveyor standard requirement as per prevailing law in operation.

17. KEY PERFORMANCE INDICATORS

The site/location should annually carry out audits as per procedures to identify:

- Compliance with the conveyor safety (specifically related to guarding) procedure.
- Arrangements to ensure competency of operators and maintenance personnel.
- Arrangements for the supervision of activities where conveyor guarding is used.
- Verification of conveyor safety devices that they exist, are reliable and in good condition.
- That the conveyor safety procedure is relevant, practicable and effective.

18. ASSURANCE

Each site shall conduct self-assurance program to ensure compliance with this STANDARD as part of its Safety assurance program. Third party system audit shall be conducted by Group Safety or external consultants to ensure compliance with the standard.

19. DEFINITIONS

Term	Definition
Competent Person	A person who has, through a combination of training, education, and experience, acquired knowledge and skills enabling that person to correctly perform a specified task.
Control Circuit Isolation	The interruption of the control circuitry of the drive motor(s) of a conveyor system(s).
Conveyor	Apparatus or equipment operated by any power other than manual, by which loads are raised, lowered, or transported or are capable of being raised, lowered, transported, or continuously driven by— (a) an endless belt, rope or chain or other similar means. (b) buckets, trays or other containers or fittings moved by an endless belt, rope, chain, or other similar means. (c) a rotating screw. (d) a vibrating or walking beam; or (e) rollers It includes the supporting structure and auxiliary equipment used in connection with the conveyor.
Conveyor system	An installation comprising one conveyor, or multiple conveyors whose control is integrated.
Danger Zone	Any zone in or around a conveyor or conveyor system in which a person is subject to a riskto health or safety.
Emergency Stop	A manual or automatically operated system designed to stop a conveyor system in theshortest practicable time in an emergency.
Energy-isolating device	A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: a manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors, and in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit-type devices are not energy-isolating devices.
Fail Safe	The principle of failure to safety, which is any failure of the machinery, its associated safeguards, control circuits or its power supply that leaves the machinery in a safe condition.

Term	Definition
Fixed Guarding	Guarding which can only be removed using tools.
Guarded	Shielded, fenced, enclosed, or otherwise protected by means of suitable enclosures, covers, casing, shield guards, trough guards or railing guards which removes foreseeable risk of personal injury being caused by accidental contact or approach, and for an under guard, removes any additional foreseeable risk of personal injury caused by contact with, or spillage of, material from the conveyor.
Guarded by location or position	Moving parts which are protected by their remoteness from the floor, platform, walkway, or other working level or which by their location with reference to frame, foundation, or structure remove the foreseeable risk of accidental contact by people or objects.
Mobile Conveyor	A conveyor whose location may be moved during its operation
Nip Point	That point at which a moving conveyor element meets a fixed or moving element so that it is possible to nip, pinch, squeeze or entrap parts of the human body encountering one of the two elements.
Normal Stop	A manual or automatically operated system designed to stop the conveyor under normal operating conditions.
Protective Stop Control	A stop control provided for the protection of the conveyor or personnel from a hazard which, when activated, stops the conveyor, and includes emergency stop controls.
Pull Cord	A cord connected to a device, normally provided for emergency stop control which, when pulled, activates the device.
Runaway	Uncontrolled movement of the conveyor in either direction.
Sequence	A control system designed to stop or start a conveyor, depending upon the state of other equipment.
Shear Point	The point at which, or the line along which, a moving part meets or passes close enough toa stationary part or object so that parts of the human body can be caught, trapped, or pinched between them.
Start	A manual or automatically operated control system designed to start the conveyor under normal operating conditions.

Term	Definition
Transportable Conveyor	A conveyor which is not a mobile conveyor that can be moved as a unit from one locationto another.

20. REFERENCE

References Document	Full Title, Brief Description and Web Links
1. European Standards	EU Directive 2006/42/EC: Machinery Directive I_15720060609en00240086.pdf (europa.eu)
2. International Organization for Standardization (ISO)	ISO is an independent non-government membership organization and the world's largest developer of voluntary international standards. They give world class specifications for products, services, and systems to ensure quality, safety, and efficiency. ISO 19353:2019 Safety of machinery — Fire prevention and fire protection IEC/IEEE 82079-1:2019 Preparation of information for use (instructions for use) of products EN 1837:2020 Safety of machinery - Integral lighting of machines ISO 2109:1975 Continuous mechanical handling equipment — Light duty belt conveyors for loose bulk materials ISO 1050:1975 Continuous mechanical handling equipment for loose bulk materials — Screw conveyors ISO 5048:1989 Continuous mechanical handling equipment — Belt conveyors with carrying idlers — Calculation of operating power and tensile forces. ISO/TR 9172:1987 Continuous mechanical handling equipment — Safety code for screw conveyors — Examples of guards for trapping and shearing points ISO/TR 14799-1:2022 Comparison of worldwide escalator and moving walk safety standards. ISO/TR 14799-2:2023 Comparison of worldwide escalator and moving walk safety standards. ISO 340:2022 Conveyor belts — Laboratory scale flammability characteristics — Requirements and test method ISO 7745:2024 Hydraulic fluid power — Fire-resistant fluids — Requirements and guidelines for use IEC/IEEE 82079-1:2019 - Preparation of information for use (instructions for use) of products — Part 1: Principles and general requirements (iso.org)
3. British Standard Institute	BSI is the business standards company that equips business with necessary solutions to turn standards of best practice into habits of excellence. BS EN 1366-7:2004 Fire resistance tests for service installations - Conveyor systems and their closures

References Document	Full Title, Brief Description and Web Links
	BS EN 12882:2015 – TC Conveyor belts for general purpose use. Electrical and flammability safety requirements BS EN ISO 20238:2019 Conveyor belts. Drum friction testing
4. The American Society of Mechanical Engineers	ASME B20.1-2021: Safety Standard for Conveyors and Related Equipment
5. Standards Australia	AS/NZS 4360:2004: risk management AS/NZS 4360:2004 - Standards Australia AS/NZS 2381.1:2005 AS/NZS 2381.1:2005 Electrical equipment for explosive gas atmospheres—Selection, installation, and maintenance - General requirements (saiglobal.com) AS/NZS 2381.1:1999 Electrical equipment for explosive atmospheres - Selection, installation and maintenance, Part 1: General requirements AS/NZS 2381.1:1999 Electrical equipment for explosive atmospheres - Selection, installation and maintenance, Part 1: General requirements | Standards Australia Store AS/NZS 1020:2023 The control of static electricity in non-hazardous areas AS/NZS 1020:2023 The control of static electricity in non-hazardous areas | Standards Australia Store AS/NZS 4024:2019 Safety of machinery AS/NZS 4024:2019 Series Safety of machinery | Standards Australia Store AS 3569-2010 AMDT 1 Steel wire ropes - Product specification AS 3569-2010 AMDT 1 - Standards Australia AS 2865 – 1995 Safe working in a confined space Code (safeworkaustralia.gov.au) AS/NZS 60079.10:2004 Electrical apparatus for explosive gas atmospheres, Part 10: Classification of hazardous areas (IEC 60079-10:2002 MOD) AS 2380.1-1989 AMDT 1 Electrical equipment for explosive atmospheres, Part 1: Explosion-protection techniques — General requirements AS 2380.1-1989 AMDT 1 Electrical equipment for explosive atmospheres, Part 1: Explosion-protection techniques — General requirements | Standards Australia Store AS/NZS 1680.2.1:2008 Interior and workplace lighting, Part 2.1: Specific applications - Circulation spaces and other general areas AS/NZS 1680.2.1:2008 Interior and workplace lighting, Part 2.1: Specific applications - Circulation spaces and other general areas | Standards Australia Store AS 1657:2018 Fixed platforms, walkways, stairways, and ladders - Design, construction, and installation

References Document	Full Title, Brief Description and Web Links
	AS 1657:2018 - Standards Australia AS 1333:2024 Conveyor belting of elastomeric and steel cord construction. AS 1333:2024 Conveyor belting of elastomeric and steel cord construction | Standards Australia Store

JSW Group

MANAGEMENT STANDARD

MACHINE GUARDING

JSW/GHS/GS-10

MANAGEMENT STANDARD MACHINE GUARDING

Management Standard Title:	**MACHINE GUARDING**	**Date of Revision**	10.12.2024
Document	JSW/GHS/GS-10	**Revision**	01

Document Issue and Revision History		
Date	Revision Number	Change Summary
10.12.2024	01	Cross-references have been included. Added Assurance Section Figures made consistent in Section 5.2.1 Added Definition of Process Owner

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1. PURPOSE

Moving and rotating machinery constitutes a major hazard with the potential to cause serious or fatal injuries. Protection against this hazard is more effective when engineering controls are provided to act as a physical barrier between personnel and the hazard.

This document establishes the safety standard for all personnel directly or indirectly involved in operations for managing the risks associated with contact with rotating moving machine and danger zone.

Line Management has the responsibility to implement this standard.

2. SCOPE

This standard applies to all moving/rotating machinery or plants operating within JSW in which injury may be sustained from any pulley, belt drives, gear drives, chain drives, couplings, universal/floating shafts, conveyor or any other moving or rotating mechanical/electrical portable devices. Ensuring the safety of machinery like lathes and portable devices is crucial during operations.

The standard is to ensure personnel are protected from exposed moving machine parts by providing a physical barrier or interlock to all access and Nip points on each machine.

This standard aims to provide practical advice for the implementation of Machine Guarding, this standard describes the process by which an operation can manage the common hazards associated with moving/rotating machinery, through the effective use of machine guards.

The safeguarding of machinery falls into two main classifications:

- The guarding of mechanical power transmission apparatus.
- The guarding of the point of operation on the driven machine.

This standard provides information for design and fabrication of guards or acceptance of manufacturer's guards and discusses the general features to be considered in guarding mechanical power transmission apparatus and applications of guards to various types of power transmission equipment.

Exclusions: This standard does not address catastrophic failure of machinery, or the materials being processed as it relates to process safety. Similarly, it does not address or alter the lockout requirements of the LOTO Standard (JSW/GHS/GS/ 07).

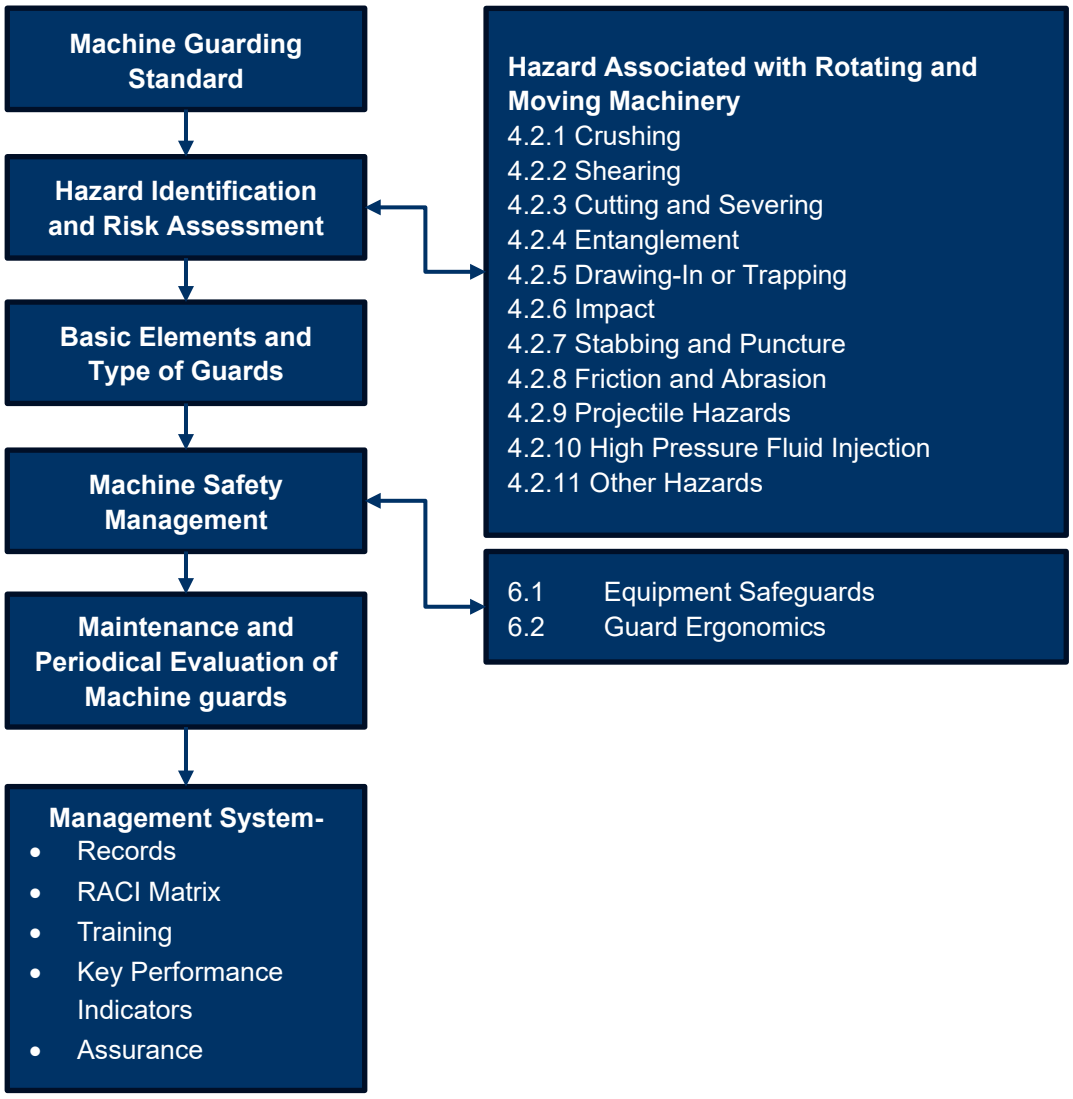
In the Standard, the following verbal forms are used to indicate requirements, recommendations, permissions, or capabilities:

- “shall” indicates a requirement.
- “should” indicates a recommendation.
- “may” indicates a permission.
- “can” indicates a possibility or capability.

3. REVIEW

The Standard shall be reviewed at least every 5 years or when a serious incident or high potential near miss is recorded.

4. PROCESS FLOW



5. HAZARD IDENTIFICATION, RISK ASSESSMENT AND CONTROL

5.1 MACHINE GUARDING ASSESSMENT

The declaration of conformity of machinery and / or work equipment is the key document that shall be retained at the site. All machinery made available to workers shall comply with the specific legislative and regulatory requirements as per the country specific regulations. The pre-requisite of the declaration of conformity of machinery is the machine guarding assessment process. Guarding should be addressed in terms of quantitative/qualitative risk assessment) during the different phases of the machinery project to ensure that effective and maintainable safeguards are selected, manufactured, and installed.

Once placed at the site, a survey of all machinery / equipment shall be undertaken by Department Heads through persons who are competent (Preferably not less than Section Head) to ensure appropriate guarding and/or safety devices are in place to prevent inadvertent or accidental contact with moving parts of machinery and assess the risks and then eliminate or control those risks that have the potential to result in harm to people involved based on the following hierarchy (preferred order) of controls. This survey shall be documented (As per Site/ Location documentation system).

The primary machine hazards of concern are associated with those tasks and conditions that have the potential to result in entrapment, pinching, crushing, and/ or cut-related injuries.

As a minimum requirement the survey shall identify the following:

- Location of all machinery/equipment both fixed and portable; the work equipment and their components shall be stably located, when required, by fastening or other means.
- The types of machine guard or safety device fitted (indicative list of safety components: guards and protective devices designed to protect operators against moving parts involved in the operations of machinery, protective devices designed to detect the presence of persons, logic units to ensure safety functions, emergency stop devices, etc.).
- Confirmation that the machine is fitted with an emergency stop or shut off device; all machinery shall be fitted with one or more emergency stop devices to lessen the risks connected to the normal running of the machinery. The control devices of work equipment that have an impact on safety should be clearly visible, identifiable, and appropriately marked.
- Identification of measures to prevent any risks associated to interference among machines (e.g. connections through conveyors and transport systems) and interference with general workplace (e.g. projection of parts, increasing of noise levels, release of hazardous substances, increased congestions of working areas with impact on emergency corridors, etc.).
- Identification of measures to prevent any hazardous interference between machinery and operators both during operation and maintenance and specific activities (e.g. de-jamming, cleaning, change of format, etc.).
- Any follow up action required to rectify any defects or deficiencies; all findings shall be recorded as well as actions identified to improve control over any deficiencies; and
- Date of the survey and signature of competent person that developed the survey.
- In addition, specific aspects need to be considered when performing the machine guarding survey:
- Personnel performing the survey (both internal or third party) is expected to be qualified and specifically trained to understand the whole range of hazards associated with moving parts and dangerous parts of machinery.
- Fitted machine guards shall be identified considering both their suitability and effectiveness in protecting the personnel. it is worth noting that guards and protective equipment shall: be of robust construction, not cause additional risks, not be easily bypassed or made ineffective, be located at a sufficient distance from the danger zone, not inhibit the execution of the work cycle more than necessary, and, allow essential work for the installation and/or replacement of tools, as well as for maintenance work, without the need to

dismantle the guards or the protective system. Should be this case the machinery is expected to be designed so to be de-energized regarding all its hazardous energies (capable of being locked out).

- Machine guarding survey shall include the installation of emergency shut off devices for both stationary and portable machinery with moving parts; all machinery shall be fitted with a control device that allows to stop in a safe condition the whole, or only a part (the hazardous part), of the work equipment.

As a guide the following outlines the main steps to performing a machine guarding survey:

Survey Steps	Overview of Activities
Step 1 Form Survey Team	Machine Guarding Element owner shall lead the survey. He will Identify persons who are trained and knowledgeable on the range of moving machinery hazards and the criteria which constitutes a suitably designed and constructed machine guard
Step2 Survey scope and methodology	Define the scope of the machine guarding survey, include all areas of the JSW facility, all stationary and portable machines. Plan and schedule the survey to systematically inspect and assess all stationary and portable machines within the operation/facility. Develop a form to capture all relevant information (refer **Annexure-7**)
Step 3 Perform the survey	Conduct the survey by assessing each machine and identifying its hazardous motion/action and the suitability of the machine guard fitted. Assess machines to ensure an emergency stop button or switch is fitted. Record where a machine requires a machine guard to be fitted or modified to ensure adequate protection is provided.
Step 4 Action deficiencies	Establish an action plan to undertake improvements based on the gap identified including a budget if needed. Monitor and report on the progress of improvements/ corrective actions
Step 5 Retain and update survey	Retain the machine guarding survey for future reference and update the document as machines are commissioned and/or decommissioned. Conduct an annual review of the survey to ensure machine guarding requirements are being maintained

The operation and maintenance logbook of machinery is a consequence of mechanical safety assessment. The facility shall keep the operation and maintenance logbook for the machines and work equipment that are in use until the machinery have been decommissioned and removed from service.

Specific industry sectors require an accurate risk assessment. In the wind industry sector, for instance, where machinery such as wind turbines and associated equipment are used, machine guarding assessment is critical for ensuring the safety of workers. As an example, the moving parts associated with the turbine, if not guarded adequately, may have the potential to cause severe workplace injuries, such as crushed fingers or hands, amputations, burns, or blindness. Machine guarding assessment should ensure that the workers are protected from the machine hazards and workers supervisors should make sure that the rotating parts and points of operation of machines are kept adequately guarded as per risk assessment outcomes.

General considerations are referred to:

- **Hazard identification:** Conduct a thorough risk assessment to identify potential hazards associated with wind turbines and moving/rotating machinery. These may include moving parts such as blades, gears, and rotating shafts, as well as electrical hazards and fall hazards associated with working at height.
- **Selection of appropriate safety measures:** Choose guards that are appropriate for the specific hazards identified according to risk assessment results. Guards may include fixed guards, interlocked guards, barrier guards, or presence-sensing devices, depending on the nature of the machinery and the tasks being performed.
- **Ensure compatibility with operations:** Guards should be designed and installed according to risk assessment results in a way that they do not impede the operation of the machinery or interfere with maintenance tasks. They should allow for safe access to necessary components for maintenance and repair activities.
- **Guarding for access points:** Install fixed or mobile interlocked barriers to prevent unauthorized access to hazardous areas of machinery, such as access doors, hatches, and openings. Lockout/tagout procedures should also be implemented to ensure that machinery is de-energized and locked out before maintenance or repair work begins.
- **Training of operators:** Ensure that workers receive proper training on the importance of machine guarding and how to operate machinery safely according to risk assessment results. This should include training on identifying hazards, using guards effectively with no chance for defeating safety barriers, and following lockout/tagout procedures.
- **Regular inspection and maintenance:** Establish a routine inspection and maintenance schedule to ensure that guards and barriers remain intact and functional. Guards should be inspected for damage, wear, or tampering, and any issues should be addressed promptly.

Risk assessments shall consider routine start-up and shut down, routine operations, including cleaning, unjamming, and maintenance activities, as well as standard categories of planned interruption of operation and standard categories of deviations from normal operating conditions; non routine operations (e.g. servicing, repairing, degraded mode, abnormal maintenance, etc.) should be considered as well. Risk assessments shall include risks associated to hazards of being struck between stationary and moving part, of moving parts that are able to force the body into a dangerous position or project pieces and materials, of machinery cutting actions, of machinery punching actions, of machinery shearing or bending actions, of nip-points (between 2 rotating parts or between rotating and tangential parts or between rotating and fixed parts which shear, crush, or abrade).

In addition to risks connected with guarding moving parts and mechanical safety, the machinery risk assessment shall also consider equipment layout and address any other associated hazards, such as:

- Authority to remove a machine guard or disable a safety device. Access to moving machine parts or any other machine hazards shall not be permitted while equipment is operational, including during troubleshooting.
- Removal of a machine guard or disabling of a machine safety device shall be prohibited unless isolation and lockout are applied in accordance with the LOTO standard (JSW/GHS/GS-07), and the machinery has been tested to ensure it is fully de-energized.
- Guarding shall never be bypassed. Any attempt to bypass machinery safeguards requires approval through the management of change procedure.
- During equipment servicing or when machine guarding devices are removed, energy sources to the machine shall be controlled according to hazardous energy control procedures.
- Guards shall not be opened or removed while the machine is in motion. Authorization for opening or removal of guards should be obtained through the Permit to Work (PTW).

- In case of machine malfunction, only trained and authorized personnel are permitted to diagnose the issue. Replacement parts and devices recommended by the manufacturer shall be utilized to ensure the machine's continued safe operation and integrity.
- Replacement parts should be properly matched to the machine's series, model, serial number, and revision. If original replacement parts are unavailable, consultation with the manufacturer for suitable alternatives is necessary. Acceptance of alternative parts or proposed modifications is contingent upon completion of the Management of Change process.
- In situation where machinery is to be operated with the machine guard removed and/or its safety devices disabled then process as explained in **Annexure 1** shall be followed.

5.2 Occupational Hazard Associated With Rotating And Moving Machinery

Rotating and moving machine parts have the potential to cause severe workplace injuries, such as crushed fingers or hands, amputations, burns, blindness, or even death. Injuries or death can occur from being trapped, entangled, or struck by machinery parts due to the unexpected starting of equipment or unobvious movements during operations, maintenance, or cleaning.

Typical hazards associated with rotating and moving machinery may include:

5.2.1 Crushing

Occurs when part of the body is caught between a moving part of a machine and a fixed object, e.g., underneath scissor lift or between the tools of a press.

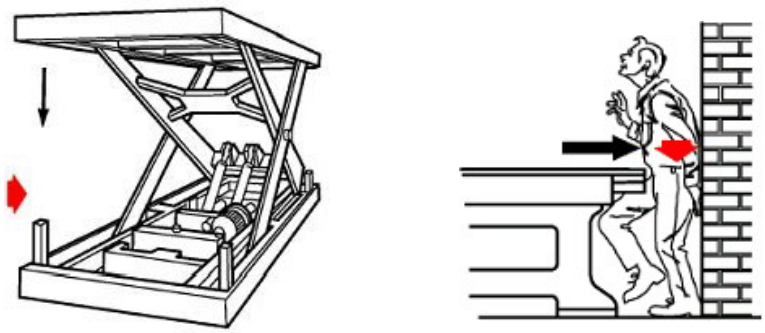


Figure -1 : Typical Examples of Crushing

5.2.2 Shearing

Shearing action involves applying power to a slide or knife to trim or shear metal or other materials. A hazard occurs at the point of operation where stock is inserted, held, and withdrawn.

Examples of machines used for shearing operations are mechanically, hydraulically, or pneumatically powered shears.

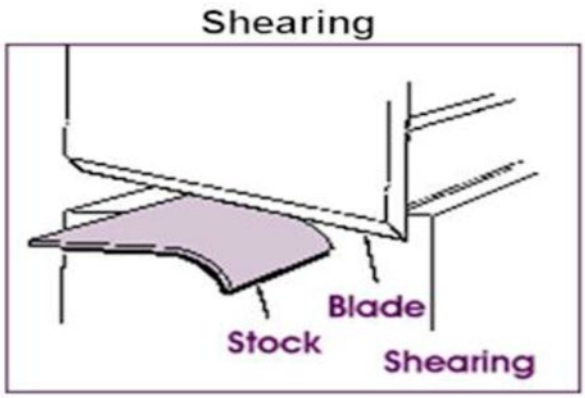


Figure - 2 : Typical Example of Shearing

5.2.3 Cutting and Severing

Cutting hazards include contact with circular saws, guillotine knife, rotary knives or moving sheet metal.

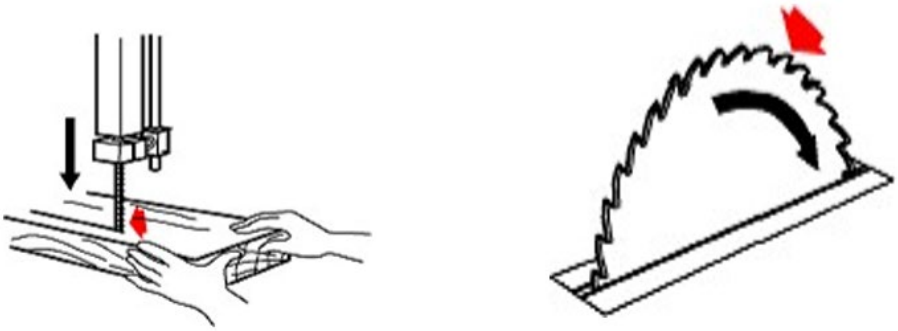


Figure - 3 : Typical Examples of Cutting and Severing

5.2.4 Entanglement

Occurs because of clothing or hair contact with rotating objects or catching on projections or in gaps, e.g., revolving beaters, cylinders, and drums; revolving shafts, spindles, mandrels, and bars etc.

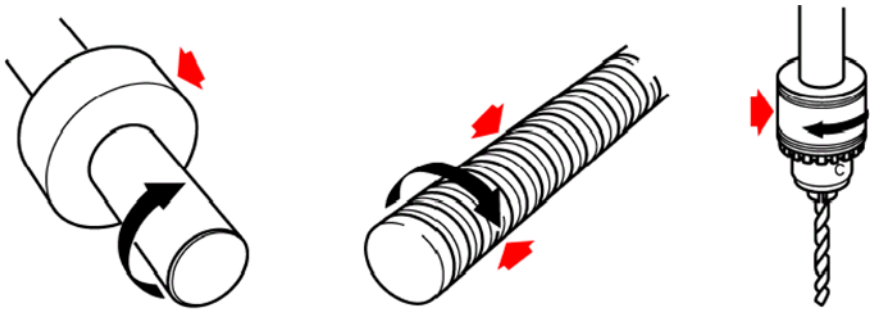


Figure - 4 : Typical Example of Entanglement

5.2.5 Drawing-In or Trapping

Occurs when part of the body is caught between two counter-rotating parts, e.g., gears, mixing mills or between belt and pulley or chain and chain wheel.

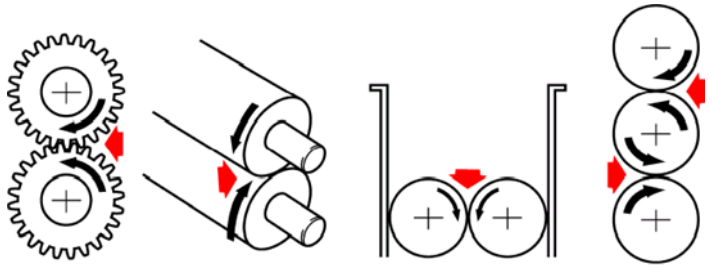


Figure- 5 : Typical Example of Drawing In Or Trapping

5.2.6 Impact

Impact hazards are caused by a moving object striking the body without penetrating it, e.g., being hit by a robot arm or moving parts of a conveyor belt.

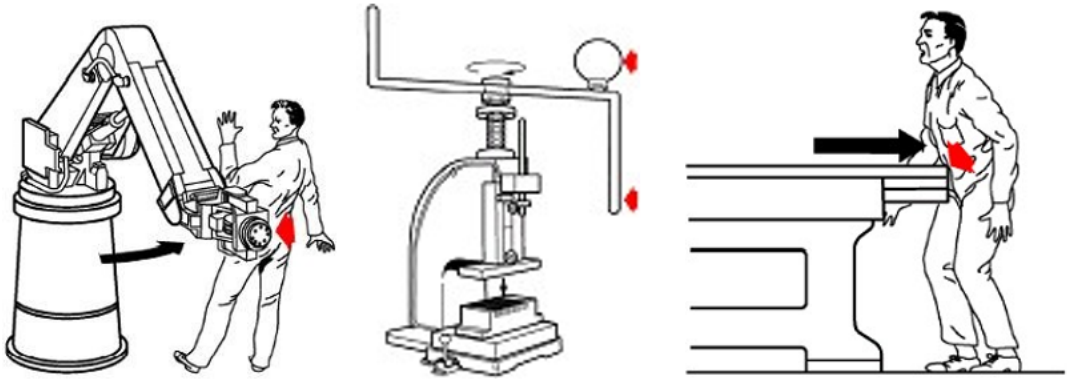


Figure - 6 : Typical Examples of Impact

5.2.7 Stabbing and Puncture

Occurs when flying objects, swarf or rapid moving parts contact the body.

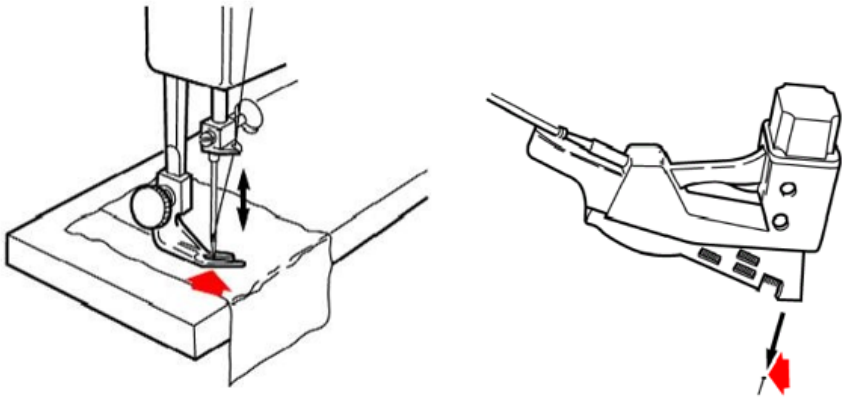


Figure - 7 : Typical Examples of Stabbing And Puncture

5.2.8 Friction and Abrasion

Occur when the body contacts moving rough or abrasive surfaces e.g., abrasive wheels, conveyor belts.

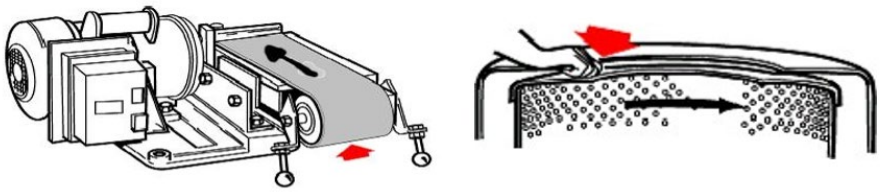


Figure - 8 : Typical Examples of Friction And Abrasion

5.2.9 Projectile Hazards

Breakage of high-speed cutting tools; disintegration of abrasive wheels; disintegration of conveyor belts; robot arm gripper (or clamp) failure.

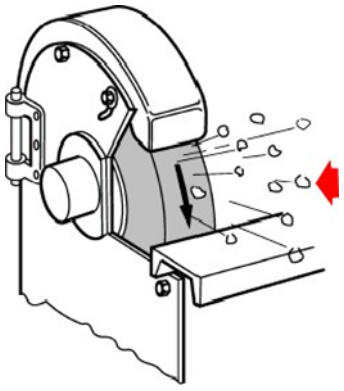


Figure - 9 : Typical Example of Projectile Hazard

5.2.10 High Pressure Fluid Injection

Sudden release of fluid under pressure can cause tissue damage like crushing; and

5.2.11 Other Hazards

Exposure to electricity; hot surfaces; ionizing and/or non-ionizing (microwaves, ultraviolet light, laser beams and radio waves) radiations; noise; work activity hazards (e.g., highly repetitive actions, stressful posture, lifting/ handling, poor workplace design etc.).

5.3 BASICS ELEMENT OF MACHINE GUARDING

Any machine part, function, or process which may cause injury shall be safeguarded according to outcomes of machine guarding risk assessment. Where the operation of a machine or accidental contact with it can injure the operator or others in the vicinity, the hazard should either be controlled or eliminated. Identifications of machine hazards should be undertaken by persons who are trained and knowledgeable on the range of moving machinery hazards and the criteria leading to a suitably designed and constructed machine guard.

There are generally three types of mechanical components on moving machinery that present a hazard these being:

1. The **point of operation** where the work is performed on the material, such as cutting, shaping, boring, or forming of stock is a potential mechanical hazard and in need of safeguarding.
2. The **power transmission apparatus**, which is the component of the mechanical system that transmits energy to the part of the machine performing the work, is a potential hazard and requires safeguards. These components may include flywheels, pulleys, belts, connecting rods, couplings, cams, spindles, chains, cranks, and gears.
3. All **other moving parts** of the machine that move while the machine is working pose potential hazards. These hazards can include reciprocating, rotating and transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine with risks of entrapment, entanglement, cutting, amputation, crushing, abrasion and pinch points.
4. A variety of different types of hazardous mechanical motions and actions can be present in nearly all machines. These hazards need to be recognized to be controlled. Motions and related hazards are as follows:

- **Rotating motions**, - Circular motion such as action generated by rotating collars, couplings, cams, clutches, flywheels, shaft ends, and spindles that may grip clothing or otherwise force a body part into a hazardous location. Projections such as locating screws or burrs on the rotating part increase the hazard potential.

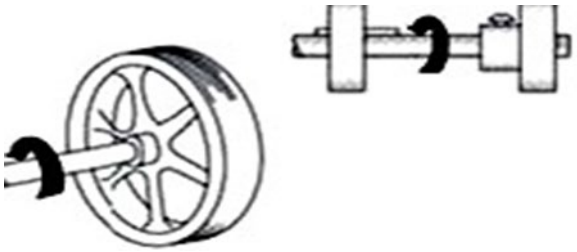


Figure - 10 : Examples of Rotating Motion

- **In- running Nip point hazards** Known as “pinch points,” these develop when two parts move together and at least one moves in rotary or circular motion.

Running nip points occur whenever machine parts move toward each other or when one part moves past a stationary object. Typical nip points include gears, rollers, belt drives, and pulleys.

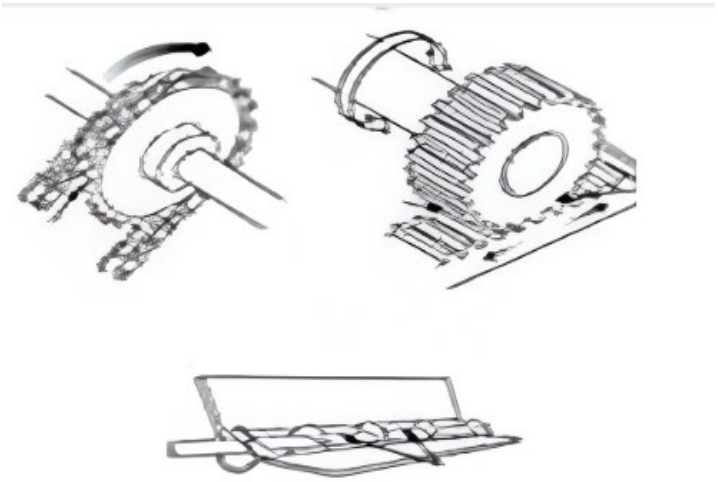


Figure - 11 : Example of In-Running Nip Point Hazard

- **Tangentially moving parts**, such as the point of contact between a power transmission belt and its pulley, a chain or a sprocket, or a rack and pinion, create nip points.

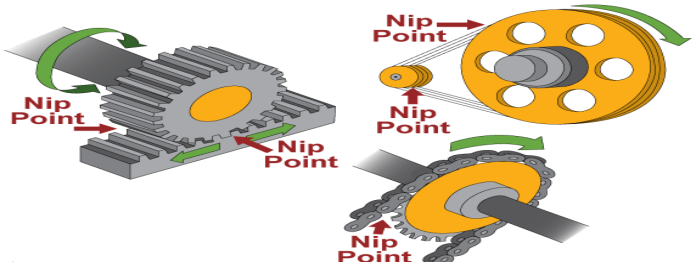


Figure- 12 : Example of Tangentially Moving Parts

- **Reciprocating motions** such as parts moving up and down or back and forth have the potential to strike, catch, pinch, or shear a worker.

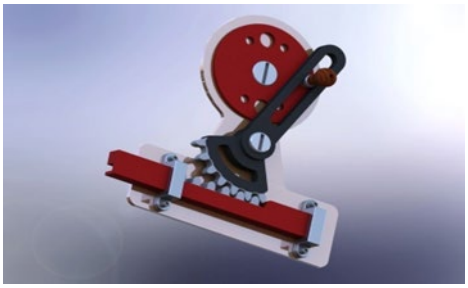


Figure - 13 : Examples of Reciprocating Motion

- **Transverse motions**, Motion in a straight, continuous line that may strike or catch a worker in a pinch or shear point created by the moving part and a fixed object.

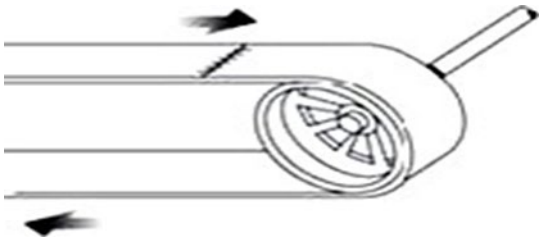


Figure - 14 : Example of Transverse Motion

- **Punching action** results when power is applied to a slide (ram) for the purpose of blanking, drawing, or stamping metal or other materials. The danger of this type of action occurs at the point of operation where stock is inserted, held, and withdrawn by hand.

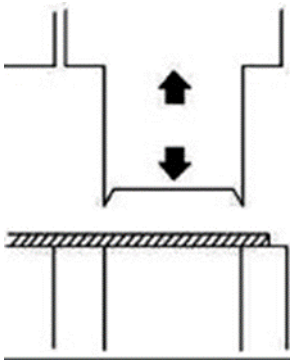


FIGURE - 15 : EXAMPLE OF PUNCHING ACTION

- **Bending action** results when power is applied to manipulate material causing it to change shape. Examples are power presses and tubing benders. The hazard occurs where the point of operation where stock is inserted, held, and withdrawn.

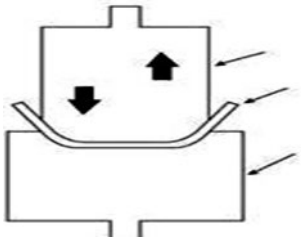


Figure 16 : Example of Bending Action

Safeguards shall be ordered and installed with the new equipment. If used equipment is purchased, required safeguards shall be retrofitted prior to placing the equipment in service. Shop made equipment shall be generally avoided; when necessary, they shall include equivalent safeguards established according to the results of machine guarding risk assessment and national compliance legislation requirements.

The machine guarding engineering controls are:

- Location and distance (location of hazardous parts in a way they are inaccessible or far enough from the user's body so not to pose a hazard during normal operation).
- Physical guards (fixed, mobile, and interlocked, adjustable, self-adjusting).
- Optical guards (safety light curtains).
- Safety devices (presence sensing, pullback, restraint, safety controls, as safety tripwire cable, two-hand controls etc.).

- Feeding & ejections operational methods aimed to limit the operator interaction (automatic and/or semi-automatic feed and ejections, robotic arms, miscellaneous aids as awareness barriers, protective shields, hand-feeding tools, etc.).

The machine guarding administrative controls include safe working instructions, specific training, SOP, SMPs, periodic inspection activities, personal safety precautions (e.g. related to lose clothing, long hair should be securely tied back and preferably tucked into appropriate headwear to avoid entanglement, jewellery, scarves).



Figure - 17 : Warning Label While Working Near Rotating

5.4 TYPE OF GUARDS

The main types of safeguards and safety devices can be classified as follows:

- **Fixed Guards**: These guards have no moving parts and are fastened in a constant position relative to the danger zone. They are kept in place either permanently, by welding for example, or by means of fasteners (screws, nuts etc.) making removal/opening impossible without using tools. If by themselves, or in conjunction with the structure of the equipment, they enclose the dangerous parts, fixed guards meet the requirements of the first level of the hierarchy. Note that, in most countries, fixed enclosing guards, and other types of guard can have openings, if they comply with appropriate safe reach distances as set by the relevant in-country regulations.

  Note the use of clips, wing nuts, etc. which can be removed without tools is not permitted for a fixed guard.

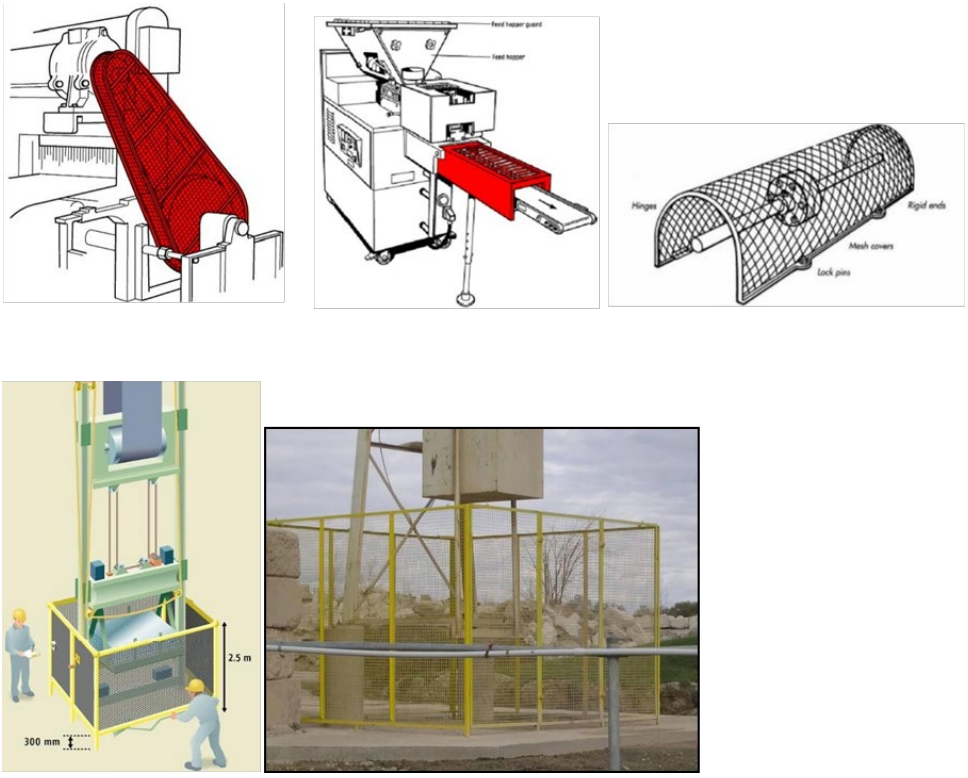


Figure - 18 : Typical Example of Fixed Guards

- **Other Guards**: These include, for example, fixed guards with an adjustable element, automatic guards, or interlocked guards.
- **Adjustable guards:** comprise a fixed guard with adjustable elements that are either self-adjusting or which the setter or operator position to suit the job being worked on. They are widely used for tool-room machines and woodworking. These guards can usually be adjusted without the use of tools. These allow limited access through openings, gates etc. for feeding materials, adjusting, cleaning etc.

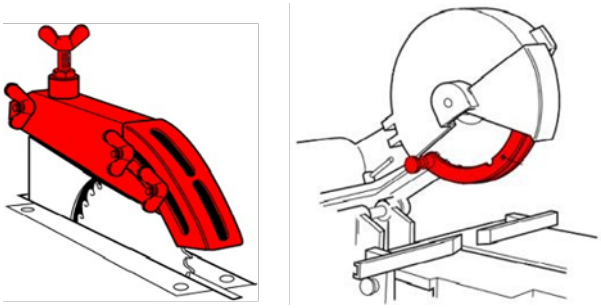


Figure - 19 : Typical Example of Adjustable Guards

- **Automatic guards**: these are guards, which are moved into position automatically by the machine, thereby removing any part of a person from the hazardous area of the machine. They are often called ‘sweep away’ guards.

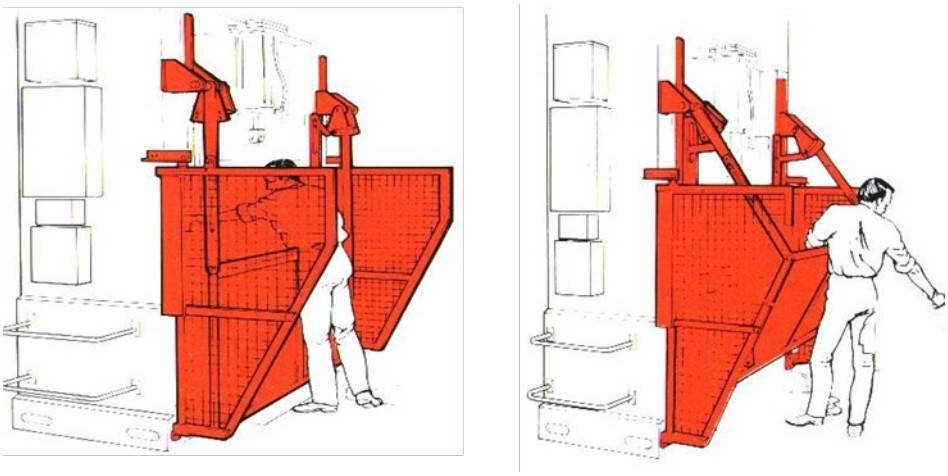


Figure - 20 : Typical Example of Automatic Guard

- **Interlocked guards**: these guards are usually movable, e.g., they can be hinged, sliding or removable. These guards are used when frequent access to hazardous parts of a machine may be needed and are connected to the machine controls by means of 'position sensors. Interlocked guards may operate mechanically, electrically, magnetically, hydraulically, or pneumatically (or a combination of these ways). The position sensors interlock the guard with the power source of the hazard. When the guard is open, the power is isolated, therefore allowing safe access into the relevant part of the machine.

Interlocked guards commonly use the following types of interlocking elements:

- **Cam-operated limit switch interlocks:** These are mechanical switches activated by the guard's position, ensuring that the machine cannot run when the guard is open. This type of interlock is versatile and easy to install.

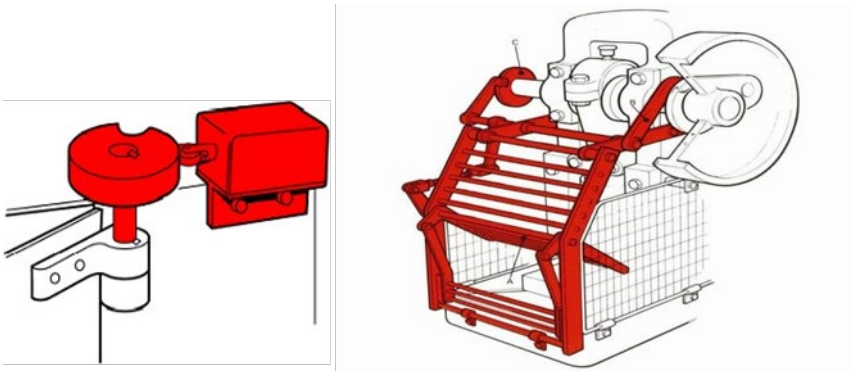


Figure - 21 : Typical Example of Cam Operated Limit Switch Interlocks

- **Trapped key interlocks***:* These interlocks require the operator to insert and remove keys from specific locations. The master key should be turned off before individual guard keys can be removed, ensuring the machine remains inoperable until the guard keys are replaced.
- **Direct manual switch or valve interlocks:** This is a system where a switch or valve controlling the power source cannot be operated until a guard is closed; and the guard cannot be opened at any time the switch is in the ON position.
- **Mechanical interlocks:** These interlocks directly link the guards to power or transmission control of a machine This means that, in practice, the power/ transmission switch cannot be reached when the guard is open.

- **Magnetic switches:** These interlocks use a 'coded' magnet attached to the guard. As the guard is removed, the magnetic field is broken, and the machine comes to a stop or fail-safe mode.
- **Electro-mechanical interlocks:** These interlocks use a mixture of electromagnetic and mechanical devices. For example, the removal of bolts on a guard may immediately trip the machine. The bolt has then to be removed a considerable distance for the guard to be completely removed.

Self-Adjustable Guards

- A self-adjusting guard is one that covers the danger zone until a work piece is pushed into the point of operation.
- Here the operator moves the work piece into the danger area, the guard is pushed away, providing a clearance large enough to admit only the work piece.
- It is operated by a trained and competent person.
- Typically used on: Circular saw, table saws, radial arm saw.

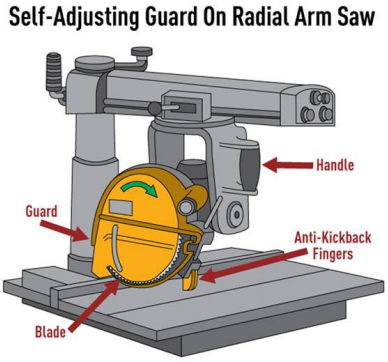


Figure - 22 : Typical Example of Self Adjusting Guard

- **Safety Devices**: A safety device is a protective appliance, other than a guard, which eliminates or reduces risk on its own or associated with a guard. There are many forms of safety device available. These devices do not prevent access to the danger zone but stop the movement of the dangerous part before contact is made. Typical examples are mechanical trip devices, active opto-electronic devices such as light curtains, Pressure-sensitive mats, Two-hand controls, Pull-back, Restraint devices, Emergency stops, warning or Awareness devices and dead man switches.

Two-hand Control:

- where both controls (buttons, levers, sensors) should be activated at the same time and kept engaged throughout the entire hazardous portion of the machine cycle.

- If the controls are released, the machine either stops or returns to top of stroke (the position that opens the dies). This type of machine operation is called part revolution clutch or friction clutch.

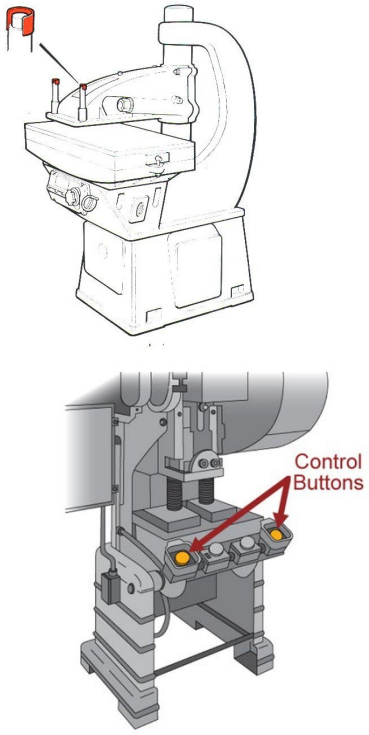


Figure - 23 : Examples of Two Hand Control

Operators make use of protection appliances to hold or manipulate materials/ products in a way which allows them to control and feed a loose workpiece at a machine while keeping their body clear of the danger zone. They are commonly used in conjunction with manually fed woodworking machines and some other machines such as bandsaws. These appliances will normally be used in addition to guards.

Two-hand trips:

- Where both controls should be activated at the same time to initiate the machine cycle but releasing the controls will not interrupt the machine cycle.
- This type of machine operation is called full revolution clutch or mechanical clutch.

Presence Sensing Devices:

- Presence-sensing device will not prevent access to dangerous points of operation, but it can detect a person once any part of his or her body enters the identified danger area.
- When this happens, the machine can be automatically programmed to raise an alarm, reduce the speed of its moving parts, or be stopped immediately.

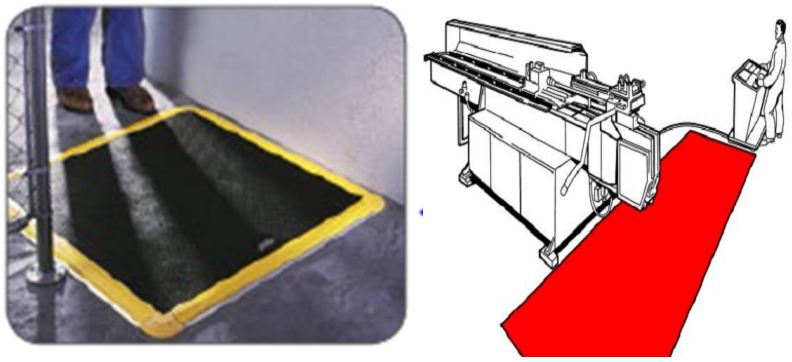


Figure - 24 : Examples of Presence Sensing Mats

- The use of presence-sensitive safety mat is a simple method for protecting workers working around a hazardous machine.
- It is achieved by laying safety mats around the machine.
- When a weight is applied onto the safety mat (e.g., if a machine operator steps on the mat), the switch closes and sends a signal to immediately stop the machine.

Light curtain:

- They operate on the principle that if a light beam is broken, the machine ceases its hazardous operation.
- Likewise, if the beam is being broken by the presence of person the machine is prevented from starting its hazardous operation.

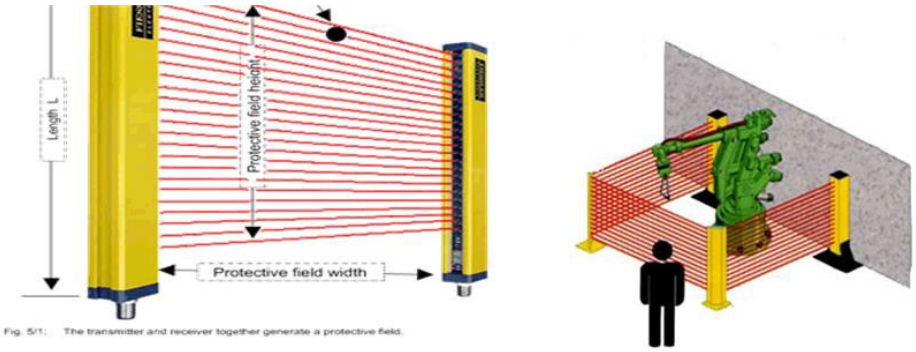


Figure 25 : Examples of Light Curtain

Pull back devices:

- Utilizes a series of cables attached to the operator's hands, wrists, and/or arms.
- Primarily used on machines with stroking action.
- Allows access to the point of operation when the slide/ram is up.
- Withdraws hands when the slide/ram begins to descend.

6. MACHINE SAFETY MANAGEMENT

The machine safety management system in this standard is designed to challenge and improve machine safety performance and is aligned with a continuing improvement cycle (i.e., Plan, Do, Check, Act) to achieve an injury-free workplace.

When the operation or inadvertent contact with a machine could cause injury to the operator or others in the immediate area, the hazards shall be eliminated, or, if not feasible, the risks controlled to an acceptable level.

Machine safety management is based on a risk reduction process that shall take into consideration the following hierarchy (preferred order) of controls:

1. Elimination
2. Substitution of less hazardous processes, operations, or equipment
3. Engineering controls
4. Warnings
5. Administrative controls
6. Personal protective equipment (PPE)
7. Often a combination of controls is the most effective way to achieve acceptable risk.

The processes outlined in this standard are interrelated to provide a comprehensive hazard safeguarding for the varied task conditions of the industrial machinery. Unless the hazardous task is eliminated or automated, the risk control provisions often count on multiple controls from engineering, warning, and administrative control options. Machine Safety Hierarchy of Controls is highlighted in **Annexure 3**.

6.1 EQUIPMENT SAFEGUARDS

Information and risk assessments related to safeguards provided by the manufacturer or supplier of the machinery or equipment, if available, shall be taken into consideration by the Site for H&S validation.

It is required to keep in place all guarding systems provided by the manufacturer of equipment/machinery to protect workers from inherent hazard associated with the operation of rotating machinery.

Equipment safeguards need to be designed to prevent accidental contact by persons or parts of clothing being caught, e.g. between belt and pulley, chain and sprockets, cable and sheave or drum and block. As a general guide, where the removal of a machine guard is not required for inspection or maintenance purposes, the guard should be secured in position so that, it cannot be readily removed without the assistance of a tool. In all instances the following characteristics need to be incorporated into the design standard:

- The safeguard shall be considered a permanent part of the machine or equipment.
- The safeguard shall be designed for the specific job and specific machine, with provisions made for inspecting, testing and lubrication, adjusting and repairing of machine parts.
- Guards should be made of solid material, mesh or equivalent construction and prevent access to the area of the hazardous motion (hazardous zone) during operation.
- if a guard is to be situated so that a person may climb or rest upon it, such guards shall be capable of supporting the person's weight (75kg) placed in any position.
- Where guards and covers need to be removed, lifting handles or lugs should be provided to assist with safe removal or opening of the guard covers.
- equipment safeguards should be clearly distinguishable from other structures i.e. through color coding or signage.
- Where there is the potential for ejection of a projectile from within the machine the guard needs to be durable and constructed strongly enough to resist the impact.
- The safeguard shall not present a hazard.
- Mobile hinged safeguards should be interlocked.

Reliability of safety devices and interlocks shall be considered starting from design risk assessment. With respect to new equipment priority should be given to highly reliable interlocks, as a mean for protecting against improper use of the equipment by operator during normal conditions and as a mean to protect employees in case of abnormal operations (as repairing and maintenance) only when “full body entry conditions” are not identified.

Interlocks include devices for which all the following requirements are addressed: a) all unexpected releases of hazardous energy, including electric, mechanical, pneumatic energy, are intercepted when the interlock is activated (e.g. by opening the interlocked barrier), b) immediate automatic re-energize of the machinery is not allowed by the interlock once it is no more active (e.g. by closing in safe position the interlocked barrier) without acting on machinery controls, and c) the interlock is periodically inspected for proper working order or it is subject to self-checking

Interlocks are not appropriate for certain operating conditions since they provide a sufficient protection against mechanical hazards provided that “full body entry” conditions are not present at workplaces, where machinery is in use. When the workers take their full body inside the danger zone of the machinery for operational, maintenance, inspection, or cleaning purposes (e.g. for large size machinery or wide protected areas of machinery), the interlocks ensure safety conditions if they are active (or one of the interlocked barriers is kept in open position). If, by any reason, all the interlocked barriers are inadvertently closed (because the presence of an operator in the dangerous zone of the machine is not perceived) and the interlocks are therefore inactive, as soon as machinery control buttons are operated from the machinery panel, potentially severe risks cannot be excluded (mainly if only one interlocked opening is present).

Equipment safeguards include measures and precautions related to inboard electric safety and stability safety. All large machinery/equipment shall be adequately anchored and electrically connected according to local or international electrical code. For example, large drill presses shall be anchored to the floor of the shop, and hard wired to an isolating ON/OFF switch. Equipment safety, and/or workplace layout safety, shall also ensure that Ground Fault Circuit Interrupters (GFCI) are used on all cord and plug electric power tools.

The installation of equipment safeguards is subject to risk assessment. The occurrence of risks potentially associated to equipment safeguard shall be avoided. For instance, careful attention should be paid to the downstream effects of emergency stops. It should be ensured that the activation of an emergency stop device does not create a worse hazard in another part of the process. In this respect, the risk assessment related to equipment safeguards may require use of a process Failure Modes Effect Analysis (FMEA) type assessment or other specific methodologies identified by the H&S Department.

Machines that are not adequately guarded need to be prioritized and interim action taken to minimize the risk of injury this should be recorded in the comments section of this survey form.

Outlined below are methods which can be considered to inform and protect personnel during this type of work activity. These methods should be used in combination:

Method	Advantage	Limitation
Temporary barrier	Provides a physical barrier between the exposed machine components and the personnel in the area	Requires a clearance around the entire area of the exposed machine and its components
Barrier Tape	Easy to erect and provides a visible demarcation area around the exposed machine component	Barrier tape is not a physical barrier this approach requires a minimum of 2 meters segregation distance from the exposed machine component
Sentry	Provides instant warning to persons and security in an area where personnel may be tempted to ignore the requirements for the staying outside a demarcated area.	Cannot provide security for a large area especially if parts of the exposed machine component are obstructed from the sentry's view by other structures
Signage	Easy to locate and provides immediate information on the hazard in the area	Does not provide protection it is only a source of information.



6.2 GUARD ERGONOMICS

It is fundamental to have an ergonomically designed work systems to enhance safety, improve human working and living conditions, counteract adverse effects on human health and improve the operator-machine system performance and reliability.

The work system includes operators, job design, work equipment (e.g. machinery), workspace, work environment, work process and the interactions between them (note that it can vary in complexity, e.g. single operator vs. workshop).

The term "ergonomics" refers to a multidisciplinary field of science and considers the design of machinery related to human capabilities, skills, and limitations. In fact, good design considers how the operator is expected to interact with the work equipment and how the work equipment fits into the system.

For the definition/dimensioning of access opening (opening through which a person can lean forward, reach forward, or extend the upper body, head, arm, hand, a finger or several fingers, leg, or foot, to be able to carry out actions during work procedures), the following criteria are of particular significance:

- Ease of access (demand of the task, frequency and duration of the task, location).
- Environmental conditions.
- Level of risk during the task.

6.2.1 General Design Requirements for Guards

- Mechanical Maintenance Head shall ensure that the design of new installations and/ or equipment and modification of existing ones should follow the Group machine guarding procedure and Machine Guarding Design Criteria for Mechanical Equipment. (e.g., ISO 14120:2015 – Safety of Machinery: Guards – General Requirements for the Design and Construction of Fixed and Movable Guards).
- Guards should be made of solid material, mesh, or equivalent construction, and should be designed to prevent persons reaching into the hazardous area.
- **Material Specifications:**

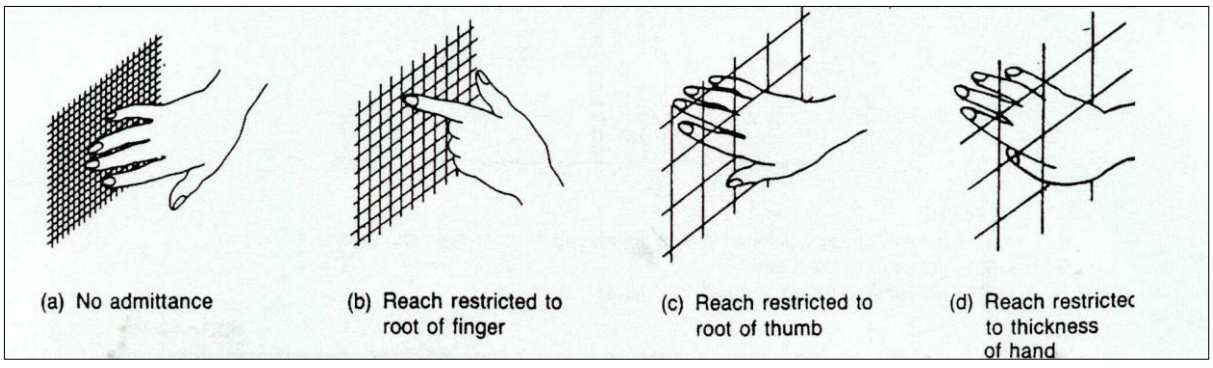
  Sheet Metal Guards: Minimum thickness of 1.5 mm.

  Mesh Guards:

  9 mm mesh: Minimum wire thickness of 1.5 mm.

  50 mm mesh: Minimum wire thickness of 3 mm.
- **Deflection Limits:** Guards should not deflect more than 12 mm under a force of 450 N applied at any point over a 50 mm² area.
- **Strength of Guards**: If a guard is located where a person may climb or lean on it, it should withstand a load of 75 kg placed anywhere on it, along with a simultaneous horizontal force of 220 N.
- **Fastening of Guards**: Guards should be securely fastened to prevent accidental removal. Fasteners should require tools for removal and, ideally, should remain attached to the guard or machinery when removed.
- **Reach Dimensions:** The design and construction of guards and their subsequent location shall be such that the distance of any nip point or shear hazard and the nearest point of access is restricted as follows:

Arm reach	1000 mm from under arm to fingertips
Elbow reach	500 mm from the inside elbow to fingertips.
Wrists reach	280 mm from wrist to tip of middle finger.
Finger reaches	150 mm.
Vertical reach	2500 mm maximum when standing on toes.



The above dimensions include an allowance made to obtain clearance from the hazardous areas.

6.2.2 Guard Placement

The size of mesh or other openings in the guard and the distance of the guard from the hazardous point shall be as follows:

Size of mesh or other opening in guard	Minimum distance between guard and danger point
less than 9mm	15mm
9 to 25mm	120mm
26 to 40 mm	200mm
greater than 40mm	1000mm

Where complete enclosure with a guard is not provided, distance/fence type guards should be used and the height of the guard and the distance of the guard from the hazardous point shall be in accordance with provisions. The size of mesh or other openings shall be not greater than 9 mm where the nip point is up to and including 150 mm from the guard, and not greater than 50 mm square where the nip point is more than 150 mm from the guard. The table below provides an example of the various height and distance requirements.

Example:

Guarding in man cooler using chicken mesh and belt conveyer using well fabricated structure which will require tools to remove the guard.



Table - 1: Example of The Various Height and Distance Requirements.

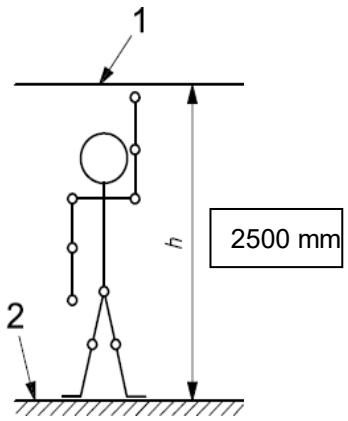
Height of nip point from floor or working surface (a)	Millimeters								
	Distance from nip point to Guard (c)								
	Height of Guard from floor or working surface (b)								
	2290	2130	1980	1830	1680	1520	1380	1220	1000
2500	-	-	-	-	-	-	-	-	-
2360	75	150	230	230	230	230	230	230	230
2290	75	150	230	300	380	380	380	380	-
2210	-	200	300	300	450	530	530	530	600
2130	-	200	300	450	530	600	600	600	-
2050	-	150	300	450	600	600	600	680	1100
1980	-	150	300	450	600	680	680	750	-

Height of nip point from floor or working surface (a)	Millimeters								
	Distance from nip point to Guard (c)								
	Height of Guard from floor or working surface (b)								
	2290	2130	1980	1830	1680	1520	1380	1220	1000
1900	-	-	230	450	600	680	680	840	-
1830	-	-	-	450	600	680	750	840	1200
1750	-	-	-	450	600	750	840	900	-
1680	-	-	-	300	600	750	840	900	-
1600	-	-	-	300	530	750	840	900	1300
1520	-	-	-	230	530	750	840	900	-
1450	-	-	-	-	530	750	840	900	-
1380	-	-	-	-	450	750	840	900	-
1300	-	-	-	-	380	750	840	900	1350
1220	-	-	-	-	-	750	840	900	-
1150	-	-	-	-	-	680	840	900	-
1050	-	-	-	-	-	680	750	840	-
1000	-	-	-	-	-	680	680	840	1400
920	-	-	-	-	-	300	680	940	-
840	-	-	-	-	-	-	600	840	-
750	-	-	-	-	-	-	380	750	-
680	-	-	-	-	-	-	300	600	1200
600	-	-	-	-	-	-	-	530	-
530	-	-	-	-	-	-	-	380	-

- **Reaching Upwards**

  The illustration below shows the safety distance for reaching upwards, if there is a low risk from the hazard zone, then the height of the hazard zone, *h*, shall be2500 mm or more.

If there is a high risk from the hazard zone, then the height of the hazard zone, *h*, shall be 2700 mm or more.



Key

1 hazard zone
2 reference plane
h height of hazard zone

- **Reaching overprotective measures**

  The following illustration will help to assess what sort of guarding is required and where it should be located (to keep a danger, point on a machine safely out of reach).

  Where doubt exists in relation to the distances shown, measurements should be taken of the actual workplace to ensure danger points are beyond reach.

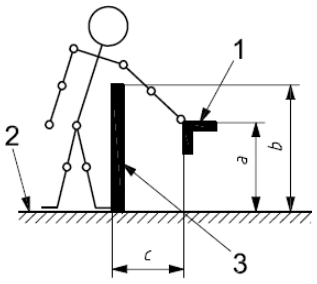


Table- 2 : Reaching overprotective structures – High Risk (from ISO 13857:2008)

Height of hazard zone	Height of protective structure									
	1000	1200	1400	1600	1800	2000	2200	2400	2500	2700
	Horizontal safety distance to hazard zone									
2700	0	0	0	0	0	0	0	0	0	0
2600	900	800	700	600	600	500	400	300	100	0
2400	1100	1000	900	800	700	600	400	300	100	0
2200	1300	1200	1000	900	800	600	400	300	0	0
2000	1400	1300	1100	900	800	600	400	0	0	0
1800	1500	1400	1100	900	800	600	0	0	0	0
1600	1500	1400	1100	900	800	500	0	0	0	0
1400	1500	1400	1100	900	800	0	0	0	0	0

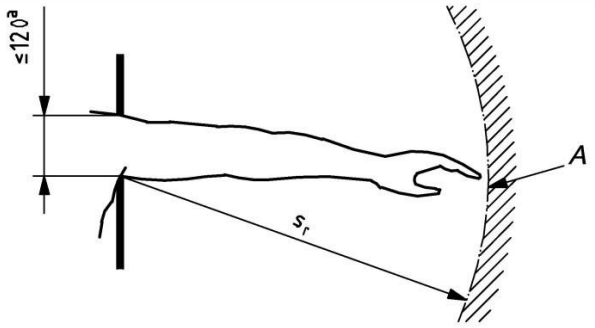
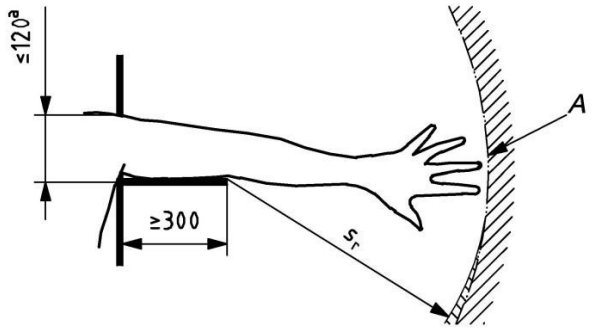
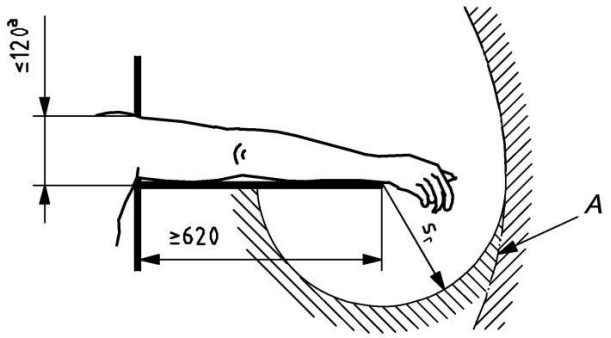
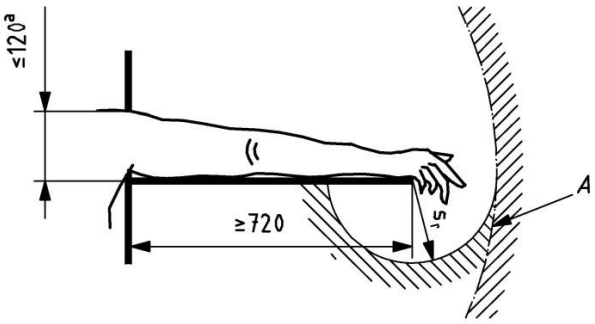
Height of hazard zone	Height of protective structure									
	1000	1200	1400	1600	1800	2000	2200	2400	2500	2700
	Horizontal safety distance to hazard zone									
1200	1500	1400	1100	900	700	0	0	0	0	0
1000	1500	1400	1000	800	0	0	0	0	0	0
800	1500	1300	900	600	0	0	0	0	0	0
600	1400	1300	800	0	0	0	0	0	0	0
400	1400	1200	400	0	0	0	0	0	0	0
200	1200	900	0	0	0	0	0	0	0	0
0	1100	500	0	0	0	0	0	0	0	0

a **Protective structure less than 1000 mm in height are not included because they do not sufficiently restrict movement of the body.**

b **Protective structure lower than 1400 mm should not be used without additional safety measures.**

Table - 3 : Reaching with limitation of movement (from ISO 13857:2008)

Dimensions in millimetres

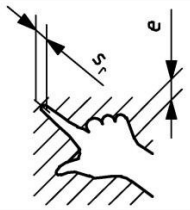
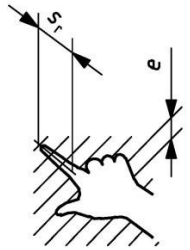
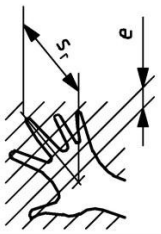
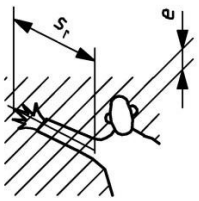
Limitation of movement	Safety distance, s_r	Illustration
Limitation of movement only at shoulder and armpit	⩾ 850	
Arm supported up to elbow	⩾ 550	
Arm supported up to wrist	⩾ 230	
Arm and hand supported up to knuckle joint	⩾ 130	

A range of movement of arm

s_r radial safety distance

[a] This is either the diameter of a round opening, or the side of a square opening, or the width of a slot opening.

Table 4 : Reaching through regular openings – Persons of 14 years of age and above (from ISO 13857:2008)

Part of body	Illustration	Opening	Safety distance, s_r		
			Slot	Square	Round
Fingertip		$e \leqslant 4$	$\geqslant 2$	$\geqslant 2$	$\geqslant 2$
		$4 < e \leqslant 6$	$\geqslant 10$	$\geqslant 5$	$\geqslant 5$
Finger up to knuckle joint		$6 < e \leqslant 8$	$\geqslant 20$	$\geqslant 15$	$\geqslant 5$
		$8 < e \leqslant 10$	$\geqslant 80$	$\geqslant 25$	$\geqslant 20$
Hand		$10 < e \leqslant 12$	$\geqslant 100$	$\geqslant 80$	$\geqslant 80$
		$12 < e \leqslant 20$	$\geqslant 120$	$\geqslant 120$	$\geqslant 120$
		$20 < e \leqslant 30$	$\geqslant 850$ [a]	$\geqslant 120$	$\geqslant 120$
Arm up to junction with shoulder		$30 < e \leqslant 40$	$\geqslant 850$	$\geqslant 200$	$\geqslant 120$
		$40 < e \leqslant 120$	$\geqslant 850$	$\geqslant 850$	$\geqslant 850$
The bold lines within the table delineate that part of the body restricted by the opening size.					
[a] If the length of the slot opening is $\leqslant$ 65 mm, the thumb will act as a stop and the safety distance can be reduced to 200 mm.					

Key

a	height of hazard zone	1	hazard zone (nearest point)
b	height of protective structure	2	reference plane
c	horizontal safety distance to hazard zone	3	protective structure

6.2.3 Correct Deficiencies

There are several different types of machine guards, all suited to purposes. The selection of most proper equipment safeguards shall take into consideration the deficiencies revealed by the risk assessment. If the moving parts of a piece of work equipment present risks of mechanical contact that can cause accidents, they should be fitted with guards or protective systems that prevent access to dangerous areas or that stop dangerous movements before it is possible to access those areas.

Guards and protective systems, aimed to correct deficiencies, therefore:

- shall be of robust construction,
- shall not cause additional risks,

- shall not be easily circumvented or rendered ineffective,
- shall be located at a sufficient distance from the danger zone,
- shall not restrict observation of the work cycle more than necessary,
- shall permit work that is indispensable for the installation and/or replacement of tools, as well as for maintenance work, while restricting access only to the area where the work is to be carried out and, if possible, without the need to dismantle the guards or protective system.

Where correcting deficiencies through effective protection or segregation of the working parts and dangerous areas of operation of work equipment cannot be achieved for actual technical or processing reasons, other measures should be taken to eliminate or reduce the hazard. In these cases, correcting deficiencies may be based on suitable tools, automatic feeders, additional devices for stopping the machinery and simultaneous multiple control starting devices, based on result of risk assessment.

When, due to the actual requirements of the work, it is not possible to fully protect or segregate the working parts and hazardous areas of operation of the work equipment, the unprotected part of the working part or area of operation should be limited to the minimum required by those requirements and measures should be taken to minimize the danger.

The following outlines the common types of machine guarding used according to international industrial practices:

6.2.3.1 Flywheel

When any part of the flywheel is 2.4m More less above floor or platform, it shall be guarded against accidental contact in one of the following ways.

- Guarding Flywheels Near the Floor: When any part of the flywheel is 2.4 m or less above the floor or platform, it shall be protected from accidental contact by one of the following methods:
  - Enclosed with sheet, perforated, or expanded metal, or woven wire.
  - Guardrails positioned 40–50 cm from the rim.
  - For flywheels extending into a pit or within 30 cm of the floor, a standard toe guard shall be provided. If the upper rim of a flywheel protrudes through a working floor, it should be fully enclosed or surrounded by a guardrail and toe guard.
- Flywheels Above Working Areas: Guards should be strong enough to contain the weight of the flywheel in case of shaft or mounting failure.
- Cranks and Connecting Rods: If exposed to potential contact, these components should be either enclosed or protected by a guardrail. Tail rods or extension piston rods should be guarded by an expanded metal cage or a guardrail on all sides with a 40–50 cm clearance when the rod is fully extended.
- Electric Motors with Exposed Moving Parts: Certain electric motors may need additional guarding if they have exposed moving components.

6.2.3.2 Shafting

- Horizontal Shafting: All exposed parts of horizontal shafting located 2.4 m or less from the floor or working platform shall be protected. Protection may include a stationary casing fully enclosing the shafting or a trough enclosing either the sides and top, or sides and bottom, depending on the shafting's position.
- Vertical and Inclined Shafting: Vertical or inclined shafting that is 2.4 m or less from the floor or working platform, except when accessed for maintenance, shall be enclosed with a stationary enclosure.
- Shafting Over Driveways: Shafting extending over a driveway should follow the above protections unless it is located 4.6 m or more above the driveway.
- Shafting Under Bench Machines: Shafting located under bench machines shall be enclosed by a stationary casing or a trough. The trough sides should extend to within at least 15 cm of the table underside or floor,

depending on shafting location. In all cases, the trough sides shall extend at least 5 cm beyond the shafting or any projections.

- Projecting Shaft Ends: Projecting shaft ends should have a smooth edge and end, and they should not extend more than half the shaft's diameter unless covered by non-rotating caps or safety sleeves. Any unused keyways should be filled or covered to prevent injury.

6.2.3.3 Pulleys

- Pulleys, any part of which are 2.4 M or less from the floor or working platform, shall be caged.
  - If the distance to the nearest fixed pulley, clutch, or hanger exceeds the overall width of the belt(s) being used, a guide shall be provided to prevent the belt from leaving the pulley on the side where insufficient clearance exists.
  - Where there are overhanging pulleys online, jack, or countershafts, with no bearing between the pulley and the outer end of the shaft, a guide to prevent the belt from running off the pulley shall be provided.
  - For the cases in which pulleys cannot be caged by virtue of its position/design/application (e.g. bend pulley, deflector pulley, snub pulley etc.) shall be sufficiently barricaded to prevent contact.
  - Where separate pulley guards are used under conditions where the belt does not require guarding, the guard shall enclose the pulley to protect the run-in point of the belt. The guard shall extend slightly higher than the top of the pulley, the belt running through a slot or narrow opening which would not permit the hand to be drawn into the nip-point.

6.2.3.4 Gears, Sprockets and Chains

- All sprocket wheels and chains shall be enclosed if 2.4M or less above the floor or platform.
- Where the drive extends over other machine or working areas, protection against falling of chain or spillage shall be provided to prevent damage.
- Gears (e.g.: open drive gears of rotary kilns, ball mills etc.,) shall be guarded in accordance with one of the following:
  - A fence at least 2.1M extending 15 cm above the mesh point of the gears.
  - A complete enclosure

6.2.3.5 Clutches, Cutoff Couplings or Clutch Pulleys

- Clutches, cutoff couplings, or clutch pulleys having projective parts, where such clutches are located 2.4M or less above the floor or working platform, shall be enclosed by a stationary guard.

6.2.3.6 Fan Blades

Fan blades located less than 2.4 M from the floor shall be guarded with expanded metal or wire mesh of sufficiently small size approximately 1 cm opening to prevent entry of hands and fingers. This guarding also includes man cooler fans.

6.2.3.7 Belt and Chain- Drives

- All power transmission belts and chains, overhead chain and link drives any part of which is 2.4 Mor less from the floor or working platform, shall be guarded.
- Belt and chain- Conveyors.
- Horizontal overhead belts and inclined belts shall be guarded for their entire length when:
  a. located over passageways or workplaces.
  b. center-to-center distance between pulleys is 3 M or more.
  c. belt is 20 cm or more in width.
- Vertical belt shall be fully enclosed.

- Metallic belt lacing or fasteners, which are prone to sparking, shall not be used in areas containing explosives or flammable vapors.

6.2.3.8 Friction Drives

The driving point of all friction drives when exposed to contact shall be guarded, all arm or spoke friction drives and all web friction drives with holes in the web shall be enclosed entirely, and all projecting belts or friction drives where exposed to contact shall be guarded.

6.2.3.9 Rolling Mills and Casters

For the cases where the persons are required to move nearer to the operation area such as

- Tundish area
- Descaler
- Mill stands.
- Roller tables
- Coiling area
- Coil handling area.
- Sufficient sign boards shall be displayed cautioning about the hazards such as exposure to heat, high pressure water jets, flying of scales, miss roll, cobbles, and tail chews.
- Appropriate barricading/guards, permanent or with suitable interlocks and color codes shall be provided to prevent entry of persons into the operating area.

6.2.3.10 Lubrication and Inspection Facilities

- When frequent oiling should be done, openings with hinged or sliding self-closing covers shall be provided. All points not readily accessible shall have oil feed tubes if lubricant is to be added while machinery is in motion. Similar facilities also may be provided when it is required for taking tachometer readings.
- All openings into guards should be secured with a screw, or other method, requiring a tool or key to open.

6.2.3.11 Keys, Setscrews, And Other Projections

- All projecting keys, setscrews, and other projections in revolving parts, shall be removed or made flush or guarded by metal cover. This does not apply to keys or set screws within gear or sprocket casings or other enclosures, nor to keys, setscrews, or oil cups in hubs or pulleys less than 50 cm in diameter where they are within the plane of the rim of the pulley. It is recommended, however, that no projecting setscrews or oil cups be used in any revolving pulley or part of machinery.
- Couplings and collars on shafts and other rotating parts shall be constructed to present no hazard from bolts, nuts, setscrews, or revolving surfaces and shall be guarded.
- Guards for couplings on shafts within the frame of a machine, such as those used to connect pump and motor drives, shall prevent entry of hands, fingers, or other parts of the body into a point of hazard by reaching through, over, under, or around the guard. These guards shall be designed to comply with the requirement of this standard.

6.2.3.12 Grinding

- Grinding machine shall be ensured that the handle and body of the machine intact.
- The machine should be provided with wheel guard.
- Only Depressed Grinding wheel shall be used for grinding operation.
- Each wheel shall be run up to its maximum operating speed on the machine under no load conditions for about 30 seconds before commencing the work.

- The machine operator shall ensure that the machine is provided with wheel guard and hold the machine away from his body during this test run, as the wheel may break if there is any damage.
- During Grinding operation excessive force shall not be used, as it would lead to wheel breakage. The wheel shall be held at angle between150 to 300.
- Handheld grinding machine having its body made of nonconductive material is preferred.
- It shall be ensured that the body of the machine is earthed if it is made of conductive material.
- Power supply for the machine shall be through ELCB / RCCB of 30 mA sensitivity.

7. MAINTENANCE AND PERIODICAL EVALUATION

- A maintenance program should be established for all machinery that is fitted with machine guards and safety devices.
- The frequency and type of maintenance performed shall comply with the machinery manufacturer's specifications and operational experience.

Maintenance Program

A maintenance program shall be established for all safety devices fitted to moving machinery. The frequency and type of maintenance performed shall comply with the manufacturer's specifications.

Establishing a maintenance program for all safety devices (interlocks and switches to automatic trips fitted to guards) is important, because it ensures that machinery is safe for use when required. Maintenance includes visual checks, inspections, testing of equipment, preventative maintenance, and remedial work. Repair and maintenance programs should specify*:*

- what components require servicing?
- the type of the servicing required.
- the frequency of servicing and
- Who is responsible for repair & maintenance program.



7.1 Steps to Implementing a Maintenance Program

STEP	TOOL	OUTPUT
1. Identify all safety devices fitted to machinery (this may be completed by reviewing the Machine Guarding survey)	Machine Guarding Survey	List of all Safety devices (mainly interlocks and safety trip switches etc.)
2. Identify manufacturer's specifications for maintenance, repair work and determine the frequency for servicing/ maintenance	Manufacturers maintenance & repair work specification	Established schedule for performing maintenance on available safety devices
3. Develop a method to record maintenance and repair work carried out. (Logbooks, computer database i.e. SAP, MAC etc.)	Manufacturers maintenance & repair work specification	Process for recording maintenance & repair work to be carried out and a means to monitor if the work is being performed

STEP	TOOL	OUTPUT
4. Refer to manufacturer's maintenance and repair work specifications and identify and record competency requirements for personnel performing maintenance and repair work.	Manufacturers maintenance & repair work specification	Competency standards for performing maintenance and repair work or requirement to send off site- i.e. automatic locking mechanism may be serviced by a contractor which has the skills and equipment to perform this. type of maintenance
5. Record the following: • List of all available Safety devices • Maintenance specifications for each safety device • Schedule for maintenance • Method for recording performed maintenance	All developed outputs	Maintenance Program Means to identify if all safety devices are being service/maintained as required, via manufacturers/ design requirements and maintenance records.

8. EMERGENCY RESPONSE & PLANNING

JSW Sites shall update, implement, and maintain a written emergency plan which covers dealing with injuries resulting from machines as defined in this Standard. The Emergency Preparedness and Response Plan (EPRP) shall identify the requirements and actions to be carried out for foreseeable emergency (with or without any casualty) situation and shall include:

- Entrapment
- Entanglement
- Caught on / Caught in / Caught by incidents.
- Fall into machine.
- Recovery and Rescue of injured personnel.

9. TRAINING

Competency requirement for Guarding Survey: Personnel performing the machine guarding survey should be provided instruction on the following aspects:

- Description of machine hazards and the types of guards and safety devices available.
- How to determine if a machine guard or safety device provides adequate protection.
- Information which needs to be recorded within the survey and how to follow up on corrective actions.
- A person will be deemed to be competent to undertake a machine guarding survey after they have received formal training in this fatality prevention element and associated guideline. As a minimum the training and competency assessment for personnel performing machine guarding surveys should address the following:
    - Knowledgeable on the range of machines used at the JSW operation/facility.
    - Able to describe the machine components and the hazardous motion/actions which may occur.
    - Understanding the machine guarding principles including the different types of machine guards and the general requirements for their design and construction
    - Identifying the different types of safety devices used to protect personnel including how they function.
    - Competence is a standardized requirement for an individual to adequately perform a specific job. It encompasses a combination of knowledge, skills, and behavior to complete a task at the shop floor or work area.

The personnel within every division/department will undergo training in accordance with the Machine Guarding Standard:

- Training will be conducted wherever it is applicable.
- The frequency of training, determined by the risk assessment, will be defined by the respective units.

10. RACI MATRIX

Activity	R Responsibility	A Accountability	S Support	I Inform	C Consulted
Implementation of JSW Machine Guarding (MG) Procedure	Section In-charge	Maintenance Head	Line Manager	Head Operations	Field Operator
MG Survey	Section In-charge	Machine Guarding Champion	Maintenance Head	Site Safety Head	Head Operations
Implementation of Identified Gap from the Survey	Section In-charge	Maintenance Head	Machine Guarding Champion	Site Safety Head	Head Operations
Training to Identified Target Audience	Respective HOD	Maintenance Head	HR & H&S	Site Safety Head	HODs
Audit	Maintenance Head	Site/ Location Head	Machine Guarding Champion and Site Safety Head	Site Safety Head	Site Safety Head

11. MANAGEMENT OF RECORDS

The Site/Location shall retain records:

Records to be maintained:

Machine Guard Register: List of all machine guards and their specifications.

Survey Reports: Detailed reports on the condition of all machine guards, including corrective actions proposed and taken.

Authorized Personnel List: List of individuals authorized to approve and oversee the Machine Guarding Program.

Safety Maintenance Planning: Records related to the planning and scheduling of safety maintenance, including key maintenance aspects.

Incident/Accident Records: Documentation of any incidents or accidents related to machine guarding, maintained by the Health & Safety (HS) Department for a minimum of five years.

12. LEGAL AND OTHER REQUIREMENTS

JSW site shall access, identify, evaluate, and keep up to date the machine safeguarding requirement as per prevailing law in operation.

13. KEY PERFORMANCE INDICATOR

- Percentage of progress related to Survey of all Machine Guards for suitability.
- Number of deficient guards detected and corrected action taken.
- Number of Training conducted related to Machine Guarding.
- Number of incidents related to deficient Machine Guarding.
- Number of compliance audits conducted & Results.

14. ASSURANCE

Each site shall conduct self-assurance program to ensure compliance with this STANDARD as part of its Safety assurance program. Third party system audit shall be conducted by Group Safety or external consultants to ensure compliance with the standard.

15. DEFINITIONS

The following definitions apply to this document:

Term	Definition
Adjustable guard	a barrier that adjusts for each setup or application
Assessment	an evaluation based on the available knowledge of the assessor(s) about the condition of machine guarding under review.
Barrier	material(s) strategically placed to impede or separate someone from physical contact at the point of operation.
Barrier guard	a barrier that prevents entry of the operator or any part of the operator's body into the point of operation.
Fixed guard	a barrier that is securely attached to the equipment in a fixed (static) position.
Floor	working platform.
Interlocking guard	a tripping mechanism that automatically shuts a machine off whenever a guard is opened or removed. The guard may use electrical, hydraulic, or pneumatic power, or any combination of these.
Moving parts	all the parts of the machine that move while the machine is working. These can include reciprocating, rotating, and transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine.
Pinch point	any point where it is possible for a part of the body to be caught between moving parts.
Point of operation	point where a machine performs work on a material, such as cutting, shaping, boring, shearing, drilling, grinding, or forming of stock.
Power tool	a portable machine tool (e.g. a hand drill)
Power transmission apparatus	all components of the mechanical system that transmit energy to the part of the machine performing the work. These components include flywheels, pulleys, shafts, belts, connecting rods, couplings, cams, spindles, chains, and gears.

Term	Definition
Process Owner	the group or person who is responsible for creation, update, and approval of this standards.
Program Leader	Head maintenance, who will ensure that the requirement of this standard is met.
Pull back device	Used as a mechanical safeguarding device they are designed to pull the operator's hands away from the area of the dangerous zone of the machinery (point of operation) during each hazardous phase of machine operation. Normally wrist bands are secured around both wrists of the operator, and the pullback is adjusted for the operator and the machinery. When the machinery is operated the pullback device can pull the wrist bands away
Revision	number that is used to track different versions of the standard.
Reciprocating motion	back-and-forth or up-and-down motion.
Rotary motion	motion in circular path (partial or full).
Safeguarding	any means of preventing personnel from meeting the moving parts of machinery or equipment during operation or during maintenance and servicing. Machine safeguarding improves productivity and morale because of the protection offered.
Safety light curtain	Used as a non-mechanical safeguarding device they are opto-electronic devices that are used to safeguard personnel in the vicinity of moving machinery with the potential to cause harm. When triggered, they automatically switch off moving parts to avoid harm.
Tripwire cables	Used as a mechanical safeguarding device they are located around the perimeter of or near the danger area of the machinery; the operator should be able to reach the cable to stop the machine.
Two hands controls	Used as a physical safeguarding device they require constant pressure on both pads to activate the machine; hands are kept on controls at safe distance while machine is in a dangerous cycle.
Shall	when used in this standard denotes a *required* action.
Should	when used in this standard denotes a *recommended* action.
Transverse moving parts.	movement of an object in a straight, continuous line such as a conveyor belt.

ANNEXURES

ANNEXURE-1: MACHINE GUARDS – ADVANTAGES AND LIMITATIONS

MACHINE GUARDS			
Method	Safeguarding Action	Advantages	Limitations
Fixed	Provides a barrier	Can be constructed to suit many specific applications In-plant construction is often possible. Can provide maximum protection. Usually requires minimum maintenance. Can be suitable to high production, repetitive operations	May interfere with visibility Can be limited to specific operations. Machine adjustment and repair often require its removal, thereby necessitating other means of protection for maintenance personnel
Interlocked	Shuts off or disengages power and prevents starting of machine when guard is open; should require the machine to be stopped before the worker can reach into the hazardous area	Can provide maximum protection. Allows access to machine for removing jams without time-consuming removal of fixed guards	Requires careful adjustment and maintenance. May be easy to disengage or bypass
Adjustable	Provides a barrier which may be adjusted to facilitate a variety or production operations	Can be constructed to suit many specific applications Can be adjusted to admit varying sizes of stock	Hand may enter Hazardous area – protection may not be always complete. May require frequent maintenance and/or adjustment The guard may be made ineffective by the operator. May interfere with visibility
Distance (Gate/Fence)	Provides a barrier between hazardous. area and operator or other personnel	Can prevent reaching into or walking into the hazardous area	May require frequent inspection and regular maintenance. May interfere with operators. ability to see the work
Self-adjusting	Provides a barrier which moves according to the size. of the stock entering hazardous area	Off-the-shelf guards are often commercially available	Does not always provide maximum protection. May interfere with visibility May require frequent

MACHINE GUARDS			
			maintenance and adjustment

MACHINE SAFETY DEVICES			
Method	**Safeguarding Action**	**Advantages**	**Limitations**
Photoelectric (optical)	Machine will not start cycling when the light field is interrupted. When the light field is broken by any part of the operator's body during the cycling process, immediate machine braking is activated.	Can allow freer movement for operator; simplicity of use; no adjustments required.	• Does not protect against mechanical failure. • May require frequent alignment and calibration. • Excessive vibration may cause lamp filament damage and premature burnout. • Limited to machines that can be stopped
Radiofrequency (capacitance)	Machine cycling will not start when the capacitance field is Interrupted. When the capacitance field is disturbed by any part of the operator's body during the cycling process, immediate machine braking is activated.	Can allow freer movement for operator.	• Does not protect against mechanical failure. • Antennae sensitivity should be adequately adjusted. • Limited to machines that can be stopped
Electro- mechanical	Contact bar or probe travels a predetermined distance between the operator and the hazardous area. Interruption of this movement prevents the starting of machine cycle.	Can allow access at the point of operation	Contact bar or probe should be adequately adjusted for each application; this adjustment should be maintained adequately.

MACHINE SAFETY DEVICES			
Method	**Safeguarding Action**	**Advantages**	**Limitations**
Pullback	As the machine begins to cycle, the operator's hands are pulled out of the hazardous area	Eliminates the need for auxiliary barriers or other interference at the hazardous area	• Limits movement of operator • May obstruct workspace around operator. • Adjustments should be made for specific operations and for everyone. • Requires frequent inspections and regular maintenance. • Requires close supervision of the operator's use of the equipment
Safety trip controls: Pressure-sensitive body Bar Safety trip/wire (Pull Rope)	Stops machine when Tripped.	Simplicity of use	• All controls should be manually activated. • May be difficult to activate controls because of their location. • Only protects the operator once they have contacted or entered the hazardous are of the machine. • May require special fixtures to hold work. • May require a machine brake

OPERATOR SAFETY DEVICES			
Method	**Safeguarding Action**	**Advantages**	**Limitations**
Restraint (holdback)	Prevents the operator from reaching into the hazardous area.	minimal risk of mechanical failure.	• Limits movements of operator • May obstruct workspace. • Adjustments should be made for specific operations and everyone. • Requires close supervision of the operator's use of the equipment

OPERATOR SAFETY DEVICES			
Method	**Safeguarding Action**	**Advantages**	**Limitations**
Two-hand control	Concurrent use of both hands is required, preventing the operator from entering the hazardous area	• Operator's hands are at a predetermined location. • Operator's hands are free to pick up a new part after first half of cycle is completed	• Requires a partial cycle machine with a brake. • Some two-hand controls can be rendered unsafe by holding with arm or blocking, thereby permitting one-hand operation. • Protects only the operator
Two-hand trip	Concurrent use of two hands on separate controls prevents hands from being in hazardous area when machine cycle starts	• Operator's hands are away from hazardous area. • Can be adapted to multiple operations. • No obstruction to hand feeding • Does not require. adjustment for each operation	• Operator may try to reach into hazardous area after tripping machine. • Some trips can be rendered unsafe by holding with arm or blocking, thereby permitting one-hand operation. • Protects only the operator. • May require special fixtures

ANNEXURE-2: MACHINE GUARD COMMISSIONING CHECKLIST

Identification		_____	Inspection Purpose
Guard Type	❑ Fixed	❑ Automatic	❑ Guarding Survey
	❑ Distance	❑ Interlocking	❑ Commissioning
Date of Inspection		_____	❑ Other

Requirement	*Considerations*	*Yes*	*No*
Total exclusion of persons from the hazardous area.	• Does the guard totally exclude all persons from the hazardous area? • Do any apertures in the guard (including holes in mesh) allow any part of a person, including persons of small stature, to reach the hazardous area. • Has the guard itself caused any secondary trap points		
Guard Integrity strong enough to withstand impact	• Is the strength of fixtures and fittings adequate? • Is the strength of guard structure such that it will not deflect?		
Proximity dangers.	• Is there a likelihood of something a person is carrying either falling through or being pushed. • through the guard?		
Guard material	• Is the guard material adequate for the proposed service conditions in terms of visibility, corrosion resistance, hygiene, and physical strength?		
The guard may create secondary trapping points	• Were checks made during guard design? • Were physical checks made after the guard was installed?		
Is there the possibility that the guard will create a new hazard, such as	• Fire hazard trap point. • Restrict/ inhibit access. • Hygiene Hazard (dust, spoil fume) • Sharp edges or protrusions • Build-up of static electricity		
Will the guard adversely affect maintenance of the plant in terms of:	• Access to lubrication points? • Access for mechanical adjustment? • Access to machine and surrounds? • Causing a heat gain in the machinery? • Causing an increase in noise? • Operation of machine?		

ANNEXURE-3: MONTHLY INSPECTION CHECKLIST FOR MACHINE GUARDS

Dept:		**Section:**		
Date:		**Performed by:**		
	Guard No./Safety Device no.	**Guard No./Safety Device no.**	**Guard No./Safety Device no.**	**Guard No./Safety Device no.**
Check Points	**Status**	**Status**	**Status**	**Status**
Is guard free from damage including fixtures and mounting brackets				
Are all locking and securing points adequately secured				
Does guard provide adequate protection against hazardous areas (nip points, sheer, cutting, rotating components)				
Does interlock or automatic shut off switches function correctly				
There is no excessive free play on pull wires/ pull ropes (40-60mm) and actuating lever is free from obstruction				
Note: Machines that are not adequately guarded need to be prioritized and Interim action taken to minimize the risk of injury this should be recorded in the comments section of this form				

ANNEXURE-4: MACHINE GUARDING SURVEY SHEET

MACHINE GUARDING SURVEY SHEET																
Name of the business				Assessment date							Name of the surveyors: 1. 2. 3.					
Name of the plant site/location				Maximum frequency												
Department name				Assessment done by:												
S. N	Name Of the Machine	Ref/Identification No.	Location	Machine Description (Fixed/Portable)	Machine Guard Color (Y/N)	Machine Guard Signage (Y/N)	Machine Guard Type Fitted				Emergency Shut Off Available	Any Defects or Deficiency	Number Allotted to Guards (Y/N)	Comments/ Action	Remarks/Notes	Target Date to Complete the Non-Compliance
							Fixed (Other Than Conveyor)	Interlocked	Automatic	Distance						

16. REFERENCES

References Document	Full Title, Brief Description and Web Links
1. International Organization for Standardization (ISO)	**ISO 45001** is an International Organization for Standardization (ISO) standard for management systems of occupational health and safety (OHS), published in March 2018. The goal of ISO 45001 is the reduction of occupational injuries and diseases, including promoting and protecting physical and mental health. ISO 45001:2018 - Occupational health and safety management systems — Requirements with guidance for use
2. International Organization for Standardization (ISO)	ISO is an independent non-government membership organization and the world's largest developer of voluntary international standards. They give world class specifications for products, services, and systems to ensure quality, safety, and efficiency. Safety of Machinery, Guards, General Requirements for the design and construction of fixed and movable guards. ISO 14120:2015(en), Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards ISO 13857:2019 ISO 13857:2019 - Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs
3. Directive 2006/42/EC (European Machine Directive)	This Directive aims at the free market circulation on machinery and at the protection of workers and consumers using such machinery. It defines essential health and safety requirements of general application, supplemented by several more specific requirements for certain categories of machinery. Directive 2006/42/EC - machinery directive | Safety and health at work EU-OSHA (europa.eu)

References Document	Full Title, Brief Description and Web Links
4. UNI EN 1005-4:2009	This European Standard presents guidance when designing machinery or its components parts in assessing and controlling health risks due to machine-related postures and movements, i.e. during assembly, installation, operation, adjustment, maintenance, cleaning, repair, transport, and dismantlement. The standard specifies requirements for postures and movements without any or with only minimal external force exertion. EN 1005-4:2005 - Safety of machinery - Human physical performance - Part 4: Evaluation of working (iteh.ai)
5. UNI EN 614-2:009	This European Standard establishes the ergonomics principles and procedures to be followed during the design process of machinery and operator work tasks. This European Standard deals specifically with task design in the context of machinery design, but the principles and methods may also be applied to job design. This European Standard is directed to designers and manufacturers of machinery and other work equipment. It will also be helpful to those who are concerned with the use of machinery and work equipment, e.g. to managers, organizers, operators, and supervisors. EN 614-2:2000+A1:2008 - Safety of machinery - Ergonomic design principles - Part 2: Interactions (iteh.ai)
6. UNI EN 547-2/3:2009	EN 547-2:1996+A1:2008 - Safety of machinery - Human body measurements - Part 2: Principles for (iteh.ai) EN 547-3:1996+A1:2008 - Safety of machinery - Human body measurements - Part 3: Anthropometric data (iteh.ai)
7. Safety Guidelines for Iron & Steel Sector	Ministry of Steel undertook extensive interactions with the stakeholders from the steel industry associations and the academic institutions of repute to evolve a set of common minimum guidelines for safety which can act as minimum safety benchmark for adoption by the Indian Steel industry. Safety Guidelines for Iron & Steel Sector | Ministry of Steel | GoI



JSW Group

MANAGEMENT STANDARD: ELECTRICAL SAFETY
JSW/GHS/GS-11

MANAGEMENT STANDARD ELECTRICAL SAFETY

Management Standard Title:	**ELECTRICAL SAFETY**	**Date of Revision**	10.12.2024
Document	JSW/GHS/GS-11	**Revision**	01

Document Issue and Revision History

Date	Revision Number	Change Summary
10.12.2024	01	PPE Technologies corrected. Inspection record retention modified. Cross-references have been included. Added calibration requirements and record-keeping for voltage testers. Recommended battery-operated tools over AC-powered tools in wet areas. Introduced annual testing intervals for static discharge systems.

Prepared by	KNV Kiran Kumar
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1. PURPOSE

The Electrical Safety Standard provides essential requirements and guidance concerning procedures and practices for safely interacting with electrical equipment and systems during all types of work. Its primary goal is to prevent injuries, operational disruptions, and damage to critical equipment due to electrical risks such as electrocution, Arc flash, and electrical fires during servicing, inspection, and maintenance activities.

This Standard practice implementation helps to prevent personnel involved in constructing, testing, operating, maintaining, and dismantling electrical equipment and systems within facilities, as they constitute the highest risk group exposed to electrical hazards. However, the requirements and guidance also extend to lower-risk groups across all work locations, including individuals using portable electrical-powered tools, appliances, and equipment.

2. SCOPE

This Standard applies to all JSW Companies and subsidiaries, managed sites, corporate offices, research and development facilities, new projects, merged and acquired entities. The requirement outlined here applies to all JSW company employees, contractors and shall remain applicable for entire life cycle of an establishment, offices, manufacturing, and project sites wherein personnel will be required to undertake servicing and maintenance activities.

This Standard provides information related to the safe interaction with electrical equipment and systems for all types of work performed on all types of fixed plant and equipment as well as mobile equipment within JSW Group premises, along with the respective responsibilities of stakeholders.

In the Standard, the following verbal forms are used to indicate requirements, recommendations, permissions, or capabilities:

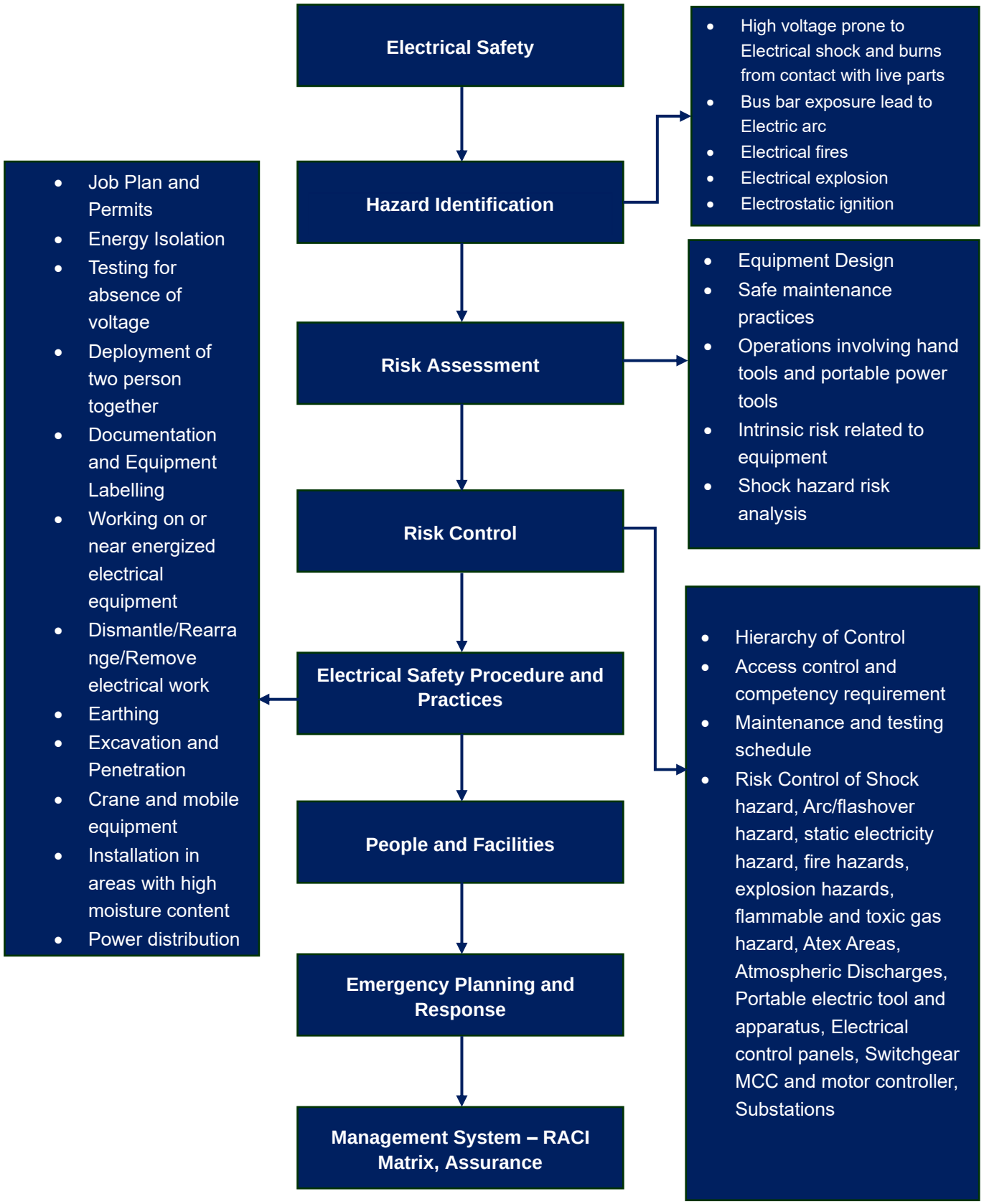
- “shall” indicates a requirement.
- “should” indicates a recommendation.
- “may” indicates a permission.
- “can” indicates a possibility or capability.

3. REVIEW

The Standard shall be reviewed at least every 5 years or when a serious incident or high potential near miss is recorded. The review shall be consistent with local regulations and the requirements of this standard and shall include the evaluation of the following:

- Introduction of new machine/equipment/process
- Action plan to implement LOTO for the specific electrical hazardous energy.
- Training Records.
- Work permit issued.
- Changes to industry standards, laws, and regulations.

4. PROCESS FLOW



ELECTRICAL SAFETY MANAGEMENT PROGRAM

5. HAZARD IDENTIFICATION, RISK ASSESSMENT AND CONTROL

Business Units shall have electrical safety procedures that are easily accessible and up to date. These procedures shall be developed using a structured risk assessment process and shall contain the safe practices necessary to identify and manage the electrical hazard exposure. These procedures shall cover both routine and emergency operations related to the electrical supply utility, detailing protocols for interacting with utility services and managing internal electrical operations effectively

5.1 HAZARD IDENTIFICATION

Hazard identification involves identifying, classifying, and addressing electrical hazards to ensure workplace safety. This process includes analyzing activities, facility conditions, and potential incident scenarios.

Examples of electrical hazards are, but are not limited to following:

Table-1 : Types of Electrical Hazards

Example of electrical hazards	Common causes
Exposed Live Parts leads to Electric shock and burns from contact.	• Exposed electrical wires • Water on electrical appliances • Cutting through a live cable • Old or faulty wiring • Lightning Strikes
Exposed Bus Bar leads to Electric arc	• Severed wiring • Damaged or exposed insulation covering • Open electrical cabinets • Over-fusing incidents
Electrical fires	• Overloaded circuits • Damaged or old wiring • Malfunctioning of electrical systems
Electrical explosions	Most often are caused by an “electric arc”; when the current fails to follow the path, the arc flash occurs and results in a brief, high-temperature discharge of electricity that leads to an explosion.
Electrostatic ignition source	Static electricity can arise when there is an intensive contact (i.e., the surfaces are max. 10nm apart) between the material and the equipment, machine, or transport facilities (for example the material flow in a conveying pipe). When an electrostatic spark occurs in a flammable atmosphere (ATEX area) it can result in fires and explosions.

The electrical hazard identification shall consider the dangers related to:

- The electricity distribution installations required for the site's operation and for the powering of the site facilities.
- The overhead operations carried out close to overhead power lines.
- The excavation work carried out in the presence of buried piping and cables.
- The use of portable electrical tools and accessories.
- The installation and connection of electrical equipment.
- The operations on existing installations.
- The voltages used on the site.
- The working conditions on the site (humidity, outside work, confined spaces, etc.).

5.2 RISK ASSESSMENT

When potential hazard is identified, the relevant permit recipient is responsible to ensure that a risk assessment is undertaken by a competent person to determine the hazards and risks and to apply control measures that will bring the potential consequence rating level to an acceptable level before carrying out work.

The Risk Assessment shall be conducted in accordance with the JSW Hazard Identification and Risk Assessment Standard (JSW-GHS/GS-17) and will consider, but is not limited to, the following factors:

- The nature of the work to be performed.
- The timing of the work (day or night) and its duration.
- Environmental conditions (e.g., weather, dust, presence of water, and environments at risk of fire or explosion).
- Soil characteristics (e.g., conductivity and ground resistance).
- Presence of aerial and buried lines.
- Presence of active electrical systems.
- Training and competence of personnel.
- The range of methods available for performing the work.
- The hazards involved and the associated risks.
- The method selected for effective isolation.

Site personnel are responsible only for performing maintenance within the plant. The installation of systems, components, connections, or any urgent requirements shall be carried out by qualified expert personnel regularly certified for such tasks. An experienced person is defined as someone who possesses the necessary technical skills or has received specific training to safely prevent electrical hazards during operations performed under specific conditions.

The installation of electrical systems and the selection of components (e.g., wires, switches, panels, sockets) shall be carried out with consideration for preventing risks related to direct and indirect contact (indirect contact risks arise from potential energization of metal parts, with **voltages below 25V**, due to insulation faults), fire, and/or explosion. For detailed risk control measures, refer to Section 5.5.

5.2.1 Minimization of Personnel Exposure to Electrical Hazards:

To minimize exposure to electrical hazards, a comprehensive risk assessment is essential. This assessment should encompass:

- **Optimal Equipment Design:** Incorporating measures such as high-resistance grounding for low-voltage systems where permissible, ground fault protection, arc-proof equipment, current-limiting devices, and smart motor control centers.
- **Safe Maintenance Practices:** Ensuring equipment with exposed parts (>50 V) is enclosed to prevent accidental contact. Devices with shrouded terminals and finger-safe features are critical for reducing inadvertent contact with energized components. Refer **Figure -1** for an illustration of finger safe terminal design).

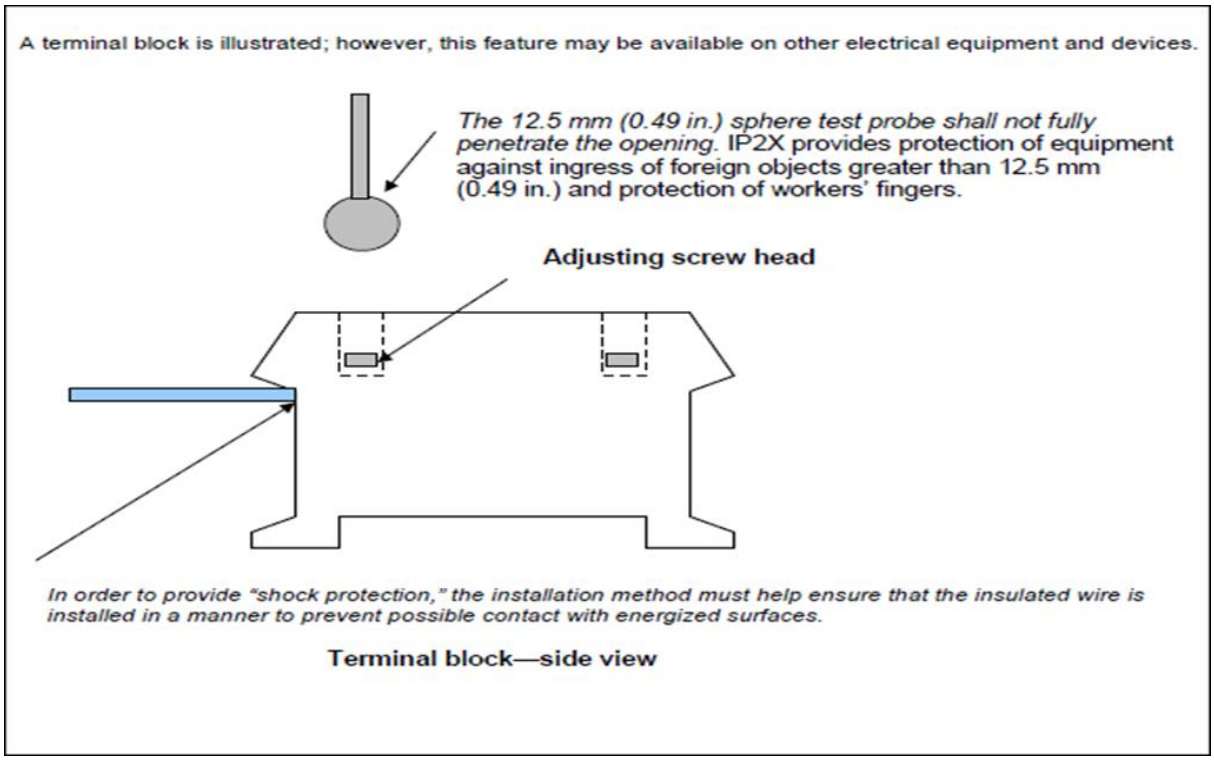


Figure-1: Illustration of Finger Safe Terminal Design

5.2.2 Specific Risk Assessments

The risk assessment process should cover:

- Concepts, methodologies, and criteria for planning and executing operations involving hand tools and portable power tools energized by electric power.
- Intrinsic risks related to equipment type, configuration, or structural design, as well as procedural risks associated with operational conditions or worker behavior.
- Risks associated with tools and instruments that should or may impact multiple workers simultaneously.

5.3 SHOCK HAZARD RISK ANALYSIS

To mitigate the risk of electrical shock, Business unit shall conduct a shock hazard analysis, this analysis determines the system voltage to which personnel should or may be exposed and identifies the protection boundary requirements as established in NFPA 70 E Table 130.4 (D) (a) & (b), This analysis also specifies the personal protective equipment (PPE) necessary to minimize shock hazards.

Shock Protection Approach Boundaries to Exposed Energized Electrical Conductors or Circuit Parts for Alternating-Current Systems.

(1)	(2)	(3)	(4)
Nominal System Voltage Range, Phase to Phase	**Limited Approach Boundary**		**Restricted Approach Boundary (Includes Inadvertent Movement Adder)**
	Exposed Movable Conductor	**Exposed Fixed Circuit Part**	
Less than 50 V	Not specified	Not specified	Not specified
50 V–150 V	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	Avoid contact
151 V–750 V	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	0.3 m (1 ft 0 in.)
751 V–15 kV	3.0 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.7 m (2 ft 2 in.)
15.1 kV–36 kV	3.0 m (10 ft 0 in.)	1.8 m (6 ft 0 in.)	0.8 m (2 ft 9 in.)
36.1 kV–46 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	0.8 m (2 ft 9 in.)
46.1 kV–72.5 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 6 in.)
72.6 kV–121 kV	3.3 m (10 ft 8 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 6 in.)
138 kV–145 kV	3.4 m (11 ft 0 in.)	3.0 m (10 ft 0 in.)	1.2 m (3 ft 10 in.)
161 kV–169 kV	3.6 m (11 ft 8 in.)	3.6 m (11 ft 8 in.)	1.3 m (4 ft 3 in.)
230 kV–242 kV	4.0 m (13 ft 0 in.)	4.0 m (13 ft 0 in.)	1.7 m (5 ft 8 in.)
345 kV–362 kV	4.7 m (15 ft 4 in.)	4.7 m (15 ft 4 in.)	2.8 m (9 ft 2 in.)
500 kV–550 kV	5.8 m (19 ft 0 in.)	5.8 m (19 ft 0 in.)	3.6 m (11 ft 8 in.)
765 kV–800 kV	7.2 m (23 ft 9 in.)	7.2 m (23 ft 9 in.)	4.9 m (15 ft 11 in.)

Note: All dimensions are distance from exposed energized electrical conductors or circuit parts to employee.

- For single-phase systems above 250V, select the range that is equal to the system's maximum phase-to ground voltage multiplied by 1.732.
- Exposed movable conductors describes a condition in which the distance between the conductor and a person is not under the control of the person. The term is normally applied to overhead line conductors supported by poles.
- This includes circuits where the exposure does not exceed 120V.

Shock protection boundaries, specifically the limited approach boundary and the restricted approach boundary, are applicable when personnel are approaching exposed, energized electrical conductors or circuit parts.

These boundaries are concerned with direct contact with energized electrical conductors and circuit parts, and do not account for exposure to arc flash hazards.

There are two shock protection boundaries:

1. **Limited Approach Boundary**: This is the closest approach distance for an unqualified person, unless additional protective measures are implemented. Unqualified personnel are not allowed to cross this boundary without supervision by a qualified person and appropriate safety precautions.
2. **Restricted Approach Boundary**: This is the closest approach distance for a qualified person, unless additional protective measures are implemented. Qualified personnel should or may only approach within this boundary if the energized parts are either insulated or guarded, or if the energized parts are insulated from any conductive objects.

The specific dimensions of each boundary are determined by the maximum voltage to which an employee might be exposed.

Figure 2 illustrates shock protection boundaries around a 600 Volt class motor control center, showing the applicable distances based on operating voltage. When conductors are placed in an electrically safe working condition, approach boundaries can be eliminated, allowing personnel to approach without the risk of injury.

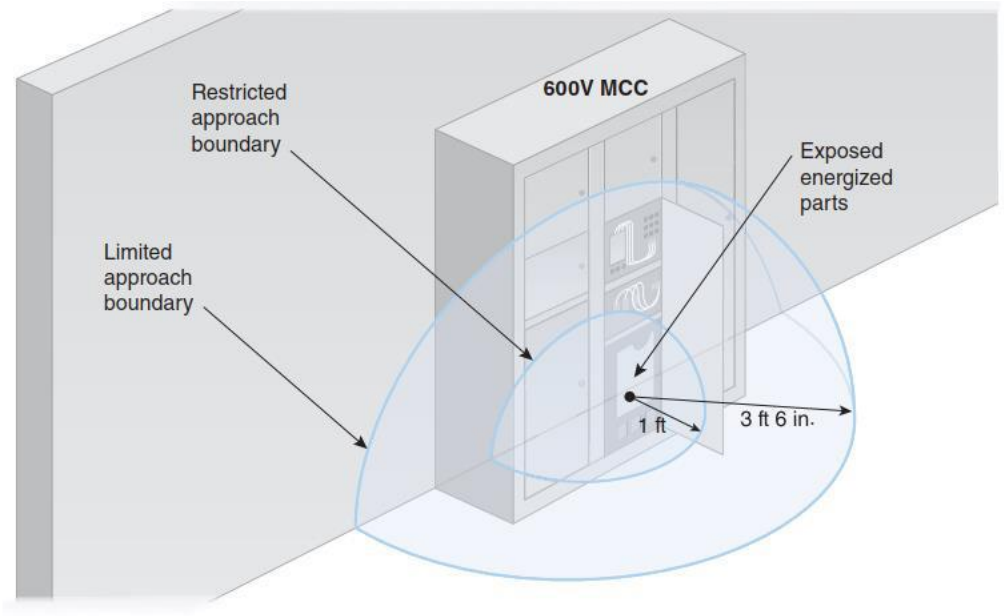


Figure-2 : Shock Protection Boundaries

Figure 3 depicts shock boundaries around a distribution board, emphasizing practical applications in workplace settings.

It's crucial to note that shock protection boundaries specifically address direct contact with energized electrical components and do not cover protection against arc flash incidents.

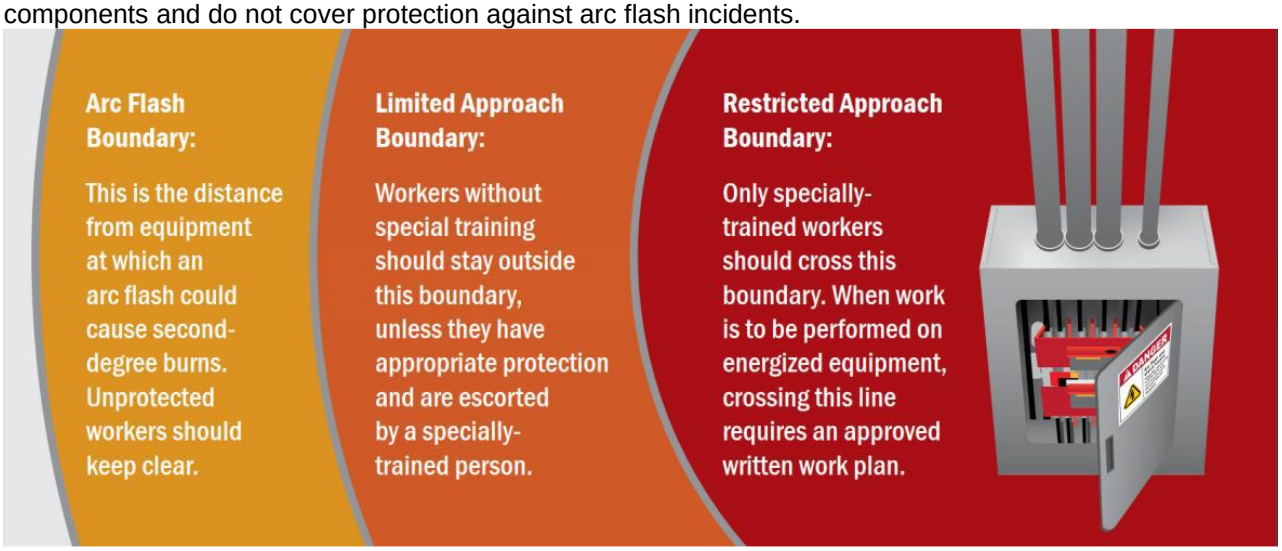


Figure-3 : Shock Boundaries around a Distribution Board

5.4 ARC FLASH RISK ASSESSMENT

Business Unit shall perform an arc flash risk assessment and determine if an arc flash hazard exists. If an arc flash hazard exists, the risk assessment shall determine:

- Appropriate safety related work

- The arc flash boundary
- The PPE to be used within the arc flash boundary (Refer PPE Standard JSW/GHS/GS- 05).

Risk assessment should be updated when a major modification or renovation takes place. It should be reviewed periodically, at interval not to exceed 5 years, to account for changes in the electrical distribution system that could affect the results of the arc flash risk assessment. Arc flash risk assessment should also consider the design of the overcurrent protective device, including its condition of maintenance.

5.5 RISK CONTROL

Hierarchy of risk control measures:

5.5.1 Technologies to Eliminate and Reduce Exposure to Electrical Hazards

Technologies that eliminate exposure to electrical hazards are crucial as the first line of defense against incidents. Examples include insulation, guarding, and earthing, which should be integrated into initial designs and redesign processes. Additionally, technologies that reduce the frequency and severity of exposures, when combined with safe work practices, form the second line of defense. This includes enhancements like insulation improvements, additional guarding, and the installation of Residual Current Devices (RCDs). The difference between MCB, ELCB, RCCB, and RCBO is provided in **Table 2**.

Table-2 : Difference Between MCB, ELCB, RCCB, and RCBO

Feature	MCB (Miniature Circuit Breaker)	ELCB (Earth Leakage Circuit Breaker)	RCCB (Residual Current Circuit Breaker)	RCBO (Residual Current Circuit Breaker with Overcurrent protection)
Purpose	Protects against overcurrent and short-circuit	Detects leakage currents to earth (ground faults)	Detects residual current imbalances (including leakage to earth)	Combines residual current detection with overcurrent protection
Operation	Trips when current exceeds its rated capacity (overload or short circuit)	Trips when leakage current exceeds a set threshold (earth fault)	Trips when residual current exceeds a set threshold (imbalance)	Trips on both residual current imbalance and overcurrent conditions
Detection Type	Thermal and magnetic sensing for overcurrent	Current differential transformer for leakage to earth	Current differential transformer for residual current imbalance	Combines differential transformer for residual current with overcurrent sensing
Typical Sensitivity	Typically ranges from 6A to 125A	Sensitivity ranges from a few milliamperes up to several amps	Sensitivity ranges from 10mA to 500mA	Sensitivity typically from 10mA to 30mA for residual current and overcurrent protection setting as per MCB
Usage	Commonly used in electrical distribution boards for branch circuit operation	Commonly used for additional protection in specific circuits or equipment	Used for circuits where human safety is critical (e.g.: bathroom, outdoors)	Used in sensitive circuits requiring both residual current and overcurrent protection

Feature	MCB (Miniature Circuit Breaker)	ELCB (Earth Leakage Circuit Breaker)	RCCB (Residual Current Circuit Breaker)	RCBO (Residual Current Circuit Breaker with Overcurrent protection)
Voltage Rating	Typically rated for low voltage applications (e.g. 230V,415V)	Typically rated for low voltage applications (e.g., 230V, 415V)	Typically rated for low voltage applications (e.g., 230V, 415V)	Typically rated for low voltage applications (e.g., 230V, 415V)
Tripping Mechanism	Trips on excess current (thermal and electromagnetic)	Trips on detected leakage current (differential transformer sensing)	Trips on residual current imbalance (differential transformer sensing)	Trips on both residual current imbalance and overcurrent (combined sensing)
Combination with MCB/RCBO	Can be combined with an MCB in an RCBO for dual protection	Can be integrated with an MCB in an RCBO for combined protection.	Typically, standalone but can be integrated with an MCB in an RCBO	Integrated device combining residual current protection with overcurrent protection

5.5.2 Electrical Personal Protective Equipment

Personal protective equipment (PPE) constitutes the last line of defense and relies on comprehensive administrative controls. This involves quality assurance in facility design, thorough hazard assessments, worker training, and rigorous protocols for PPE selection, fitting, inspection, and maintenance (refer to **Annexure 1**- Electrical Personal Protective Equipment and **JSW PPE Standard** (JSW/GHS/GS-09).

5.5.3 Access Control and Competency Requirements for Electrical Work

Business units shall establish electrical safety procedures to protect personnel and ensure the reliability of electrical systems. All individuals involved in electrical work, including company employees and contractors, shall demonstrate full competency relevant to their assigned tasks. This competency includes the appropriate training, qualifications, and experience in accordance with industry standards and applicable regulations.

Additionally, all personnel engaged in electrical work shall receive training in emergency response and basic first aid to effectively manage unexpected incidents. Business units should also implement access control measures, using barricades and safety signs where necessary to restrict access to work areas containing energized conductors or circuit parts. It is important to note that conductive barricades should not be used in situations where they should or may increase the risk of electrical exposure.

Barricades should be placed no closer than the limited approach boundary. If the arc flash boundary extends beyond the limited approach boundary, barricades should not be placed closer than the arc flash boundary.

Each site should provide danger sign as per electrical rule for all places where voltage level is at or above 230V as per **Annexure – 4**.

5.5.4 Maintenance and Testing Schedule

Business unit should develop comprehensive schedules and protocols for predictive maintenance, condition monitoring, and preventive maintenance activities. Predictive maintenance utilizes data analytics and monitoring techniques to predict when maintenance is needed, optimizing equipment performance and minimizing downtime. Condition monitoring involves regular inspections and assessments to detect early signs of equipment wear or failure, allowing for timely intervention and maintenance. Preventive maintenance encompasses scheduled inspections, repairs, and replacement.

Business unit should establish testing schedules for various critical components, including but not limited to portable hand tools, transformers, cable cellars, and cable tray laying. These schedules ensure that equipment

is regularly inspected and tested to maintain operational safety and efficiency. Testing procedures should adhere to industry standards and manufacturer recommendations to verify functionality, detect potential faults, and ensure compliance with safety regulations to promptly address potential issues, ensuring equipment reliability and operational efficiency.

5.5.5 Prevention from Electrical Hazards

5.5.5.1 Prevention from Direct Contact

Prevention involves installing systems compliant with safety standards and using components suited to their environment and purpose.

5.5.5.2 Prevention from Indirect Contact

Prevention includes installing automatic differential switches, adequate grounding systems, and magnetic-thermal switches for protection against short circuits and overloads.

5.5.5.3 Fire and/or Explosion Prevention

Mitigated by installing protective devices that quickly shut off power during faults, preventing overheating of components and wires.

Business Units shall perform an electrical hazard analysis for the plant electrical distribution system to identify unsafe conditions and situations during activities and maintenance operations. This methodology helps Business Units evaluate situations where electrical hazards should or may be present and evaluate the effectiveness of control measures (e.g., the operation of protection system devices to minimize indirect contacts or arc-flash energy), the guarding of energized parts, and the completeness of electrical safety procedures, safety instructions, training, as well the potential impacts of human factors (e.g. sub-standard behaviors, etc.).

5.5.6 Shock Hazard Management

Business Units shall have procedures and practices in place to assess and manage shock hazards. At a minimum, the following requirements shall be followed:

- The limited approach boundary for circuit parts and conductors without an IP2X-equivalent design shall only be crossed by a qualified person covered under the authorization list and list shall be displayed at the entry door. Appropriate personal protective equipment (PPE) shall always be worn.
- The prohibited approach boundary limit for circuit parts and conductors shall only be crossed by a qualified and competent person, with written authorization from management. Appropriate personal protective equipment (PPE) shall always be worn.
- Any voltage greater than 30V relative to any reference point shall be considered a lethal shock hazard, and appropriate procedures shall be developed to address this risk.
- Proper design, installation, and maintenance of equipment grounding and/or earthing are essential for effectively managing shock hazards.

The following measures shall be adopted to complement the overall shock protection program and to minimize the risk of shock:

- Voltage-rated PPE (e.g., gloves or helmets) shall be worn whenever a shock hazard is present.
- The proper design, installation, and maintenance of equipment earthing, which is critical for managing shock hazards, shall be ensured.
- Installation and maintenance of RCCBs (Residual Current Circuit Breakers) shall follow the company's standards and procedures. RCCBs should be periodically tested according to local legislation or manufacturer's recommendations.
- Battery-powered tools should be used instead of AC-powered tools wherever possible.
- Reduced-voltage equipment should be utilized where applicable.
- Double-insulated equipment, such as portable electric tools, shall be used.
- Shrouding and barriers should be installed as required to prevent exposure to electrical hazards.
- Insulated or voltage-rated tools shall be used for electrical work.
- Insulated mats should be placed on floors in areas where electrical work is performed.
- Insulated, flexible barriers shall be used to cover exposed equipment parts.
- Multiple voltage sources inside cabinets should be clearly identified and properly labeled.

- Voltages should be segregated to prevent accidental contact when multiple voltage sources exist in a single unit, terminal block, or marshalling box. Site Business Units shall have procedures in place to manage shock hazard exposure in such situations.
- Practices and procedures shall be in place to prevent the use of common or borrowed neutrals in new installations or retrofits. For existing installations, the use of common or borrowed neutrals should be identified and addressed.
- Finger-safe terminals shall be used to prevent finger contact with live electrical parts.

Specific precautions are related to:

- Plug shunts and intermediate mobile wires shall be of the type that, due to their design, ensure that any plug not securely connected to its socket will not be energized.
- Sockets shall be designed so that it is impossible to accidentally touch live parts of the socket (unless special equipment is used) or the live parts of the plug during the entire process of plugging and unplugging.
- When plug shunts are used to supply power to users with equipment exceeding 1000 watts, they shall be equipped with a switch upstream of the socket, interlocked with the plug. This ensures that the plug can only be inserted or removed when the circuit is open, and that each phase has a valve for additional safety.
- High voltage shall not be used for mobile or portable machines and tools.
- When working outdoors, the maximum supply voltage for electric tools shall not exceed 220V (to ground).
- For portable tools used in wet or very damp conditions, or for work involving large metal bodies, this limit is reduced to 30V (to ground). In compliance with international standards, wet or very damp places are defined as areas where water or water solutions spill, where steam diffusion creates condensation on walls, ceilings, and floors, or where walls, floors, or the ground are regularly exposed to salt, mold, or humidity. Work involving large metal bodies refers to activities performed in enclosed spaces with conductive surfaces that are well-grounded, where there is a high likelihood of contact with these surfaces, excluding hands and feet, and where breaking contact is difficult.
- In these cases (outdoor work, damp environments, etc.), if tools are powered by a low-voltage network through a transformer, the transformer shall be an "insulation" transformer, meaning the primary and secondary circuits are separated and insulated from each other, with the secondary circuit's midpoint grounded.
- From a manufacturing perspective, portable electric tools powered by alternating voltage exceeding 25V to ground (or 50V DC) shall typically have their metal cases connected to ground. However, an exception is made for equipment with complete special insulation that meets the required resistance, insulation, and dielectric rigidity standards, as certified by a qualified body, marked with the appropriate symbol (a square within a double square).
- Additionally, portable and mobile tools shall have extra safety insulation between internal live parts and the external metal casing. They shall also feature an easily accessible switch built into the tool's frame to turn the tool on and off safely.

5.5.7 Risk Control of Arc / Flashover Hazards

Arcing faults in electrical equipment are multi-energy events involving heat, blast, light, and sound, which typically release high levels of energy over a short duration. Business Units shall have procedures and practices in place to minimize potential exposure to electric arc hazards.

Arcing faults occur due to phase-to-phase and phase-to-earth fault conditions, which can happen even at low voltage levels. These faults can lead to severe flash-over incidents, causing significant injury to employees in close proximity. When incident energy exceeds 1.2 cal/cm² (5.0 joule/cm²), plants shall implement and document an arc flash risk assessment to determine how to safely perform the work. At a minimum, the following factors shall be assessed:

- Incident energy at the working distance
- Arc-flash boundary.
- Activity
- Equipment
- Body positioning
- Tools

In some cases, the level of risk should or may indicate that the work is too hazardous to perform under energized conditions. In such instances, line management and functional experts should be consulted to reduce the risk to an acceptable level.

Business Units shall clearly define the incident energy threshold above which the recommended PPE (such as cool coats, face shields with goggles, safety shoes, hand gloves, and insulated electrical tools) shall be used. Additionally:

- Areas where arc flash or flashover hazards should or may occur should be identified.
- Warning boards should be placed in areas where the use of arc suits and arc shields is mandatory.

Arcing faults in oil-filled electrical equipment, such as oil-filled transformers and circuit breakers, present additional hazards. Arcing faults inside an enclosure or tank can cause a burn hazard due to hot oil being expelled from the unit. This occurs because arc energy creates overpressure from expanding gases, potentially leading to a tank rupture or the activation of a pressure-relief device, resulting in hot oil spilling nearby. When the hot oil comes into contact with oxygen, it can ignite, leading to burn injuries or fatalities.

Business Units operating liquid-filled, insulated electric power distribution equipment shall have a process (such as a process hazard analysis or another method deemed appropriate by plant management) for assessing the additional hazards associated with this equipment. The analysis should include, but not be limited to, the following:

- Reviewing the adequacy of protection systems periodically to prevent such faults.
- Evaluating the frequency and duration of personnel exposure based on proximity to walkways and work areas.
- Assessing the potential direction of oil expulsion from the pressure-relief system.
- For transformer tap changers rated for operation only in de-energized conditions, implementing a control method, such as personal lockout/tagout, to ensure these devices are operated only when de-energized.

5.5.8 Static Electricity Management

Static electricity hazards present significant risks during various operational and maintenance activities, potentially causing ignition, injuries, or equipment damage. Business Units shall implement effective control measures to mitigate these risks.

Operations involving the handling or transport of liquids, solids, or gases in portable containers or piping systems inherently generate static electricity hazards. These activities include, but are not limited to:

- **Handling and Transport**: Loading and unloading flammable liquids, powders, or gases into/from containers or tanks.
- **Pipeline Operations**: The flow of liquids or gases through pipelines, particularly those involving hydrocarbons or other conductive fluids.
- **Bulk Material Handling**: The transfer of bulk solids (e.g., grain, powder) through pipes or chutes.

To mitigate these hazards:

- Ensure that all containers, tanks, and pipelines are properly grounded and bonded to dissipate static electricity buildup. Static discharge systems should be tested at least annually or as specified by local regulations. Test results, including measurements of resistance to ground, shall be documented and reviewed to identify any deviations requiring corrective action.
- Implement grounding and bonding procedures in accordance with industry standards and regulations to prevent sparks caused by static electricity.

Certain maintenance activities can also generate static electricity hazards, particularly those involving:

- **Steam Cleaning**: The use of steam to clean equipment or surfaces, which can generate static charges on nearby conductive materials.
- **Industrial Vacuuming**: The movement of conductive dust or debris through vacuum systems.
- **Sandblasting**: Abrasive blasting processes that generate airborne particles capable of accumulating static charges.

To manage static electricity risks during maintenance:

- Ensure that equipment undergoing maintenance is de-energized and grounded before starting work.
- Use static-dissipative hoses or equipment during vacuuming or sandblasting to prevent static buildup.

- Implement procedures to discharge static charges from equipment and personnel before and during maintenance tasks.

Proper earthing and bonding are essential to prevent the buildup of static electricity and mitigate lightning hazards. Key measures include:

- Install and maintain adequate lightning arrestors at strategic locations across the site, following local standards and regulations.
- Conduct regular inspections and tests of lightning protection systems to ensure they are functional and compliant.
- Ensure that all earthing conductors are effectively bonded to equipment and structures to prevent potential differences that could lead to static electricity accumulation.

5.5.9 Fire Safety Management

Business Units shall have procedures and practices in place to assess and manage fire hazard risks associated with electrical equipment and installations, including firefighting procedures specific to electrical equipment at the plant. These procedures should encompass the following measures:

5.5.9.1 Selection, Procurement, and Installation of Equipment

Business Unit shall ensure the selection, procurement, and installation of electrical equipment and devices consider factors that minimize the possibility of igniting flammable and combustible materials. Key considerations include:

Use of Intrinsically Safe Equipment: Where applicable, select intrinsically safe electrical equipment that is designed to prevent ignition of hazardous atmospheres.

Enclosure Ratings: Install equipment with appropriate enclosure ratings (e.g., IP ratings) to prevent ingress of dust and liquids that could cause equipment malfunction or overheating.

Heat Dissipation: Choose equipment with efficient heat dissipation mechanisms to prevent overheating, which can be a potential ignition source.

Compatibility with Hazardous Areas: Ensure equipment installed in hazardous areas (ATEX zoning) complies with area classification requirements and is suitable for the specific environment .i.e. Dust and Vapor/ Gas.

5.5.9.2 Maintenance Practices to Prevent Overheating

Business Unit shall implement maintenance practices that reduce the likelihood of equipment overheating or malfunctioning, which can lead to fire hazards:

Regular Inspection and Cleaning: Schedule routine inspections to check for dust accumulation and debris that could obstruct ventilation and cooling systems. Clean equipment as needed to maintain optimal airflow and heat dissipation.

Tightening and Securing Connections: Inspect electrical connections periodically for signs of loosening or corrosion, as these can increase resistance and generate heat. Ensure all connections are tightened according to manufacturer specifications.

Thermographic Inspections: Perform thermographic inspections to identify hot spots in electrical equipment, which should or may indicate issues such as loose connections or overloading. Address any anomalies promptly to prevent overheating.

Load Monitoring: Continuously monitor electrical loads to prevent circuit overloading, which can cause overheating and increase fire risks. Ensure circuits are balanced and operate within their rated capacities.

5.5.9.3 Mechanical Integrity Management

Business Unit shall manage mechanical integrity to eliminate or reduce potential sources of fire ignition:

Equipment Stability and Mounting: Ensure electrical equipment is securely mounted and stable to prevent physical movement that could cause short circuits or mechanical damage leading to fire.

Equipment Alignment: Align moving parts properly to prevent frictional heat buildup that could ignite nearby combustible materials.

Sealing and Gasket Integrity: Maintain seals and gaskets on equipment enclosures to prevent ingress of dust, moisture, or contaminants that can compromise equipment operation and safety.

5.5.9.4 Control of Toxic Substances

Business Unit shall evaluate toxic substances emitted from burning electrical equipment and materials to control potential personnel exposure:

Material Safety Data Sheets (MSDS): Maintain up-to-date MSDS for materials used in electrical equipment and installations to understand potential hazards and necessary precautions in case of fire.

Ventilation Systems: Ensure adequate ventilation systems are in place to mitigate the spread of toxic gases and smoke in the event of a fire involving electrical equipment.

Emergency Response Plans: Develop and train personnel on emergency response plans specific to fires involving electrical equipment, including procedures for evacuation, firefighting, and containment of hazardous materials.

5.5.9.5 Safeguarding Critical Electrical Installation

Business Unit shall establish procedures to safeguard critical electrical installations from the incidence of fire:

Fire Detection and Suppression Systems: Install and maintain fire detection and suppression systems that are specifically designed for electrical equipment and installations.

Emergency Shutdown Procedures: Develop protocols for emergency shutdown of critical electrical systems to prevent escalation of fire incidents and minimize damage.

Fire Barrier Systems: Implement fire barrier systems to compartmentalize electrical equipment and installations, reducing the spread of fire and smoke to other areas.

5.5.10 Explosion Risk Management

The assessment and management of explosion risks associated with electrical equipment (e.g., hydrogen-filled generators) is essential. These measures should include, but are not limited to:

- Provision and maintenance of drawings and documentation that define the limits of the hazardous area and its classification.
- Selection and procurement of electrical equipment that is suitable for the area's classification.
- Explosion-proof equipment is recommended which is designed to prevent explosions and fires in potentially explosive atmospheres where there are flammable gases, vapors, dust, or fibers. It is crucial for use in hazardous locations.
- Maintenance of proper working order of the installation, including grounding and bonding.
- Implementation of methods to prevent any potential ignition sources from entering the area.
- Regular maintenance and calibration of explosimeters to ensure their mechanical integrity and accuracy.
- Establishment of a system to ensure that electrical work is carried out safely and securely, through specific procedures, safety instructions, and specialized training.

Sources of explosion risk related to electrical equipment and installations should be evaluated using the risk methodology outlined in the Risk Assessment Standard. The safety conditions identified through the risk assessment should be ensured during shopfloor activities by utilizing a permit-to-work system.

5.5.11 Flammable and Toxic Gases Safety

Since the entry into hazardous areas by electricians should or may be required for installation of lighting, or other equipment, purposes, each Site Business Unit shall assess and manage the risk of hazards associated with handling systems containing flammable and toxic gases. These could include Cl2, SF6, H2, N2, CO2, furnace exhaust gases, etc.

- Promptly arresting the leakage of combustible gases and liquid and avoid accumulation of combustible waste.
- Warning signs should be put up with instruction for emergencies.
- No hot work to be carried out near flammable gases.

Sources of risks associated to systems containing flammable and toxic gases should be evaluated according to risk methodology specified in the Risk Assessment Standard. Safety conditions resulting from risk assessment should be ensured during activities at shopfloor level through permit to work system.

5.5.12 ATEX Zoning

In compliance with ATEX directives, which classify areas based on the likelihood and duration of explosive atmospheres, strict risk control measures shall be implemented in areas where flammable materials, such as liquids or powders, are present.

These areas shall be clearly marked with signage indicating their classification. Electrical equipment used in these zones shall bear appropriate ATEX safety markings, confirming their suitability for operation in explosive atmospheres, and shall be accompanied by the necessary conformity certificates. All metal components, including moving parts like agitator shafts, shall be interconnected to ensure equipotential bonding and effective grounding using cables, braids, or copper wires. Additionally, elements such as piping and containers in contact with liquids and powders shall be conductive to static electricity both internally and externally.

Each tank within these classified areas shall be equipped with flame arresters on vents to prevent external flames from igniting vapors inside the tanks and to prevent the spread of fires between adjacent tanks. Tanks equipped with explosion vents shall have these vents connected externally and shall undergo specialized technical assessments.

To mitigate residual risks from flammable vapors due to open-air operations or accidental leaks, rooms shall be equipped with ventilation systems tailored to the ATEX area classifications and specific risk assessments. This typically involves two ventilation rates: a baseline of five air changes per hour during continuous operations, which should or may be reduced during shutdown periods, and a higher rate of ten air changes per hour activated by explosimeter detectors.

Moreover, comprehensive site-specific procedures shall be established to promptly address leaks, manage combustible gases and liquids, and prevent the accumulation of hazardous materials in ATEX classified areas. Fixed explosimeter probes or detectors, selected according to the identified ATEX zone classifications and associated risk assessments, shall be installed and rigorously maintained to ensure continuous operational safety, even during probe failures or maintenance periods.

5.5.13 Risk Control of Atmospheric Discharges

Buildings and installations related to business (loss prevention-related areas) and workplaces premises, and industrial chimneys which, due to their location and height, should or may constitute danger should be protected against atmospheric discharges by suitable means.

Furthermore, the metal structures of buildings and provisional works, containers, and apparatus, of considerable size, located outdoors, should, by themselves or by means of an appropriate conductor or spreader, be electrically earthed so as to ensure the dispersion of atmospheric discharges to a reasonable extent.

Site procedures should include requirements for assessment of the protection level of building and premises according to local legislation or, if missing, international best practices based on technical survey on building structures, related bonding and earthing equipment and likelihood of lightning discharges in the target area. Technical survey should evaluate both direct discharges risks and indirect discharges risks.

5.5.14 Risk Control of Portable Electrical Tool and Apparatus

When purchasing portable electrical equipment Business unit shall ensure it complies with the compulsory requirements contained in national and international legislation, such regulations require manufacturers, importers, product supplier etc. to deliver only safe products, also these products should be delivered with instructions on their safe use.

Example of safety markers/identifiers:



Figure-4: Examples of Safety Markers

The following procedures shall apply to the use of portable electrical equipment.

- Portable equipment shall be stored, used, and handled in accordance with the manufacturer's instructions and safety warnings.
- Electrical cords shall not be used for raising or lowering equipment and shall not be fastened with staples or hung in a way that could damage the outer insulation.
- Extension cords, cord connectors, and cords on equipment shall be visually inspected before use or at the beginning of each shift to ensure they are not defective or damaged (e.g., loose parts, deformed or missing pins, damage to the outer cover or insulation, or pinched/crushed outer jacket). A visual inspection is not required if equipment and cords remain connected and are not exposed to damage. Any defective or damaged cords, cord connectors, or equipment shall be immediately removed from service until repaired and tested by a qualified person.
- If a defect or damage is found that could expose an employee to injury, the defective or damaged item shall be removed from service, and no employee should or may use it until it has been repaired and tested to ensure safety.
- Grounding-type cords shall be used with grounding-type equipment. Receptacles and plugs shall not be altered in a way that disrupts proper continuity, and adapters that defeat the grounding connection of equipment are prohibited.
- Only equipment and cords approved for use in wet locations should or may be used in areas where personnel might encounter conductive liquids.
- Hands shall be dry when plugging or unplugging energized equipment. If energized plugs or receptacles are wet or could provide a conducting path, insulating protective equipment shall be used to handle the connection devices.
- Energized plug and receptacle connections should or may only be handled with insulating protective equipment if the connection could provide a conducting path to the worker's hand (e.g., if a cord connector is wet).
- Adapters that interrupt the continuity of the equipment grounding connection shall not be used.
- Locking-type connectors shall be properly locked after connection.
- The orientation of an attachment plugs to be connected to a receptacle (including those on a cord set) shall be checked to ensure proper mating configurations. Attachment plugs and receptacles shall not be connected or altered in a way that disrupts proper continuity. These devices shall not be modified to allow the grounding pole of a plug to be inserted into slots intended for current-carrying conductors.

Any apparatus which is capable of being taken from place to place while it is being operated is called portable, as distinct from transportable apparatus which has to be switched off and then move to a place where it is

required to be operated. In case of a portable apparatus, switching off the current for the purpose of shifting is not necessary. In view of this it is necessary to take special precautions in the matter of flexible cables.

Units shall have a specific procedure to check suitability of electrically operated portable tools. It should involve checking for,

- Mechanical integrity
- Quality and conditions of basic isolations
- Supplementary (Protective installations)
- Verification on recommended types of tools with respect to a specific job. It should also outline class of tools to be used.
    - **Class I:** Tool in which accessible conductive parts cannot become live in the event of failure of basic installations and protective conductors for cables.
    - **Class II:** Tools with additional safety precautions like double/ re-in forced installations

      Portable electrical equipment shall adhere to stringent safety standards to prevent electric shock hazards, especially in environments where these tools are extensively used. A key safety measure for such equipment is double insulation, denoted by Class II classification. The following definitions and requirements apply:

    - **Class II A:** Tools in this class feature a durable and substantially continuous enclosure of insulating material that covers all metal parts, except for components like nameplates, screws, and rivets, which are isolated from live parts by the insulation.
    - **Class II B:** Tools classified as Class II B shall meet the same criteria as Class II A, with the additional requirement of double insulation throughout. In situations where achieving complete double insulation is impractical, reinforced insulation is utilized in specific areas.



Figure-5: Verification for Double Insulation

- Brush gear confirming to IS: 3003 Part III with insulating covering & restricted access.
- The basic insulations of internal wiring shall be at least equivalent to minimum insulation for flexible chords given in IS: 8868 (Part I) 1881 & IS: 684 (1877).
- Protection from Moisture: Tools should be so constructed that they are proof against ingress of moisture that should or may occur in normal use, complying to clause 20.8 of IS: 4665 (Part I) 1884.
- Moving parts of the tools should be arranged or enclosed so that they provide adequate protection against personal injury. Compliance to this requirement is checked by means of standard test fingers specified in IS: 1401-1870.

CEA 2010 Section 107 prohibits the use flexible cables for portable and transportable apparatus, except when:

- Such cables are heavily insulated.

- They are adequately protected from mechanical injury and
- In case where protection to the cable is by metallic sheath or covering such covering is in metallic connection with the frame of such apparatus and earth.
- The cables shall be three core type and four-core type for portable and transportable apparatus working on single phase and three phases supply respectively and the wire meant to be used for ground connection shall be easily identifiable.
- If the cable is 2 core type only then equipment body shall be of PVC/FRP and double insulated.

RCDs shall be used for all type of portable equipment's.

5.5.14.1 Electric Arc Welding Operations

- Ground the frame of electrical arc welding machines.
- Securely attach ground returns to the material being welded by cable lugs, clamps, or bolts.
- Connect returns as close as possible to the location being welded.
- Do not connect ground returns to piping containing flammable gases or liquids, or conduits containing electrical circuits.
- Ensure that welding cables are continuous within 3 m (10 ft) of the electrode holder. Repair damaged welding cables using a standard plug-and-socket coupling.
- Inspect welding cables for cuts or abrasions to the insulation. Remove all damaged welding cables from service. Temporary repairs, splices, and taped joints are prohibited.
- Use non-combustible or flameproof welding screens when working near other personnel or equipment.
- Remove the electrode from the holder and unplug electrode holders when operations are discontinued.
- Ensure electrical outlets for welding machines are with switch interlocking (welding socket can be powered after inserting and locking the welding plug) and with residual current devices (RCDs).

5.5.15 Electrical Control Panels

The following procedures shall apply to work on electrical control panels:

- Enough space shall be provided around electric equipment to allow ready and safe access, operation, and maintenance of the equipment.
- When operating the control or main switch, never stand in front of or look at the electrical panel. Always stand off to the side of the panel to operate the switch. If the panel is subject to an arc flash/blast event, this procedure will keep your eyes and body from being in a direct line with the explosion.
- Before operating switches or breakers, make sure all protective panels are closed and fastened.
- To disconnect the electrical power from the equipment, always move the control switch to the "Off" position before moving the main switch to the "Off" position.
- To connect the electrical power, always make sure all control switches are off *before* engaging the main switch.

5.5.16 Switchgear, MCC and Motor Controller

The following procedures shall apply to work on electrical switchgear, MCCs, and motor controllers.

- Follow all safety procedures outlined in this Program.
- Sufficient space shall be provided around electrical equipment to allow safe and easy access for operation and maintenance.
- Never open switches or other circuit isolating devices while the circuit is loaded (e.g., a pump motor in operation). Shed as much load as practical before operating the switch. Loads should be shed as close to the device as possible using normal operational controls (e.g., open/disconnect branch circuits before opening/disconnecting a main).
- Assess the operating condition of the circuit (e.g., load applied, removal of protective grounds) before opening or closing any switch. This precaution protects you and others in case the circuit is faulty.

- Only load-rated switches, circuit breakers, or other devices specifically designed for disconnecting purposes should be used to open, reverse, or close circuits under load conditions.
- Open and close switches fully. Leaving switches partially open can cause arcing or flashover, potentially damaging the switch and causing serious burns to the operator. Lock and tag switches in the desired position to prevent accidental operation, if necessary.
- When operating high-voltage knife-blade switches or fused cut-outs, use the appropriate hot stick of the correct length.

5.5.17 Substations

Work in substations shall conform to the following work practices.

- Follow all the safety procedures outlined in this Program.
- Enough space shall be provided around electric equipment to allow ready and safe access to, operation and maintenance of the equipment.
- Draw-out-type circuit breakers shall be inserted and removed while the breaker is in the open position.
- Conductive fences around substations shall be grounded.
- Specifically identified areas in a substation are subject to the following rules:
    - They shall be enclosed to minimize entry of Unqualified Persons.
    - Warning signs should be displayed.
    - Entrances not under the observation of an attendant shall be locked.
    - Unqualified Persons are not allowed to enter these areas while equipment is energized.
    - When any work is being done in the fenced area, all gates shall be fully opened prior to any work commencing to facilitate immediate exit if warranted.
- Live parts operating at more than 150V nominal shall be guarded (by physical guards or by location) or insulated.

5.5.18 Borrowed Neutrals in Electrical Installation

In electrical installations, "borrowed neutrals" refer to situations where multiple circuits share a common neutral conductor. While sometimes unavoidable, this practice introduces significant safety concerns and operational risks:

Definition and Concerns: Borrowed neutrals occur when a single neutral conductor is used for multiple circuits originating from different phases. The primary concern is the potential for overloading the neutral conductor, which can lead to overheating and fire hazards.

Safety Risks and Operational Issues: Overloaded neutral conductors can cause electrical imbalances, voltage fluctuations, and damage to connected equipment. Additionally, this practice should or may not comply with local electrical codes and standards.

Precautions and Mitigation Measures: To mitigate the risks associated with borrowed neutrals, Business Units should:

- **Avoidance**: Minimize the use of borrowed neutrals where possible, ensuring that each circuit has its own dedicated neutral conductor.
- **Identification**: Clearly label shared neutral conductors to prevent accidental disconnection or misuse during maintenance.
- **Code Compliance**: Adhere to local electrical codes and standards governing multi-circuit installations to ensure safety and regulatory compliance.
- **Monitoring and Maintenance**: Regularly monitor neutral conductors and electrical circuits for signs of overload or imbalance and promptly address any identified issues.

By implementing these measures, Business Units can effectively mitigate the risks associated with borrowed neutrals, ensuring safe and reliable electrical installations throughout operations.

6. ELECTRICAL SAFETY GUIDELINES (TASK BASED)

Business units shall ensure electrical safety procedures are easily accessible, up-to-date, and developed using a rigorous risk-assessment process. These procedures shall encompass safe practices aimed at identifying and managing exposure to electrical hazards during normal and emergency operations, including those associated with the electrical supply utility.

Personnel working on or near electrical equipment shall be fully aware of the hazards and receive appropriate training to work safely. Emphasis shall be placed on minimizing exposure to electrical hazards through practices such as de-energized troubleshooting techniques. When de-energized techniques are not feasible, all test instruments used shall meet design and certification requirements suitable for the task.

Additionally, Business Units shall periodically review and reauthorize these electrical safety procedures at intervals not exceeding two years. Reviews shall involve individuals directly engaged in tasks covered by the procedures to ensure alignment with local regulations and internal standards. Compliance with these procedures shall be audited as part of the Business Unit internal audit process.

6.1 JOB PLANS AND PERMITS

Careful planning is fundamental to understanding, assessing, and managing potential exposure to hazards in electrical work. It is beneficial for both Business Units and departments to break jobs into individual tasks to identify specific hazards and ensure safe work practices are in place. A documented Permit to Work (PTW, JSW/GHS/GS-08) system, including the concept of "test before touch," should be universally followed for all electrical systems work.

Procedures and practices should be established to effectively address identified hazards in job plans and permits. This includes determining necessary documentation requirements and ensuring the review and approval process is commensurate with the level of hazards involved. Management oversight and input from personnel with electrical competency are crucial aspects of this process.

If unforeseen circumstances arise during job execution or conditions change, work shall be halted, and plans reassessed. Line management holds responsibility for clearly communicating job plans to all involved parties, including operations and emergency response personnel where applicable, and conducting safety instructions and toolbox talks before commencing work.

Furthermore, adherence to JSW permit to work standards (JSW/GHS/GS- 08), including power isolation, and verification of proper tools, tackles with test certificates, and availability of required Personal Protective Equipment (PPE), are critical before job commencement. Ensuring proper site lighting, confirming the working agency's authorization, and verifying the removal of all personnel, materials, and earthing before surrendering the PTW are essential steps to maintain safety and compliance.

6.2 ENERGY ISOLATION

Energy isolation shall be done before carrying out work on electrical equipment as per Lock out Tag out (LOTO) procedure standard. In addition to the requirements of JSW LOTO Standard (JSW/GHS/GS-07), plant procedures for isolating electrical energy shall include:

- The application of temporary safety grounding and/or earthing as determined by risk assessment to ensure electrical system are safely grounded to prevent inadvertent energization during maintenance activities, even when the equipment is already in shut down mode.
- Test for the absence of voltage before touching bare conductors or parts (i.e. Test Before Touch).
- Practices to identify, communicate, and clearly define the limits of safe work boundaries.
- Note: Personnel should know the safe work boundary to avoid electrical hazards. In complex electrical equipment, the safe work boundary should or may not be obvious. A section of switchgear, a single starter in a motor control center, or other equipment should or may be isolated for safe work; however, adjacent

compartments or cubicles should or may remain energized. There should or may also be multiple sources of energy.

- Techniques to enhance communication and understanding of the safe work boundaries should include, but not be limited to, temporary signs, locking doors and covers on adjacent compartments, barricades, job walk-throughs, a description of the safe work boundary in job plans, and additional emphasis on Test Before Touch.
- Identification of ownership and control of hazardous energy during construction, Commissioning, handover to operations, maintenance, and other situations in which control responsibility should or may change.
- Business units shall ensure that all instruments that test for the absence of voltage are designed and certified to meet the requirements of relevant National/International standards.

6.3 TESTING FOR THE ABSENCE OF VOLTAGE

All circuits are considered energized until verified dead using appropriate instruments. Personnel shall test each circuit and conductor each time before any work to confirm the absence of voltage (Test Before Touch). This practice is essential to minimize the risk of accidental contact with live conductors, particularly in unforeseen situations. All personnel conducting voltage-free tests should be trained in specific procedures tailored to the voltage testing instrument used.

Business units shall establish procedures to ensure that voltage testing instruments are validated on a known voltage source before and after use, in accordance with the manufacturer's specifications. Instruments shall have valid calibration certificate, with calibration conducted at intervals not exceeding 12 months or as recommended by the manufacturer. Records of calibration shall be maintained and readily accessible during audits or inspections.

6.4 DEPLOYMENT OF TWO PERSONS TOGETHER

Business Units shall implement a risk-assessment process to determine when it is necessary to deploy at least two individuals for certain tasks. This practice ensures the safety of workers by providing mutual support, a quick response to emergencies, and the sharing of knowledge and expertise. Business Units will also assess the qualifications and competencies required for the specific task. Both individuals shall be trained and qualified to perform their responsibilities. Their responsibilities shall include, but are not limited to:

- Understanding the hazards involved in the task.
- Being qualified to disconnect power to the equipment being worked on.
- Being capable of initiating an alarm at the work location. This responsibility shall be specifically reviewed prior to starting the task at the work site.
- Being trained in administering appropriate first aid (e.g., CPR in case of electric shock or burn treatment in case of electric burns) or seeking assistance from a CPR-trained person within the Business Unit.
- Preventing personnel from removing covers not included in the job plan or crossing the safe work boundary.
- Preventing unauthorized personnel from crossing the safe work boundary.
- Refraining from performing tasks that interfere with their ability to fulfill any of the above duties.
- Communicating critical information to emergency responders.
- Both individuals shall wear the same PPE as the person performing the task, especially if they should or may need to cross the safe work boundary (e.g., to disconnect power or initiate first aid).

Due to differences in equipment, tasks, hazards, and risks, the specific qualifications required for both individuals should or may vary. However, given the responsibilities outlined above, it is preferred that both individuals be electrically qualified. As the severity of hazards and risks increases, the need for qualified electrical personnel will also rise.

Before starting a task, the person(s) performing the work shall ensure that the second individual is adequately qualified to handle all duties related to the task.

6.5 DOCUMENTATION AND EQUIPMENT LABELLING

Drawings, panel directories, and other documentation provide critical reference information for planning and safely and reliably executing isolation, operation, maintenance, and construction of electrical equipment and systems. Examples of critical reference information include, but are not limited to,

- Single line diagram drawings.
- Schematic diagrams.
- Maps of underground electrical services.
- Area classification drawings.
- Panel schedules.
- Electrical system studies (e.g., short circuit, protective device coordination, and arc flash hazards-analysis studies).
- Procedures and practices shall be in place to help ensure. that
- Electrical documentation and labeling necessary to identify and isolate electrical hazards are accurate, up-to-date, and readily accessible.
- Labels and equipment identification are designed, specified, provided, and maintained to communicate warnings, cautions, and circuit information critical to safe operation and maintenance of electrical equipment and systems, including abandoned wiring and equipment.
- Business Units should or may find it beneficial to have the same labelling convention across all plants.

6.6 WORKING ON OR NEAR ENERGIZED ELECTRICAL EQUIPMENT

The primary goal when working on or near energized electrical equipment is to ensure that no work is performed within the prohibited approach boundary. Risk controls to achieve this goal should include thorough equipment and hazard assessments, limiting work activities based on the level of risk, and requiring higher levels of formal authorization and work permits for tasks involving greater risks. Business Units/Plants should demonstrate a commitment to minimizing exposure to uninsulated or unguarded electrical circuits and conductors energized above 30 V, including avoiding contact with tools or any part of the body, regardless of the PPE used.

The boundary assessment should be readily available in the substation to guide personnel movement. If the arc flash protection boundary cannot be maintained, the necessary deviation should be obtained, and anyone entering the room shall wear an arc flash suit.

Work within the prohibited approach boundary shall only be performed when all of the following requirements are met:

- Only authorized personnel, trained on the specific task and the associated hazards, are permitted to work on energized conductors.
- Line management has been involved in the decision to authorize work on energized conductors.
- Each Unit/Plant shall define the level of management approval required for this authorization.
- A specific job plan is written for the task.

Although voltage and diagnostic testing are typically performed within the prohibited approach boundary, these tasks are often routine and should be managed through established practices, procedures, and authorization, instead of requiring specific written job plans. Voltage testing shall only be performed when all of the following conditions are met:

- Proper test instruments are selected and used.
- The person performing the test is qualified and authorized to do so as part of their job responsibilities.
- Appropriate PPE is used during the task.

The preferred method for performing diagnostic testing and troubleshooting is on de-energized circuits. If this is not possible, such tasks should or may only be permitted on energized circuits when performed in

compliance with the above requirements, and in accordance with guidance for de-energized troubleshooting techniques.

6.7 DISMANTLE / REMOVE / REARRANGE ELECTRICAL WORK

The identification, cutting, and removal of electrical raceways and cables involve significant risks, primarily the danger of exposing personnel to electrical hazards and the potential disruption of operations if a critical energy or control circuit is damaged.

Business Units shall implement a process to ensure that a risk assessment is conducted, and that procedures and practices are developed to minimize both the risk of injury to personnel and the disruption of operations. The following procedures and practices shall be in place:

- Ensure that all protection and isolation systems are fully functional.
- Test for the absence of voltage at both the source and destination ends of each cable using panel meters, breaker rack-out, and inductive high-tension (HT) testers. Each cable shall be positively identified before it is cut. Avoid tracing cables by hand-over-hand methods along their length.
- Positively identify cables on both sides of a barrier (e.g., walls or ducts) for each specific circumstance, and ensure a qualified person approves the procedure or practice. Cables should not be traced using the hand-over-hand method. Proper labeling and identification shall be maintained at both ends of each cable to avoid mistaken identity.
- The location and method of cutting a cable should consider the risk associated with potentially damaging other cables. Using appropriately grounded pneumatic cutters or cable-spiking tools, along with the proper PPE, can help minimize risk to personnel. To avoid damaging adjacent cables and reducing the risk of electrical exposure, cables within a tray should not be cut.
- Any remaining cable after the removal of cable trays shall be properly supported and protected from damage caused by nearby equipment, moving parts, UV rays, hot pipelines, etc.
- Verify that the correct methods are being used when shifting or lifting electrical equipment to avoid physical injury or equipment damage.
- Ensure that sufficient access and working space are provided, with proper guards, for moving equipment during shifting or lifting.
- Confirm that adequate illumination is provided at the site.
- In confined spaces, ensure that illumination is powered by a 24V supply.

6.8 EARTHING

Proper earthing (grounding) is essential to maintain electrical safety standards and protect personnel and equipment from electrical hazards. The objectives of an earthing system include achieving uniform potential and minimizing risks associated with electric shock and equipment malfunction.

6.8.1 Types of Earthing

System/Neutral Earthing Involves grounding of neutral points in electrical systems to ensure safety and operational integrity.

Equipment Earthing Focusses on grounding non-current carrying metal parts of equipment to prevent hazards.

6.8.2 Standards and Practices

Earthing practices shall adhere to the IS Code of Practice for Earthing (IS 3043:2018) and relevant regulatory requirements (e.g., CEA Reg. 72). The system should include:

- **Multiple Connections**: Star-connected systems with earthed neutrals or delta-connected systems with earthed artificial neutral points shall have at least two separate connections to earth to ensure effective protection and operational reliability.
- **Marking of Earthing/Protective Conductor**: The bi-colour combination, green and yellow (green/yellow), shall be used exclusively for identifying the protective conductor and for no other purpose.

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Figure-6: Bi-Color Marking of Protective Conductor

In addition to traditional methods such as rod and plate earthing, chemical earthing has emerged as an effective alternative. Chemical earthing involves the use of a specially formulated compound around an electrode (typically a galvanized rod or pipe) buried in the ground. This compound enhances the electrode's contact with the soil, thereby improving conductivity and reducing resistance to ground.

Key Aspects of Chemical Earthing:

Components: It includes a conductive electrode and a backfill compound consisting of minerals, salts, and water-retaining agents.

Installation: The electrode is installed vertically in a pit, surrounded by the backfill compound to ensure optimal contact with the soil.

Advantages: Chemical earthing offers low resistance, durability, and requires less space compared to traditional methods. It also requires minimal maintenance and is resistant to corrosion.

Applications: Widely used in industrial plants, telecommunications, and power distribution networks where reliable earthing is essential for safety and operational continuity.

6.8.3 Requirements of Effective Earthing

An effective earthing system shall meet the following criteria:

Low Impedance Path: Provide a low impedance path to ground for personnel and equipment to ensure rapid dissipation of fault currents.

Mechanical and Chemical Resilience: Withstand corrosion and mechanical stresses, ensuring continuous functionality throughout equipment lifespan.

Compliance Testing: Periodic testing of earthing systems to verify integrity and compliance with safety standards.

Visibility and Accessibility: All earth connections should be visible and accessible for inspection and maintenance purposes.

6.8.4 Safety Precautions

Periodic Inspection: Regular inspection of earthing devices to ensure functionality and safety before use.

Proper Disconnection Procedures: Use of earthing switches or other designated apparatus for safe disconnection and verification of circuit de-energization.

Protection during Work: Ensure personnel are protected by earth connections on both sides of their working area during electrical operations.

Testing and Records: Maintain records of periodic earth resistance tests and ensure compliance with testing schedules as per regulatory requirements.

6.8.5 Additional Considerations

High Voltage Installations: Proper grounding of metal parts subject to contact by personnel to prevent electric shock.

Double Earthing: Implement redundant earthing where feasible to enhance safety measures and minimize electrical hazards.

6.9 Execution of Electrical Work

Business Units shall have procedures in place to help ensure that all electrical works are performed safely even in case electrical systems are affected by design changes and field modifications. Business Units shall have a practice for involving a qualified electrical person in the approval of new electrical technology and equipment, and in assessing the impact of the changes in electrical safety management.

6.9.1 Excavations and Penetrations

Business Units shall have procedures and practices in place to help ensure that the electrical lines, conduits, and cables in work activity are identified before performing excavations and/or penetrations of floors, roofs, and walls. Up-to-date maps, drawings and electronic tracers' systems should or may be used for locating underground or concealed cables and GIS system should or may be preferred wherever it is available.

The procedures should include boundary limits for approaching underground lines (energized or de-energized) with mechanized and hand-held tool excavation methods. All excavation and penetration work should be performed on a permit basis, and permit approval forms should specifically address the hazards of buried electrical lines. Prior to excavation and penetration, it shall be ensured that there is an appropriate Job Safety Analysis (JSA), Permit to Work (PTW) and Lock Out Tag Out (LOTO) compliance supported with Hazard Identification and Risk Assessment (HIRA).

Referring to JSW Excavation Standard, it is important to: Check whether the Excavation permit is duly signed by authorized person only after physical verification and to ensure that fixed barricade is provided one meter away from electrical cables / cable trench. De- energize the cable falling in the excavation area.

6.9.2 Cranes and Mobile Equipment

Business Units with overhead electric lines shall establish procedures and practices to ensure that cranes, mobile equipment or any other manual task near these high voltage lines closer than the defined approach distance specified in the table

Voltage (KV)	Minimum Approach Distance
Up to 33 KV	3 meters (10 feet)
33 KV to 66KV	4 meters (13 feet)
66 KV to 132 KV	5 meters (16 feet)
132 KV to 220 KV	6 meters (20 feet)
220 KV to 400 KV	7 meters (23 feet)
Above 400 KV	8 meters (26 feet)

When removing a fixed barricade, the following steps shall be followed:

- **Switch off the power supply** and ensure proper earthing.

- **Reinstall the barricade** securely.
- **Remove the earth connection** and then restore the line's charge.
- **Ensure safety instructions** are provided to the heavy vehicle or hydra operator before entering the restricted area.
- Verify that **adequate illumination** is provided, if required.
- The **crane** shall be moved only under the close supervision of authorized or experienced personnel.
- Ensure the **area is properly barricaded**, and caution strips are in place during shifting or lifting activities near overhead lines.
- Check that the **surface level** in the permitted area under or near the overhead line is appropriate.
- Include all individual activities associated with the task, such as manual handling, maintenance, or any specific operations, in the safety assessment. Each activity should be evaluated for potential hazards near overhead lines, with appropriate safety measures and precautions implemented accordingly.
- Verify that the concerned **Business Unit has confirmed the boom height** in the permit.

6.9.3 Installations in Areas with High Moisture Content

Installations in areas with high moisture content shall include safeguards to prevent hazards such as moisture ingress to electrical equipment. Battery-operated tools should be prioritized over AC-powered tools to eliminate potential shock risks. For essential AC tools, ensure they are equipped with RCD protection, rated for outdoor or wet environments (IP67 or higher), and regularly inspected before use.

Furthermore, it is important to check that adequate illumination is provided while working and that the electrical installation area is free from flammable and combustible material.

6.9.4 Power Distribution Operations

Plant electric power systems operations, including switching, maintenance, and construction activity, involve risk of serious personal injury, widespread and prolonged disruption to plant operations, and impact on process safety.

Only personnel authorized with electrical supervisory license for engineers and wireman license for electricians, plant management shall manage and execute power system operations activities. Plants shall develop and implement procedures and practices to eliminate hazards where feasible and minimize risk of personal injury and disruption of power to operations. Plant procedures and practices shall address the following, where appropriate:

- Switching sequences to minimize risk of, and exposure, to arc flash hazards
- Techniques to effectively identify and communicate safe work zones in switchgear
- Training, renewal, and succession planning for key job functions
- System studies updates (e.g., arc flash hazard analysis, protection coordination, and others deemed appropriate by each plant)
- Operational plan for the electrical power system in the event of severe weather, blackouts, and brownouts
- Management plan for the installation of temporary generators

Business Units should or may find it beneficial to have a dedicated power distribution team.

6.9.5 Contractor Management

In the development of plant conditions for contractors, the plant contract administrator shall incorporate all applicable electrical safety requirements in the contract. These electrical safety requirements shall comply with local and national regulations and consensus standards and with this standard.

The plant contract administrator can seek assistance from the corporate electrical safety leader and consult with the plant electrical safety resource to comply with these requirements. Consideration should be given to including long-term contractors on the plant electrical safety team.

Business Units shall have a process in place to verify that contractors have received electrical safety training aligned with plant requirements. This should include compliance with government regulations and plant conditions.

A qualified electrical person shall be involved in the contractor management process.

7. PEOPLE & FACILITIES

7.1 TRAINING AND PERFORMANCE

a) Each Business Unit shall ensure that all personnel working on electrical systems are qualified in accordance with applicable National and International legislation, as amended from time to time.

b) Authorities issue licenses for qualified engineers and workers to supervise and carry out work on electrical equipment, ranging from low voltage to extra high voltage. These licenses shall be kept valid at all times.

c) In addition to statutory licenses, qualified personnel shall have adequate knowledge of the equipment they operate. They should be trained on the specific equipment they intend to use, including safe work practices.

d) Business Units shall develop employee training and certification programs to qualify workers in safety-related work practices relevant to their job responsibilities. Electrical safety training shall be included in the annual training plan for personnel actively involved in electrical-related tasks. Personnel shall be trained and qualified to recognize and manage the electrical hazards they should or may encounter in their work. This training should cover the use of electrical PPE, as well as electrical safety procedures and practices.

A basic training course shall be provided to all staff designated as affected persons (those not directly involved in electrical work). This course should include:

- Introduction to electrical safety
- Identification of electrical hazards
- Overview of applicable safety regulations and standards at the site level
- Proper use of personal protective equipment (PPE) and equipment safety
- Safe work practices
- Emergency procedures for electrocution incidents.

A specific training course shall be provided to all staff acting as involved persons (a having an active role in performing electrical related works). It should include:

- Definition of the roles and responsibilities of electricians
- Duties regarding the use of assigned powered tools, including proper maintenance and reporting any faults
- Effects of electric shock on the human body and first aid procedures
- Selection, use, and maintenance of electric PPE
- Concepts, design, and planning of electrical work
- Managing foreseeable abnormal situations
- Effective communication and information exchange related to the work
- Examples of managing electrical worksheets
- Practical demonstrations and drills related to low voltage (simulations)
- Final test to assess learning.

Refresher training should be mandatory at regular intervals, as determined by local legislation, risk assessments, and at least every two years. Refresher training should also be conducted whenever significant

changes occur in processes, equipment, or work practices. It should be triggered by workplace inspections, post-accident investigations, or risk assessments that reveal deficiencies in competency levels.

Workers handling hand tools powered by electricity or portable power tools should be provided with comprehensive instructions on their use, including guidance on abnormal but foreseeable situations.

On-site, electric emergency response and rescue operations should be part of the training program. This should include emergency mock drills, stop-work signals, and procedures for activating the emergency response plan.

Recording of all training undertaken and of the results of competency assessments is required. This shall include the following information:

- Employee's name and job assignment
- Employer's details
- Date of training
- Content of the training provided
- Trainer's name
- Verification method (e.g., written tests, practical demonstrations).

Training records should be maintained in a computer-based system and available in hard copy upon request, ensuring accessibility for all relevant parties, including employees, management, and safety auditors. Retention periods for training and competency records should comply with legal requirements and industry best practices.

7.2 INCIDENT INVESTIGATION AND REPORTING

Electrical incidents shall be investigated and reported as defined in JSW Incident Investigations Standard (JSW/GHS/GS-02). Business Units shall have procedures in place to help ensure that any electrical incident with the potential for serious injury and electrical incident is investigated. The plant electrical safety resource, or a person designated by that resource, shall participate in the investigation of electrical incidents and events. If the incident involves electrical injury, the corporate electrical safety leader shall be consulted to help ensure that appropriate resources participate in the investigation.

Unusual events occurring during electrical tasks and during work on electrical equipment provide learning opportunities. Business Units should investigate and share these events with the corporate electrical safety leader.

7.3 FACILITIES

7.3.1 Quality Assurance

Unit / Plants shall establish a quality assurance program, including documentation, to help ensure that electrical equipment is fabricated and installed according to the design specifications and manufacturer’s recommendations.

All installations shall meet all applicable national codes and local regulations at the time of installation. When required by local codes and regulations, existing installations shall be upgraded to meet current codes and regulations.

7.3.2 Pre-Start-Safety Review

Unit / Plants shall perform pre-start up safety reviews of all new and modified electrical systems and equipment. The pre-start up safety review shall confirm that: -

- Permanent circuit identification and isolation information is installed and verified as correct.
- Accurate documentation needed to plan energy isolation and lockout/tag out is available.
- Equipment construction and installation are in accordance with design specifications, local regulations, and Unit / Plant requirements.

- Arc flash hazard assessment, if applicable, is complete and equipment arc flash hazard labeling is installed.
- For details, refer PSSR checklist.

7.3.3 Mechanical Integrity

Unit / Plants shall have procedures and practices in place to manage the integrity of electrical equipment, including circuit breakers and protective relay systems; grounding and/or earthing and bonding conductors; electrical equipment auxiliary facilities; and tools and equipment critical to the safety and reliability of the electrical equipment.

Examples of auxiliary facilities, equipment, and tools include, but should or may not be limited to,

- Roofs and other weather protection for electrical equipment.
- Switchgear internal heaters and room-space conditioning to prevent moisture contamination of insulating materials.
- Temporary safety grounds and/or earths.
- Testing and troubleshooting instruments.
- Insulated sticks used for switching or fuse installation and/or removal.
- Thermography of electrical installation
- Transformer oil testing
- RCCB checking mechanism should be available in site specific procedure, wherein scheduled maintenance should be a part.
- Integrity of earthing shall be ensured for all the power supply sources.

7.3.4 Management of Subtle Change Facilities

Unit / Plants shall have procedures and practices in place to manage subtle change that affects exposure to electrical hazards. Examples of subtle change include, but should or may not be limited to: -

- Change in grade elevation that could alter the depth of underground conductors or elevation of overhead electric lines.
- Connection of temporary generators.
- Temporary connection of redundant power sources.
- Temporary electrical installations or service to temporary buildings.
- Any change that significantly affects the available fault current.
- Any change in the size, or settings of circuit protection devices.
- Abandoned electrical equipment, including cable trays, cables, and wiring. Unit / Plant practices should emphasize the removal of abandoned electrical equipment to control “creep” in increased complexity of Unit / Plant electrical systems.
- Use the existing change management procedure

8. EMERGENCY PLANNING AND RESPONSE

Business Units shall demonstrate preparedness for electrical-safety emergencies (e.g., rescue and treatment for electric shock, arc-flash burns, blast injuries, or fire involving electrical equipment and displaying power shutdown system schematic during such occurrence).

Business Units shall have procedures established to help ensure prompt and immediate medical evaluation for anyone exposed to an electrical shock greater than 50 V, regardless of observable symptoms, wounds, or discomfort.

Plant preparations for response to electrical emergencies shall include, but not be limited to,

- Providing CPR training to first responders and personnel with high-risk exposure to electric shock.
- Conducting mock drills of electrical injury emergencies.
- Identifying energy isolation points and providing training on energy isolation requirements for emergency responders.
- Having emergency equipment, including communications equipment, available and accessible.
- Establishing procedures for securing the scene of an electrical incident.

9. TRAINING

JSW Site should develop and implement comprehensive Electrical Safety Standards to ensure the safety of all personnel working with or around electrical systems. These standards should include detailed procedures for the safe operation, maintenance, and de-energization of electrical equipment, as well as guidelines for working in hazardous areas.

10. RACI MATRIX

The roles and responsibilities to implement this standard are outlined below: Activity Description	Section In-Charge	Head Maintenance	Head Operations	Safety
Identification and assessment of site conditions	R	A	C	I
Planning, Preparation, Risk Assessment	R	A	C	I
Assign responsibility for implementing control measures	R	A	C	I
Protective and Rescue equipment plan	R	A	C	I
Ensure Job execution	R	A	C	I
Training and Certification	C	R	A	I
Audit/Inspection and monitoring for compliance	C	R	A	I
Identify Rescue Team	R	A	C	I

RACI chart

R: Responsible: People who are expected to actively participate in the activity and contribute to the best of their abilities.

A: Accountable: The person who is ultimately responsible for the results.

C: Consulted: People who have the specific expertise and can contribute to decision making.

I: Informed: People who are kept informed, but do not necessarily participate in the effort.

11. MANAGEMENT OF RECORDS

Records to be maintained by the concerned department are as follows:

- A detailed register of all electrical equipment and systems, including specifications, locations, and operational status.
- Logs of regular inspections, maintenance schedules, and corrective actions taken for electrical equipment and installations.

- Documentation of training provided to employees, contractors, and electricians on electrical safety protocols, hazard awareness, and emergency response.
- Records of all electrical incidents, near-misses, or accidents, including root cause analysis and corrective/preventive measures implemented.
- Records of testing, calibration, and certification of electrical systems and safety devices (e.g., circuit breakers, relays, earthing systems).
- Documentation of the issuance and usage of electrical Personal Protective Equipment (PPE) such as insulated gloves, arc-rated clothing, and face shields.
- Reports on arc flash hazard evaluations and control measures implemented to mitigate risks.
- Logs of grounding and bonding system testing to ensure compliance with safety standards.
- Updated electrical circuit diagrams, single-line diagrams, and operation manuals for all systems.
- All electrical safety records should be retained for a minimum of five years or as per organizational and legal requirements.

12. LEGAL AND OTHER REQUIREMENTS

JSW site shall access, identify, evaluate, and keep up to date the Electrical Safety requirement as per prevailing law in operation.

13. KEY PERFORMANCE INDICATORS

JSW Site should develop and implement Key Performance Indicators (KPIs) specifically tailored to monitor and improve electrical safety performance.

These KPIs should be designed to track critical safety metrics, such as the frequency of electrical incidents, near misses, and safety violations related to electrical systems.

Key indicators could include the percentage of employees trained in electrical safety, compliance with lockout/tagout (LOTO) procedures, and the number of electrical safety audits conducted per quarter. Additionally, KPIs should focus on equipment maintenance metrics, such as the percentage of electrical systems inspected and maintained according to schedule, and the rate of preventive versus corrective maintenance activities. These KPIs should be regularly reviewed, with actionable insights used to drive improvements in safety practices, reduce electrical hazards, and ensure a proactive approach to risk management.

14. ASSURANCE

Each site shall conduct self-assurance program to ensure compliance with this STANDARD as part of its Safety assurance program. Third party system audit shall be conducted by Group Safety or external consultants to ensure compliance with the standard.

15. DEFINITION

Term	Definition
Authorized Person/Employee	Person/Employee determined by management to be qualified and given permission and support to perform and/or direct specific tasks or functions.
Competent Person/Employee	See “Qualified Person/Employee.”
Electrical event	An unusual occurrence that did not, but had the potential to, lead to an electrical incident.
Electrical incident	One of the following types of incidents: • Any SHE incident having an error or failure in electrical systems as a contributing cause. • An incident that involves, or has the potential to cause, an electrical injury as defined in this standard, or other injury that should or may result from direct exposure to electrical energy (e.g., a fall injury that might result from reaction to electric shock).
Extra Low Voltage	“Extra Low” Where Voltage does not exceed 50 V.
Low Voltage	According to European Standard (EN 50160), a nominal voltage below 1 kV is classified “Low voltage” (LV). Under international standards “Low” where the voltage does not exceed 250 Volts under normal conditions subject, however, to the percentage variation allowed by these rules; 50 V to 250 V.
Medium Voltage	According to European Standard (EN 50160), a nominal voltage can be classified as “medium voltage” (MV) if it is comprised between 1 and 35 kV. Under international standards “Medium” where the voltage does not exceed 650 volts under normal conditions subject, however, to the percentage variation allowed by these rules; Greater than 250 V up to 650 V.
High Voltage	“High” where the voltage does not exceed 33,000 Volts under normal conditions subject, however, to the percentage variation allowed by these rules; Greater than 650 V up to 33 KV.
Extra High Voltage	Extra high” where the voltage exceeds 33,000 volts under normal conditions subject, however, to the percentage variation allowed by these rules. Greater than 33 KV.
Electrical injury	An injury that results from electrical, thermal, light, pressure, acoustic, or radiation energy released at the moment of an electrical incident.
Earth Leakage Circuit Breaker (ELCB)	Earth Leakage Circuit Breaker (ELCB)
Hand Tool	Hand tools are those tools directly driven by the strength of the operator.
Lethal shock hazard	Any voltage greater than 50 V to any reference point.
Limited approach boundary	An approach limit at a distance from an exposed live part, within which a shock hazard exists. 1 This term is used to identify a particular distance within which special considerations are necessary to protect the worker.
Prohibited approach boundary	An approach limit at a distance from an exposed live part, within which work is considered the same as contacting the live part.

Term	Definition
Qualified	Having validated skills, knowledge, ability, training, and experience to perform the job safely and to recognize personal limitations in these areas. (In some regions, the term “competent” is used instead of “qualified.”) A qualified individual has the following characteristics that help to plan, audit, and perform a task safely: • Knows the construction and principle of operation of the equipment to be worked on • Knows, and is skilled in the use of, the work methods and safe work practices for performing the task • Understands the hazards associated with the equipment • Is able to recognize the hazards • Is able to avoid the hazards • Is able to recognize and manage changing conditions of equipment or operation • Knows the local legal requirements
Power supply	The systems power supply can be taken from one or more distribution points made available by the Customer or from a supply point provided by the Public Provider or from self-contained supply groups (generation units).
Residual current device (RCD)	An electrical safety device that functions to protect people from electric-shock injury by sensing leakage of current to ground associated with electric shock and de-energizing the circuit before a serious injury is likely to occur. National standards and regulations determine the performance parameters of RCDs and RCCBs.
Restricted approach boundary	An approach limit at a distance from an exposed live part within which there is an increased risk of shock, due to electrical arc over combined with inadvertent movement, for personnel working in close proximity to the live part.
Arc Flash Boundary	Distance at which the incident energy equals 5 Joule/cm^2 (1.2 calorie/cm^2) The purpose of Arc flash boundary is to limit the severity of a potential burn injury to an unprotected workers should an arc flash occur.
Risk assessment	A systematic and structured process whereby hazards present in a workplace, or arising from workplace activity, are identified; risks are evaluated; and protective and preventive measures are verified, including procedures and practices, are put in place to reduce risks to the acceptable levels.
Site electric system	Site electric systems are provisional systems necessary to carry out site activities, including those necessary to supply auxiliary services (offices, workshops, sanitary services, assistance services, etc.). Such electric systems should or may be fixed (stable for long periods) or mobile (provisional supply of portable tools, etc.). Ground systems and protection systems against lightning are integral part of the site electric systems.
Users	Users are all systems, fixed, mobile and portable equipment that uses electric power for their operation.
“Working near” energized electrical equipment	Any activity involving crossing or working inside the shock hazard limited-approach boundary and/or crossing or working within the flash-hazard boundary established by hazard analysis.
“Working on” energized electrical equipment	Any activity involving crossing or working inside the shock hazard prohibited-approach boundary or coming into contact with exposed, energized electrical conductors or circuit parts with any part of the body or with tools, probes, or test equipment, regardless of the personal protective equipment a person is using.
Work Permit	The written or printed document that is issued to control working in operational area/ in vicinity of electrical equipment.
Work supervisor	A person who is authorized; to verify that all conditions for working have been met, to define ongoing precautions to maintain safe working conditions during the work, to authorize the work to occur, and to cancel the permit allowing the work; also known as proprietor, work group supervisor, or authorizing person.

ANNEXURES

ANNEXURE-1: ELECTRICAL PERSONAL PROTECTIVE EQUIPMENT

a. **Safety Glasses:** Non-conductive safety glasses, which meet ANSI Z87.1, with permanent side shields shall be always worn when working on electrical equipment.
b. **Electrical Safety Gloves**: shall be worn when working around energized electrical equipment. Gloves shall be selected based on the work being done and level of risk. Selection and care of electrical safety gloves shall be done in accordance with following:

- Once the Hazard/Risk Category number has been identified, determine the protective clothing and PPE required using the matrix below.
- For each Hazard/Risk Category number in row 1 in the matrix, the minimum ATPV for the FR clothing required is shown in row 2.
- PPE Requirements are indicated in the corresponding column for each Hazard/Risk Category

Table-3: PROTECTIVE CLOTHING SELECTION MATRIX

	Hazard/Risk Category Number	-1	0	1	2	2*	3	4
(note 4)	**Required ATPV rating of FR clothing (cal/cm²)**	n/a	n/a	4	8	8	25	40
Untreated Natural Fiber	Untreated Cotton, silk, wool, protective clothing	X			x	x	x	x
	Long sleeve shirt		x					
	Long pants, including jeans	X	x	x	x	x	x	x
FR Clothing	Long sleeve shirt and pants or coverall			x	x	x		
	Jacket, parka, or rainwear			AN	AN	AN	AN	AN
FR Protective Equipment	Flash suit jacket and pants						x	x
	Arc-rated face shield. (atpv => 8) ATPV 8				x	x		
	Flash suit hood						x	x
	Sock hood or hard hat liner					x		
	Class E hard hat			x	x	x	x	x
	Safety glasses with permanent side shields	X	x	x	x	x	x	x
	Ear canal inserts				x	x	x	x
	Leather gloves (note 2)			AN	x	x	x	x
	Leather safety shoes rated EH			AN	x	x	x	x

NOTES

1) X indicates – Requirement, AN = As Needed.
2) If High voltage gloves are worn, the leather protectors outside the gloves satisfy this requirement.
3) In row 2, the Required ATPV rating listed is the minimum required for the respective Hazard/Risk Category in row 1.

Example: For a job determined to have a Hazard/Risk category of 2, the following PPE would be required using the matrix:

1) Untreated cotton, wool, protective clothing
2) Long pants or jeans
3) Fire retardant shirt and pants (or coverall) with a minimum ATPV rating of 8.

4) An arc-rated face shield with a minimum ATPV rating of 8
5) Hard hat (Class E).
6) Non-conductive safety glasses with permanent side shields
7) Hearing protection (canal inserts)
8) Leather gloves or high-voltage glove protectors (Kevlar)
9) Safety shoes (leather with an Electrical Hazards rating)

Selection and Care of Electrical Safety Gloves Selection of Gloves

1. Wear **Class 0** gloves, at a minimum, when working on or near energized low voltage electrical equipment, unless other precautions eliminate all shock hazards to the employee.

2. Except for **Class 00** gloves as discussed in this procedure, always wear protective gloves over rubber gloves. Any direct contact of a rubber glove with sharp or pointed objects should or may cut, snag or puncture the glove and reduce the protective qualities.

3. Rubber insulating gloves worn during electrical work shall comply with ANSI/ASTM std. D 120/77, or equivalent standard. Gloves covered under this specification are designated Type I or Type II: Class 00, Class 0, Class 1, Class 2, Class 3, or Class 4. The type refers to the characteristics of the material from which the glove is made, and the Class refers to certain electrical properties, as follows:

    - Type I: Non-resistant to ozone. Made from a high-grade cis-1.4- polyisoprene rubber compound of natural or synthetic origin and properly vulcanized. Do not purchase Type I gloves in the future.
    - Type II: Ozone-resistant. Made of any elastomer or combination of elastomeric compounds. All new rubber insulating gloves purchased shall be Type II.

GLOVE CLASS	MAXIMUM USE VOLTAGE
00	500
0	1,000
1	7,500
2	17,500
3	26,000
4	36,000

Notes:
Maximum use voltage is the classification of the protective equipment that designates the maximum nominal design voltage of the energized system on which work should or may be safely performed.

Protector gloves need not be used with Class 00 gloves, during LV testing, or where instrument/tool manipulation necessitates high finger dexterity.

The minimum under-lap of the protector gloves shall be the glove class in inches or one (1) inch, whichever is greater.

1. Do not wear synthetic **clothing** made entirely of, or a blend of acetate, nylon, rayon, or polyester. 100% cotton clothing is recommended.
2. If the insulating capability of protective equipment should or may be subject to damage during use, protect the insulating material. For example, wear an outer covering of **leather to protect** rubber insulating gloves.
3. Do not wear conductive articles of jewellery and clothing, such as watch bands, bracelets, rings, key chains, necklaces, cloth with conductive thread, or metal headgear when performing electrical work.
4. Pull back long hair.
5. Additional PPE is required for work on or around Energized Equipment. PPE shall be selected based upon the equipment being worked on and the work being done.
6. Only approved Live-Line Tools in good condition shall be used. Guidance on selection, care and inspection of live line tools is as follows.

1. Live-Line Tools include:

   - ☑ Hot-Sticks
   - ☑ Shot-Guns
   - ☑ Switching Sticks,
   - ☑ Non-Conductive or Insulated Tools
   - ☑ Instrument Extensions
   - ☑ Other insulated tooling required for electrical equipment operation, forground application, or for use with Tic-Tracers or other voltage indicator devices.

2. Live-Line Tools constructed entirely or in part of fiberglass shall be designed and tested in accordance with Fiberglass Tools ASTM F711-02, Standard Specification for Fiberglass-Reinforced Plastic (*FRP*) Rod and Tube Used in Live-Line Tools, 2002, or equivalent standard.
3. Insulated Hand Tools shall meet requirements of ASTM F1505-01 Standard Specification for Insulated and insulating Hand Tools, ANSI - American National Standards Institute, ASTM - American Society for Testing and Materials (*70E-129*),or equivalent standard.
4. Wipe clean, using manufacturers approved method, Live-Line Tools and inspect them daily for defects before use.
5. If the insulating capability of protective tools should or may be subject to damage duringuse, protect the insulating material.
6. Clearly mark Live-Line Tools to indicate the maximum voltage to which they can be exposed during normal use.
7. Remove Live-Line Tools from service and have them examined and tested by an Electrically Qualified Employee if any defect or contamination is present after wiping the tool.
8. Remove Live-Line Tools from service at least every two years and test them in accordance with ASTM standards for dielectric strength. Secure a visible indication of calibration to the tool, such as a sticker or other durable marking thatindicates last test date.

Type of Electrical Equipment	Dielectric Test Frequency
High voltage gloves	Every 6 months
Hot-Stick	Every 24 months
Shot-Gun	Every 24 months
Switching Stick	Every 24 months
Instrument Extensions	Every 24 months
Non-conductive/insulating tools	Every 24 months
Insulating floor mat	Every 12 months
Insulating blankets	Every 12 months

9. Insulated Hand Tools shall meet requirements of ASTM F1505-01 Standard Specification for Insulated and Insulating Hand Tools, ASTM (70E-129), or equivalent standard.

10. Live-Line Tools shall be cleaned and inspected for defects before each use.

ANNEXURE-2: WORKING ON / NEAR ENERGIZED ELECTRICAL EQUIPMENT – SALIENT FEATURES

- Only authorized personnel trained on the specific task and the hazards involved are permitted to perform work on energized conductors.
- Follow JSW PTW & LOTO standard
- Ensure that proper Earthing clamp / rod is properly fixed.
- Check whether proper platform, insulated ladder, and Rubber mat is in place.
- Check whether Risk assessment has been done & all measures taken.
- List out all required PPE'S & ensure all people are using it.
- Safety instruction is given to all concerned before starting up the job.
- Check whether adequate illumination is available at site.
- Check whether appropriate tools, tackles and measuring devices are available at site.
- Ensure that nearby charged source is properly barricaded / shrouded.
- Use insulated Tools always.

Ensure proper and valid fire extinguishers of specified class are available.

Ensure that safe working distance from nearby charged equipment is maintained.

The basic policy for this is that working on unguarded energized equipment is not permissible. However, situations should or may arise that require energized work. In such cases, specific approval shall be obtained, and the following four hazards addressed:

- Shock and burn due to contact.
- Electric arc burns caused by high energy electrical faults (arc flash).
- Damage to equipment due to arcing or short-circuited conductors.
- Upset or shutdown of an operating unit.

Work within the prohibited approach boundary shall only be performed when all of the following requirements are met:

- Line management has participated in the decision to authorize work on energized conductors. Each site shall establish the level of management approval for this authorization.
- A specific job plan is written for the task.

  Although voltage testing and diagnostic testing are performed within the prohibited approach boundary, it is recognized that these tasks are performed regularly and should be managed by practices, procedures, and authorization in lieu of specific written job plans. Voltage testing shall only be performed when all of the following requirements are met:
- Proper test instruments are selected and used.
- The person performing the test is qualified and authorized to perform voltage testing as part of his or her job responsibility.
- Appropriate PPE is used while performing the task.
- The preferred method for performing diagnostic testing and troubleshooting is on de- energized circuits. If this is not possible, diagnostic testing and troubleshooting shall only be permitted on energized circuits when performed in compliance with the requirements above on de-energized troubleshooting techniques.

ANNEXURE-3: ELECTRICAL EARTHING SYSTEM

System/Neutral Earthing

System/Neutral Earthing refers to the electrical connection of the neutral conductor in a 3-phase, 4-wire system, the middle conductor of a 2-phase, 3-wire system, or a single-phase supply to the general mass of earth. It also includes the artificial neutral point created by an earthing transformer in a 3-phase, 3-wire system.

The purpose of system/neutral earthing is to ensure the safety of the electrical system by maintaining the voltage on each live conductor within safe limits, relative to the earth's potential. This helps to ensure that the insulation level and other safety equipment can effectively protect against electrical hazards.

The neutral of the source (transformer) should be earthed only at the transformer. The generator neutral should be isolated from any transformer neutral or other earthing systems.

Equipment Earthing

Equipment earthing refers to the electrical connection of the non-current carrying metallic parts of electrical equipment to the general mass of earth. The objective is to ensure the effective operation of protective switchgear in the event of leakage through the metalwork, which could otherwise pose a risk to life or cause a fire hazard.

Welding machine secondary earthing cables should be connected directly to the job. Single-core and shielded cables should be earthed at only one point. Insulated cables should be used for earthing electronic equipment.

Design and application.

The design of the earthing system is based on the following key factors:

1. Selection of the conductor for the earthing system and the metal parts of the equipment to be grounded.
2. Selection of the point where the conductor is to be earthed.
3. Selection of the size of the earth wire/lead, its mechanical protection, and the method of connecting it to the earth electrodes.
4. Selection of earth electrodes and ensuring their resistance to ground is within acceptable limits.
5. Consideration of the fault current of the system.

The location of the earthing system and the precise location of the earthing station should be shown in the project drawing. This drawing should be a dimensional layout and permanently displayed at the substation for the convenience of maintenance and testing personnel. The earthing system should be designed so that the individual resistance is less than 2 ohms, and the combined resistance is less than 1 ohm.

Barricading:

The earthing station area should be properly barricaded with wire mesh fencing, which is considered part of the protected area. The wire mesh shall be separately earthed. In cases where barricading is not possible, such as in extensions to existing installations, a suitable concrete chamber with a cover of appropriate size should or may be used to protect the earthing pit.

Height:

Height of the wire-mesh fencing shall be 1.8 meters.

Name Plate:

The details of the earthing pit should be written on a nameplate located at a conspicuous location. A nameplate measuring 300 x 220mm should be placed near the earthing station. The nameplate for

neutral earthing stations should have a red background, and for equipment earthing stations, a black background.

This nameplate should be mounted on masonry work separately by an angle and should be raised above the level of the masonry.

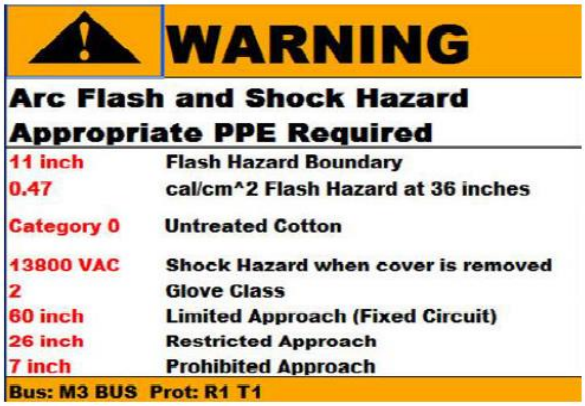
Away from Roads:

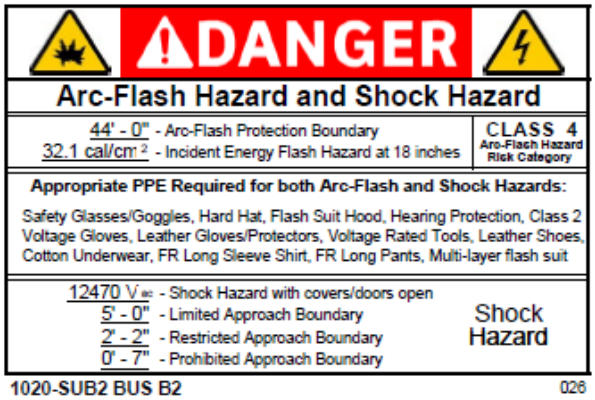
Earthing pits that are not barricaded should be located at least 1.2 meters away from roads, thoroughfares, and passageways to prevent accidental interference or damage.

ANNEXURE-4 – ELECTRICAL SAFETY SIGNAGE

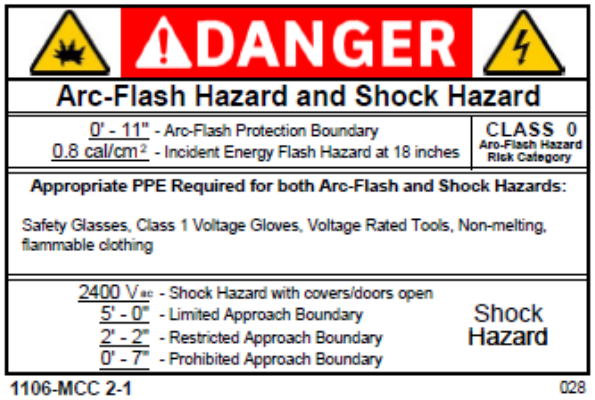








1020-SUB2 BUS B2
REAR OF 2-12A CUBICLE
026



1106-MCC 2-1
STARTER DOOR OF AIR COMPRESSOR #1
028

16. REFERENCE

References Document	Full Title, Brief Description and Web Links
1. Occupational Safety and Health Administration (OSHA)	OSHA is a part of the United States Business Unit of labor to ensure safe and healthful working conditions for workers by setting and enforcing standards by providing training, outreach, education, and assistance. Electrical - Overview | Occupational Safety and Health Administration (osha.gov) Electrical - Standards | Occupational Safety and Health Administration (osha.gov) eTool : Construction - Electrical Incidents | Occupational Safety and Health Administration (osha.gov) Electrical - Training | Occupational Safety and Health Administration (osha.gov)
2. Health and Safety Executive	The health and safety executive are Britain's National regulator for workplace health and safety dedicated to protecting and prevent people and places Electrical standards and approved codes of practice - Electrical safety (hse.gov.uk)
3. ANSI - American National Standards Institute	As the voice of the US standards and conformity assessment system, the American National Standards Institute empowers its members and constituents to strengthen the US marketplace position in the global economy while helping to assure safety and health of consumers and the protection of the environment. Electrical Safety Archives - ANSI Blog NFPA 70E-2018 - NFPA 70E Standard for Electrical Safety in the Workplace®, 2018 edition (ansi.org)
4. NFPA – National Fire Protection Agency	NFPA stands for the National Fire Protection Association, a global nonprofit organization dedicated to eliminating death, injury, property, and economic loss due to fire, electrical, and related hazards. NFPA develops codes and standards, conducts research, training, and education, and provides information and advocacy on fire safety. NFPA 70E Standard Development
5. European Standards ▪ 2014/35/EU Directive Electrical safety: low-voltage electrical equipment	Directive - 2014/35 - EN - Low Voltage Directive - EUR-Lex (europa.eu) IEC 60364-1 - Low-voltage electrical installations - Part 1: Fundamental principles, assessment of (iteh.ai)

References Document	Full Title, Brief Description and Web Links
▪ IEC 60364 “IEC Electrical Installation Guide” ▪ EN 50110 “Operation of electrical installations “ ▪ EN 61010 “Safety requirements for electrical equipment for measurement, control and laboratory use “ ▪ EN 60335 “Household and similar electrical appliances “ ▪ EN 60204-1 “Safety of machinery - Electrical equipment of machines “ ▪ EN 61029 “Safety of transportable motor-operated electric tools” ▪ EN 50160 “Voltage Characteristics of Public Distribution Systems	EN 50110-2:2023 - Operation of electrical installations - Part 2: National annexes (iteh.ai) EN IEC 61010-2-061:2021 - Safety requirements for electrical equipment for measurement, control and (iteh.ai) EN 60335-1:2012/A1:2019 - Household and similar electrical appliances - Safety - Part 1: General (iteh.ai) EN 60204-1:2018 - Safety of machinery - Electrical equipment of machines - Part 1: General (iteh.ai) EN 61029-1:2009 - Safety of transportable motor-operated electric tools - Part 1: General (iteh.ai)

JSW Group

MANAGEMENT STANDARD: WORK AT HEIGHT
JSW/GHS/GS-12

MANAGEMENT STANDARD WORK AT HEIGHT

Management Standard Title:	**WORK AT HEIGHT**	**Date of Revision**	10.12.2024
Document	JSW/GHS/GS-12	**Revision**	01

Document Issue and Revision History

Date	Revision Number	Change Summary
10.12.2024	01	• Updated Purpose with Work at height definition to be used for JSW. • Updated Section 5, with regards to hazard identification, Risk Assessment & Risk Control • Wind Speed limit at WTG is reviewed and corrected. • Fall Protection System Guard Rail-Picture changed, and conversion values (lbs. to kg) corrected. • Policy word removed from Flow chart. • WAH protection, Prevention word removed. • Removed requirements of Acrophobia test

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1. PURPOSE

The purpose of this Standard is to establish procedures that support a Health & Safety program in alignment with the JSW Health and Safety Policy, addressing the risks associated with working at height. For the purpose of this Standard, "working at height" refers to any work where a person could fall a distance likely to cause personal injury, or where materials or objects could fall and cause injury. This Standard provides requirements and guidance for:

- Safe working at height.
- Preventive and protective measures to safeguard individuals and materials from falls.
- Regular inspection and maintenance of personal and collective protective equipment.
- Training procedures, including competency assessments related to safe work at height.

Work in areas where safeguards or controls are absent—resulting in a risk of falls or falling materials that could cause injury—requires hazard identification, risk assessment, and implementation of effective control measures to reduce these risks to acceptable levels. This Standard outlines a systematic approach to eliminating fall hazards, preventing falls, and minimizing injury in the event of a fall.

2. SCOPE

This Standard applies to all companies and subsidiaries within the JSW Group, including managed business units, sites/locations, corporate and regional offices, research and development facilities, new projects, as well as merged and acquired entities. It is relevant to all JSW employees and contractors across these entities.

Compliance with this Standard is required throughout the entire lifecycle of a project, business, or site/location, including the planning, assessment, exploration, evaluation, design, development, operation, and closure phases.

Each business unit within the JSW Group shall develop and publish its own specific requirements as supplementary documents to this Work at Height Group Standard, ensuring alignment with the Group's overarching policy.

National and local legislation shall be adhered to, and where the requirements of national or local regulations concerning work at height are more stringent than those outlined in this Standard, the more stringent requirements will take precedence.

In the Standard, the following verbal forms are used to indicate requirements, recommendations, permissions, or capabilities:

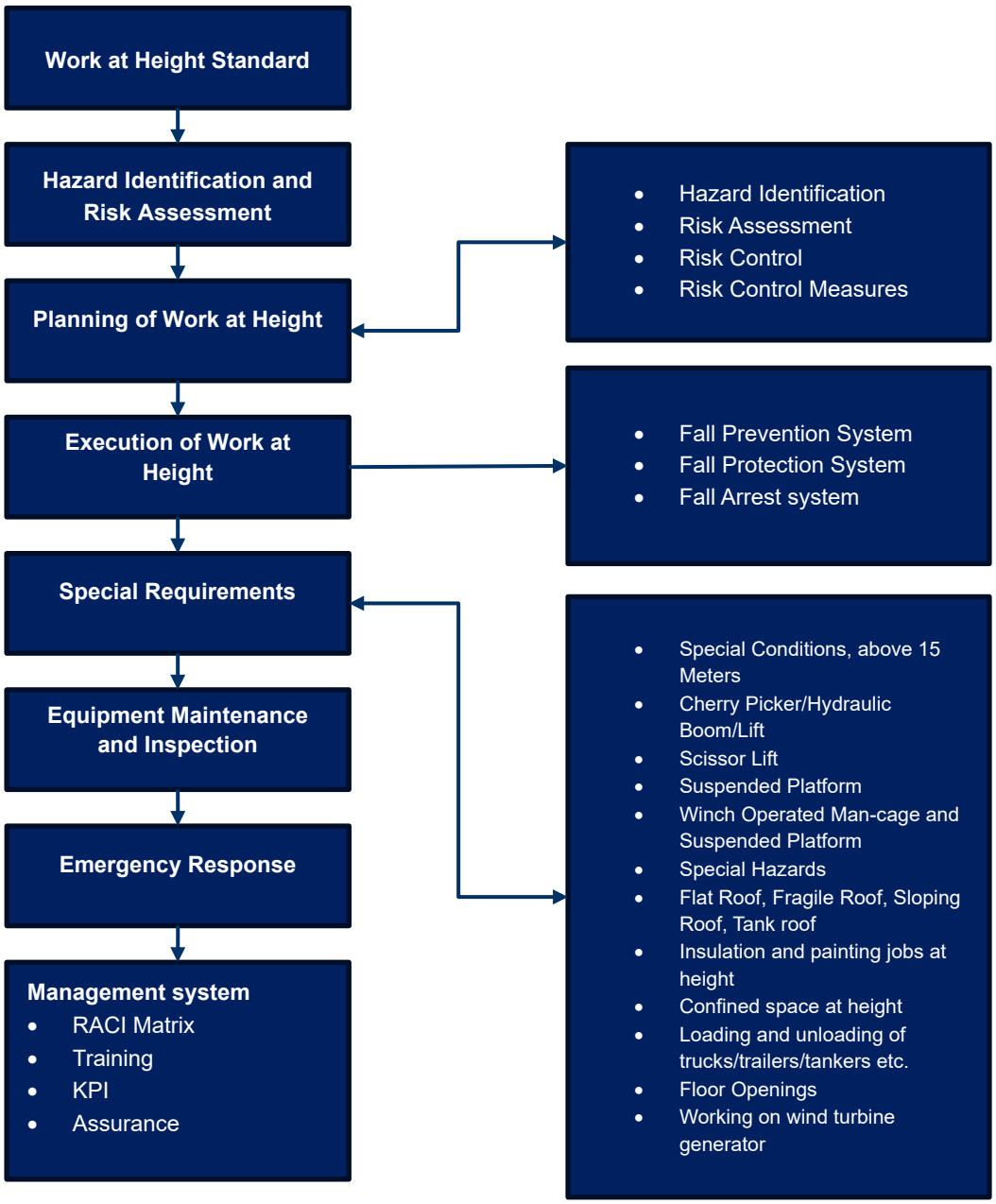
- "shall" indicates a requirement.
- "should" indicates a recommendation.
- "may" indicates a permission.
- "can" indicates a possibility or capability.

3. REVIEW

The Standard should be reviewed at least every 5 years or following any serious incident or high potential near miss. The review should include the evaluation of the following:

- Work at height procedure, including fall hazard risk assessments for work at heights.
- Training records and programs for employees exposed to fall hazards.
- Lessons learned from incidents involving work at height.
- Fall protection equipment inspection records.
- Changes to industry standards, laws, and regulations.

4. PROCESS FLOW



5. PLANNING

5.1 HAZARD IDENTIFICATION

Before any risk management activities can be carried out, it is crucial to identify the hazards associated with working at height and below ground level. Hazard identification involves recognizing what could go wrong during tasks at height, which is the first step in preventing incidents.

Some key hazards that should be identified include:

- **Falls from Height:** The most obvious hazard, which includes falling from ladders, scaffolding, platforms, or structures.
- **Unstable Working Surfaces:** Hazards posed by unstable or sloped surfaces, or working on surfaces that are poorly maintained, which could lead to slips or falls.
- **Inadequate Edge Protection:** The absence of guardrails, barriers, or other safety systems to prevent workers from falling off edges or elevated surfaces.
- **Falling Objects:** Tools, materials, or equipment that could fall from a height and strike workers below.
- **Scaffolding Collapse:** The risk of temporary structures, such as scaffolding, collapsing under the weight of workers or equipment.
- **Failure of Lifting Equipment:** The possibility that lifting equipment such as cranes, hoists, or ropes might fail, leading to potential falls or injury.
- **Inadequate Personal Protective Equipment (PPE):** The failure to use appropriate PPE, such as harnesses, lanyards, helmets, and fall arrest systems.
- **Improper Use of Equipment:** Misuse of equipment such as ladders, scaffolds, or lifting devices, which can result in accidents.
- **Inadequate Training or Awareness:** Workers or supervisors lacking the necessary training or awareness regarding the specific hazards of working at height.

Additional Considerations:

- **Poor Weather Conditions:** Weather-related risks, including rain, wind, snow, ice, and poor visibility, which can make working at height dangerous.
- **Vertical and Horizontal Movement:** The movement of workers on ladders, suspended platforms, or lifting equipment, which may introduce instability or increase the risk of falls.
- **Walking and Working Surfaces:** The condition, stability, and structural integrity of surfaces workers walk or stand on, including potential slip or trip hazards.
- **Ability for Self-Rescue and Emergency Rescue:** The lack of proper rescue plans or equipment for workers who need to rescue themselves or be rescued in case of a fall.
- **Peripheral Activities:** Hazards arising from other activities occurring nearby, such as hot work or lifting operations, which may increase the risk when working at height.

5.2 RISK ASSESSMENT

After identifying the hazards, the next step is Risk Assessment. The purpose of the Risk Assessment is to evaluate the likelihood and severity of each identified hazard to determine how significant the risk is and prioritize it accordingly.

The Risk Assessment should consider the following elements:

- **Work Location and Surface Stability:** Assess the work environment for specific conditions such as uneven terrain, elevated work platforms, or fragile surfaces (e.g., skylights, old roofing). The stability of the work surface and the number of workers involved should also be considered.
- **Fall Hazards:** Evaluate the likelihood of falls, both for workers and falling objects. This includes the potential fall distance, working at height near unprotected edges, and objects that may fall from elevated surfaces.

- **Environmental Conditions:** Consider the impact of weather conditions such as high winds, rain, snow, poor visibility, temperature extremes, and other environmental factors that can create additional hazards during work at height.
- **Equipment Selection:** Evaluate the equipment needed for the task. This includes choosing tools, ladders, scaffolds, or fall protection equipment that is suitable for the work and environmental conditions.
- **Anchorage and Tie-off Points:** Ensure secure, properly rated, and well-maintained anchor points for any fall protection systems.
- **Supporting Structure Condition:** Ensure the condition of any structure supporting workers, such as roofs, scaffolds, or beams, is stable and capable of bearing the load.
- **Barricading and Demarcation:** Define the work zone with appropriate barricades and warning signs to prevent unauthorized entry and to alert others to the risks of working at height.
- **Fragile Roof Surfaces:** Identify and manage risks associated with fragile roof surfaces, such as skylights, skylights, or domed roofs that may collapse under weight.
- **Lighting and Night Work:** Assess risks related to night work or poor lighting, ensuring the work area is well-lit for safety.
- **Interference Risks:** Identify risks arising from adjacent operations that may interfere with the work, such as moving equipment, traffic, or electrical hazards.
- **Slip and Trip Hazards:** Evaluate potential slip and trip hazards, such as cluttered work areas or uneven surfaces, that could lead to accidents.
- **Overhead Work Ergonomics:** Consider ergonomics when working overhead to reduce strain from extreme postures and repetitive movements. Also, assess potential emergency scenarios.
- **Fall Clearance:** Ensure that adequate clearance is available in the event of a fall, considering factors like lanyard length, worker height, and safety margins to prevent injury.
- **Proximity Hazards:** Assess nearby structures, machinery, or electrical components that could pose additional risks when working at height, such as the risk of electrocution or crushing injuries.

Steps of Risk Management for Working at Height:

- Identify hazards related to workplace operations.
- Assess the risks associated with each hazard.
- Determine and Implement Control Measures to reduce or eliminate the risks, and continuously monitor the effectiveness of these measures.

Refer Annexure-1: Fall Protection Risk Assessment Form.

5.3 RISK CONTROL

Once the hazards have been identified and the risks assessed, the next step is to implement Risk Control measures to reduce or eliminate the identified risks. Control measures shall be selected and applied based on the Hierarchy of Controls, starting with the most effective solutions.

Control measures may include:

Documented Job-Specific Procedures: Prepare procedures for each specific job considering all identified risks, such as:

Job Specific Procedures

- The workplace location and its associated hazards.
- The fall distance and hazards, including the pendulum effect, which could increase the severity of a fall.
- The risk of falling objects and the need to protect workers below.
- Identifying floor and barrier openings, shafts, or trap doors.

- Ensuring safe access to work at height, including ladders, lifts, or scaffolding.
- Consideration of environmental conditions (e.g., wind, rain) that may elevate risks.

Fall Protection Systems:

- Verify anchor points for fall protection systems, ensuring they meet the required standards (e.g., EN 365:2004).
- Select and install appropriate personal fall protection systems such as harnesses and lanyards, in line with safety standards.
- Ensure adequate fall clearance in the event of a fall, accounting for all potential distances (e.g., lanyard length, tear-out distance, worker height).

Competency and Supervision: Ensure that only authorized and competent workers perform tasks at height. Workers shall be properly trained in fall protection systems and safety procedures. They shall be closely supervised to ensure safe work practices.

Emergency Rescue Plan: Develop a detailed emergency rescue plan to ensure that workers can be safely rescued in the event of a fall. This plan should include procedures for both self-rescue and team-based rescue operations.

Medical Fitness Screening: Prior to engaging in work at height, workers shall undergo medical fitness screening to ensure they are physically and psychologically capable of safely performing work at height. This will minimize the risk of accidents caused by fatigue, dizziness, or other health-related issues.

5.4 HIERARCHY OF FALL PREVENTION AND PROTECTION



Figure-1 : Passive & Active Fall Protections

5.4.1 Elimination

Work at height should only be carried out if necessary. The Business/Site/Location should consider implementing the elimination phase for all work at height activities. This should be done when planning for an activity being performed at height. In elimination, the work is being performed by a different means that does not expose the workforce to the fall hazard.
The Business/Site/Location should ensure to consider the following steps to eliminate work at elevation/height activities:

- Performing work on the ground
- Attaching guardrail protection to forms and work platforms while on the ground.
- Attaching fall arrest systems to formwork or other structural components before erection
- Using ground release devices to disconnect rigging from the ground, and
- Maximizing the pre-assembly of formwork, structural steel, and other components

Some of the examples of fall elimination are:

- Exploring the means to fabricate items on the ground rather than assembling them at height, thereby, eliminating the need to access the fall risk area.
- Exploring means of painting of fabricated structure at the ground before installing.
- Certain equipment such as air condition units (installed in the office building) may be installed at ground level to facilitate installation and maintenance without having to work at heights.

5.4.2 Substitution

When it is not possible to apply elimination in an activity, the Business/Site/Location should consider the second-best control which is Substitution.
Substitution can be defined as replacing a hazard/hazardous work practice with a less hazardous one – “Prevent fall”.

Examples of Substitution with respect to WAH activities are:
Providing alternative means of access such as a safe walkway so the risks of falls are avoided. Installation of an elevating working platform for work at heights.

5.4.3 Engineering Control

Engineering Control means designing controls which reduce risks. Business/Site/Location include Scaffolds, Step Platforms, Elevating Work Platforms, Aerial lifts etc. Besides, the Business/Site/Location may consider maximizing the use of prefabricated modular units. Using stairways and platforms that should be used for access both during installation and maintenance operations can also be used depending on the nature of the work that is being performed at height. The Business/Site/Location should design attachment points for guardrail systems or self-retracting lifelines that should be attached on the ground and provide protection for the workforce to access the elevation.

5.4.4 Administrative Control

Administrative controls focus on managing risks by changing the way work is performed, rather than isolating hazards. This includes practices such as:

- Implementing work procedures that limit exposure to hazards.
- Scheduling work during safer conditions or limiting the number of workers at height.
- Using signage or barriers to direct workers away from hazardous areas.
- Regularly maintaining and inspecting equipment to ensure it meets safety standards.

Examples include providing barricades or edge protection around fall risk areas, installing guardrails, and covering floor openings. These controls aim to reduce worker exposure to hazards by altering work practices or environment layout.

5.4.5 Personal & Collective Protective Equipment

Personal protective equipment (PPE) serves as the final layer of defence in the risk reduction hierarchy. For detailed guidance, refer to the PPE standard (JSW/GHS/GS-05).

- PPE only minimize the consequences of a fall rather than preventing its occurrence, and,
- PPE rely on human behavior to prevent injury.

The use of fall protection equipment shall be planned in the work activity and used properly to reduce the risk of injury from falling.
The following hierarchy shall be considered when planning the use of fall protection equipment:

- Fall Restraint Systems- full body harnesses, lanyards, anchorage, etc.,
- Fall Arrest Systems- Self-retracting lifelines, retractable devices, shock absorbing lanyards etc., and Safety Net System.

Where it is not practical to eliminate the falling hazard through engineering or design change, a Fall Protection system shall be implemented. As well as taking account of the risk assessment in selecting the most suitable equipment, collective prevention, and arrest measures, e.g. guard-rails, shall take precedence over personal measures.

Along with collective protective equipment's, ensure personal protective equipment as per Risk assessment are selected and provided to individuals working at height.

5.4.6 Work At Height Prevention and Protection Through Safety by Design

Planning for work at height fall hazard prevention and protection during design and engineering phase provides the best opportunity to establish effective prevention and protection systems. Fall hazard prevention and protection during access, working and egress should be addressed during design and major modifications and upgrades.

The project or equipment installation should consider the following:

- **Avoidance of Work at Height:** Design installations and equipment to be accessible at ground level wherever possible to facilitate easy access, operation, and maintenance.

- **Permanent Working Platforms:** Provide standard, permanent platforms with access and egress options, handrails, guardrails, and provisions for safety harness tie-off or anchor points.
- **Permanent Ladders:** Install permanent ladders in process and operational areas with safety cages in compliance with relevant codes and standards (e.g., ANSI ASC A14.2-2017 or IS 3696-2).
- **Spacing for Mobile Elevating Work Platforms (MEWPs):** Allow adequate space for vertical lifts, scissor lifts, boom lifts, and aerial bucket trucks.
- **Gap and Opening Protection:** Ensure gaps and openings are covered or otherwise protected during the project stage.

Addressing fall protection in the early phases of project means that safety should be designed into the work process, not added as an afterthought to an inherently unsafe work procedure. For example, the project can be designed with providing access ladders to roof.

5.5 RISK CONTROL MEASURES

5.5.1 Permit To Work for Work at Height

Before carrying out any Work at Height (WAH) activities, the Site shall ensure that a Permit to Work (PTW) is issued for the activity, particularly for non-routine tasks. The PTW system is a key control for managing Work at Height activities. A PTW should be obtained and approved by authorized personnel. Before issuing the permit, the Site should ensure that the worker performing the WAH activity holds a valid Work at Height certificate, indicating adequate training and competency for the task. This certificate shall be attached to the PTW prior to its approval.

The Permit to Work system shall be documented and define the types of work at height, including plant and equipment maintenance work and other non-routine tasks carried out by workers (whether employees or contractors). Each permit shall specify the duration for which it is valid, and it should not exceed the duration of the job (Refer to Permit to Work Standard - JSW/GHS/GS-08).

Additionally, the Permit to Work should consider any risks from simultaneous hazardous activities that may affect the safety of working at height, such as disconnection, removal of valves, work on gas lines, spool piece isolation using spades or solid blank flanges, and the provision of fire-resistant tarps/blankets to contain sparks from welding, burning, or grinding.

5.5.2 Fall Clearance Calculation

Personal Fall Arrest Systems (PFAS) should be selected and rigged in such a way that the free fall distance — the distance a worker will fall before the system begins to arrest the fall — never exceeds the safe length of the lanyard. However, it's not just the free fall distance that needs to be considered. The total fall distance is the combination of the free fall distance, the deceleration distance (the distance the system travels as it slows down the fall), dynamic elongation (the temporary stretch of the system's components under load), and the worker's height.

In addition to this, one should account for the clearance below the worker to ensure that the worker doesn't hit any obstacles during the fall. A safety factor of 1 meter shall always be allowed for clearance beneath the worker's feet to prevent contact with the ground or any structures below.

Calculation of Fall Distance:

To ensure the PFAS is set up correctly and safely, the total fall distance shall be calculated based on available fall clearance and the type of fall protection equipment used. Here's how to approach the calculation:

Free Fall Distance: This is how far the worker will fall before the fall arrest system activates.

Deceleration Distance: This is the distance the system will stretch as it slows the worker's fall.

Dynamic Elongation: This refers to the temporary stretch of the lanyard and other components of the system under load, which can vary depending on the material and design of the equipment.

Worker's Height: The height of the worker shall also be considered, as it affects how much additional distance is needed before the fall arrest system activates.

Clearance Below the Worker: The distance below the worker's feet should be sufficient to allow for a safe stop. Always allow an additional 1-meter safety margin for clearance.

Calculation Example:

Let's look at a typical scenario using a 1.8-meter lanyard:

When the available fall clearance is greater than 5.6 meters (18.5 feet), there is enough space for the worker to fall safely without risk of hitting the ground or structures below. In this case, a 1.8-meter lanyard is acceptable, as the total fall distance (including deceleration, elongation, and clearance) is well within the available space.

However, when the available fall clearance is less than 5.6 meters (18.5 feet), the situation becomes more critical. In this case, the total fall distance may exceed the available space. To mitigate this risk, an alternative solution should be used, such as a shorter lanyard or a self-retracting lanyard or fall limiter, which would reduce the total distance the worker could fall.

The 5.6-meter (18.5 feet) threshold is not a fixed rule but a guideline for determining when an alternative fall protection solution is needed. This threshold is used to help assess whether the current fall protection equipment will provide sufficient clearance.

In other words, when the available fall clearance is under 5.6 meters, additional precautions, such as using shorter lanyards or self-retracting devices, should be considered to reduce the risk of a worker falling too far. The key is to always calculate the total fall distance based on your specific site conditions to ensure safety.

Important Notes:

- Never tie a knot in a lanyard to shorten its length, as this weakens the lanyard by more than 50%. Instead, always use an adjustable lanyard, which can be properly set to the correct working length.
- The 5.6-meter clearance threshold is a guideline used for general fall clearance calculations and should be adapted to site-specific conditions. The actual required clearance may vary depending on the type of equipment, lanyard length, worker height, and other factors.

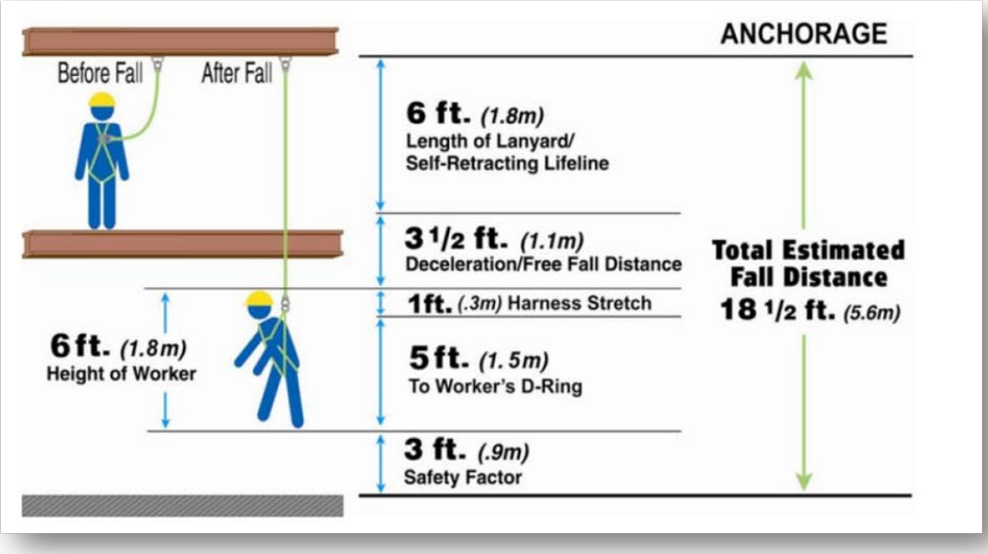


Figure-2 : **Fall Clearance Calculation**

5.5.3 Weather Conditions

All work at height should consider weather conditions that could endanger the health and safety of personnel and property. Adverse weather conditions should be anticipated, and suitable precautions planned for all external work at height.

If extreme wind conditions are anticipated with limited forewarning due to the Company's geographical location (e.g., hurricanes, tornados), adequate alarm systems should be installed based on the risk assessment. These alarms should be positioned appropriately, such as at the top of high facilities (e.g., cranes or structures along the perimeter of the Company area). The alarm system should activate automatically when critical parameters are detected, such as high wind speeds or sudden increases in wind velocity.

Work platforms shall be inspected before beginning work at height to ensure conditions remain safe and to detect any changes that may affect stability.

When alarms signal extreme weather, immediate evacuation of all elevated outside workplaces is required. This response takes priority over managerial or supervisory decisions regarding work continuation or suspension, as rapid atmospheric changes, especially during events like tornados, demand immediate action to prevent severe risk associated with any delays.

When deciding to continue or suspend work, consideration should be given to:

- Wind speed: – as a best practice, no work at height activities should be performed above 20 kmph wind speed.
- Controls already in place to prevent fall from height.
- The position/height of the working platform in respect of any material being handled.
- The work being undertaken.

Avoid working at height during fog, rain, or heavy wind conditions. Minimize night work at height whenever possible. If working at height at night is essential or specific to the site, ensure continuous supervision, adequate lighting, fall protection controls based on a job-specific risk assessment, and complete area barricading (either hard or soft).
The final authority to permit work at height under adverse conditions rests with the Unit Head and Safety Head at the site.

5.5.4 Contractor Management and Simultaneous Operations

When working at height activities are part of site with more companies involved, the related planning is supervised by the competent person in the line management. The competent person has the legal responsibility (defined in Directive 92/57/EU Art. 5 and Art. 6) on the safety coordination, planning and supervising for all activities in the sites.

He/she is also in charge of preparing the risk assessment (Safety and Health Plan) integrating the risk assessment report issued by the main contractors and all involved contractors and subcontractors. Other activities in charge of the safety coordinator include: the planning and across the lifecycle of operations and maintenance, the coordination meetings with contractors including work at height safety controls and monitoring of related measures.

5.5.5 Simultaneous Operations

When more companies are involved in the same work at height, or they are present in the same location where work at height is performed (so that there is the potential for interference related risks), the legal entity who commissioned the work (e.g. Client/main contractor) is required to promote a documented joint risk assessment between its Health & Safety organization and the Health & Safety organization of the companies, based on documented coordination meetings with contractors.

6. EXECUTION OF WORK AT HEIGHT

6.1 RESOURCES

Based on Job Safety Analysis/Risk Assessment, site should mobilize the fall arrest systems, other equipment, and manpower. Appropriate rescue equipment set, along with a trained rescue team and rescue plan (**Annexure – 2**) should be made available, personal fall arrest system components shall be visually inspected before each use.

Makeshift arrangements viz. drum, barrels, chairs etc. shall not be used as work platform for working at height**,** ladder should be inspected prior to use.

Simultaneous activities occurring directly one below the other in a multilevel structure should be avoided, or each level should be properly isolated. Effective coordination and communication among all agencies working at the same location, one above the other, should be established. Such simultaneous activities, where one level is directly beneath another, should be controlled through the Permit to Work (PTW) system as per the PTW standard (JSW/GHS/GS-08). Housekeeping or other activities should never be allowed below the work area during Work at Height activities unless fall protection measures have been ensured against falling objects. As per Scaffolding Standards (JSW/GHS/GS-13), proper scaffolds and/or temporary work platforms equipped with guardrails should be provided for working at height at elevations where there is a risk of falling, and no permanent work platforms are available for safe access.

Use of ladders for working at height should be discouraged. If ladders are used for working, it should be done only as per the guidelines in the **section 6.5.11.**

6.2 ACCESS

Access to areas of high risk, such as roofs should be limited to authorized qualified personnel only. Personnel who have received the appropriate training for this type of work will only be permitted to work on roof. These areas should be clearly identified, and the access limited. Access restrictions should include physical barriers as self-closing gates, chains, locked plates at the bottom of safety cage ladders. Roof should be designed to have fixed lifeline support and anchorage point before sheeting arrangements starts.

The area where work is conducted at height should be barricaded with hard barricading to prevent people walking across and below the working area. Hard Barricading should be done before commencing any work at height. If such barricading is not possible, safety net should be provided, and “Work in Progress” boards displayed along with indicative barricading.



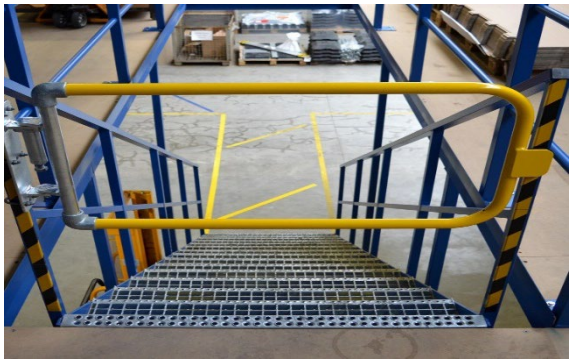


Figure-3 : Physical Barriers to Access Restriction

6.3 CLASSIFICATION OF WORK AT HEIGHT

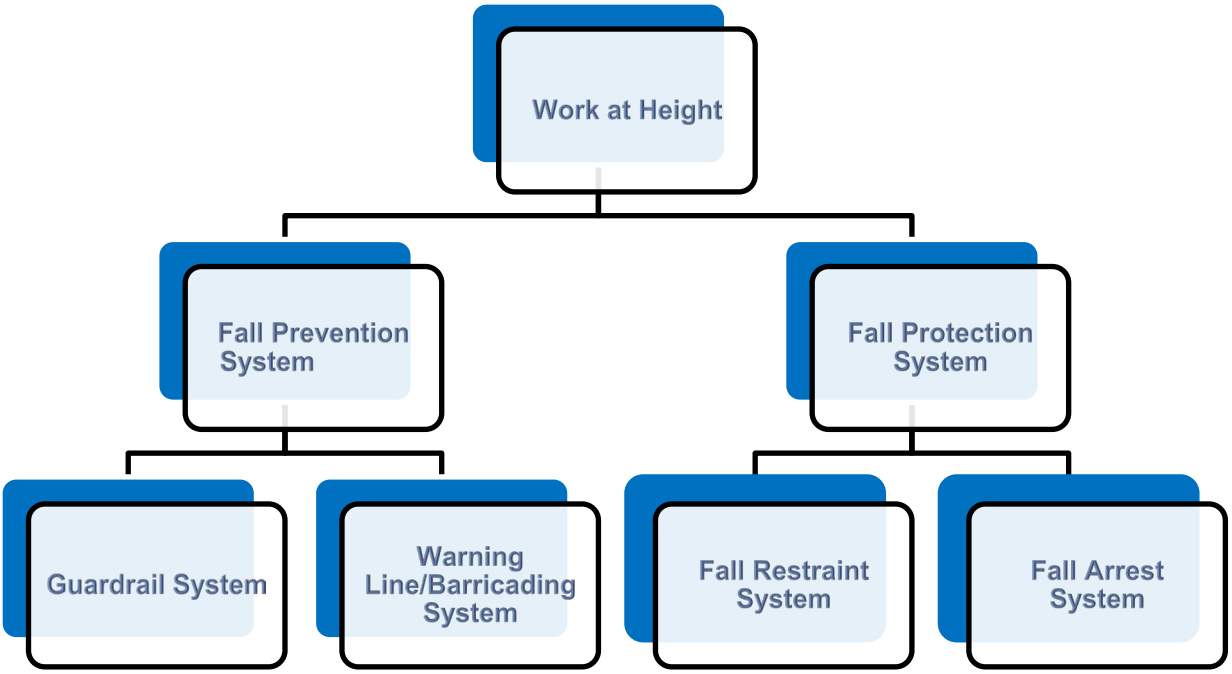


Figure-4 : Classification of Work at Height

Fall hazards control should be provided in the form of Fall Prevention System and Fall Protection System. The Site should consider the following methods (but not limited to) of fall prevention and protection for the workforce working at height.

- Fall prevention system refers to a system that prevents or eliminates the hazard of a fall. These include guardrail systems, scaffolds, aerial lifts, barricades, and hole covers.
- Fall protection measures refers to the use of devices or equipment that are used to mitigate or limit the effects of a fall from a height. These include the use of personal fall arrest systems or similar means of fall protection. The Site should also ensure to emphasis on protection from falling objects and from slips and trips on the same level.

6.3.1 Fall Prevention System

6.3.1.1 Guardrail Systems:

Guardrails are a stationary (or fixed) system used to protect workers from falls when working at heights. The Site shall consider using Guardrails as a preferred means of protecting workers because the system does not rely on the worker to be trained to use, inspect, and wear a fall protection system. Well-built guardrails are a reliable and convenient means of fall protection because they act as a visible and physical barrier to help prevent falls from heights or between levels including falls from roofs, stairwells or falls into open holes. Guardrails should be used where covers, floors or walls cannot be installed or are not practical.

The Site should ensure to follow the below mentioned requirements (but not limited to) in respect to use of Guardrails:

- Guardrail systems shall be surfaced to prevent injury from punctures or lacerations and to prevent snagging of clothes.
- The ends of top rails and mid-rails shall not overhang the terminal posts, except where such projection does not constitute a projection hazard.
- Guardrail systems used around holes and horizontal wall openings shall be erected on all unprotected sides and edges of holes.
- Guardrail systems used on ramps and runways shall be erected along each unprotected side or edge.
- Guardrail systems shall be used around holes, which are points of access, such as ladder-ways. Every ladder-way floor opening, or platform shall be guarded by a standard guardrail system including toe-boards on all exposed sides, except at the entrance to the opening. The passage through the railing shall either be provided with a barrier or offset such that a person cannot walk directly into the opening.
- Guardrail installation shall occur as work progresses.
- Inspections of the guardrails shall be conducted for damage and proper construction. Replacement of the guardrails shall be done immediately once they are found to be in damaged condition.
- Guardrails typically feature a top rail, mid-rail, toe boards with evenly spaced vertical posts.
- All open tanks and containers, more than 42 inches (1.07 meter) deep, containing hazardous substances are fenced with a fence of a minimum height of 36 inches (0.9 meter).
- Every floor opening including opening for temporary maintenance work, into which any person can fall shall be guarded by a standard guardrail system or by a metallic grating dully fixed in position.

Top Rails

- Top-rail height shall be 42 inches (1.07 meter) plus or minus 3 inches (0.08 meter) above the walking and/or working surface.
- Guardrail systems shall be capable of withstanding, without failure a force of 200 pounds (90.7 kilogram) applied within 2 inches (0.05 meter) of the top edge in any direction.
- When the 200-pound (90.7-kilogram) force is applied in a downward direction to the top edge of the guardrail, it shall not deflect to a height less than 1 meter above the walking or working level.

Mid-Rails:

- Mid-rails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members shall be installed between the top edge of the guardrail system and the walking/working and when there is no wall or parapet wall at least 21 inches (0.5 meter) high.
- Mid-rails, when used shall be installed at a location midway between the top edge of the guardrail system and the walking or working level.
- Screens and mesh when used shall extend from the top-rail to the walking/working level and along the complete opening between top-rail supports.
- Mid-rails, screens, mesh intermediate vertical members or equivalent structural members shall be able to withstand a force of at least 150 pounds (68 kilogram) applied in any direction.
- Intermediate vertical members when used between posts shall not be more than 19 inches (~0.5 meter) apart.

Toe-Boards

Falling object protection is provided by toe-boards, or screens on guardrail systems. Toe boards shall be:

- Erected along the edge of the overhead walking/working surface for a distance sufficient to protect workers who are working below.
- Capable of withstanding, without failure, a force of 50 pounds applied in any direction.
- A minimum of 100mm to 150 mm in vertical height

- No more than 6 mm above the walking and/or working surface.
- Solid or have openings not more than 1 inch (0.02 meter) in greatest dimension.
- where tools, material, equipment are piled higher than the top edge of a toe-board, paneling or screening shall be erected from the walking/working surface to the top of the guardrail systems top or mid-rail for a distance sufficient to protect workers who are working below. Screens or paneling from the toe board to the mid or top rail will be required when equipment or material is piled higher than the toe board and is capable of being ejected from the working surface to the level below.

Where gates or openings are required in the guardrail system to facilitate material movement, personal fall arrest or restraint systems should be used. It is recommended to have dual railing wherever railing is required to be frequency opened for material movement. Location should have visuals/warnings to alert user about openable rail system. All such opening should have door type railing arrangement opening inside only.

Guardrail/Platform Removal

Site to establish authorization process for temporary removal of any Guard rail, managing risk during period and ensuring restoring of guard rail/platform. Respective EHS/Fire & Safety Head and Area in-charge to give the authorization for such removal to Line manager or activity executor. While execution of railing removal and after railing is removed complete floor/platform should be treated as working at Height.

For permanent removal Site to follow process of management of Change (MOC) (JSW/GHS/GS/16).

Protection against Corrosion/Wear and Tear

JSW Business Units should establish periodicity of inspection and painting of railing and platform as per site condition.

For highly corrosive atmosphere, units can explore and use non-ferrous or non-metal railing and platforms such as:

- FRP/GRP material.
- Hot dip galvanized material
- Aluminum railings

Housekeeping:

- The Site should ensure to keep walking and working areas free of debris, material, and equipment.
- The Site should ensure to enforce daily clean-up of work areas.
- The Site should ensure to provide enough trash containers for clean-up.

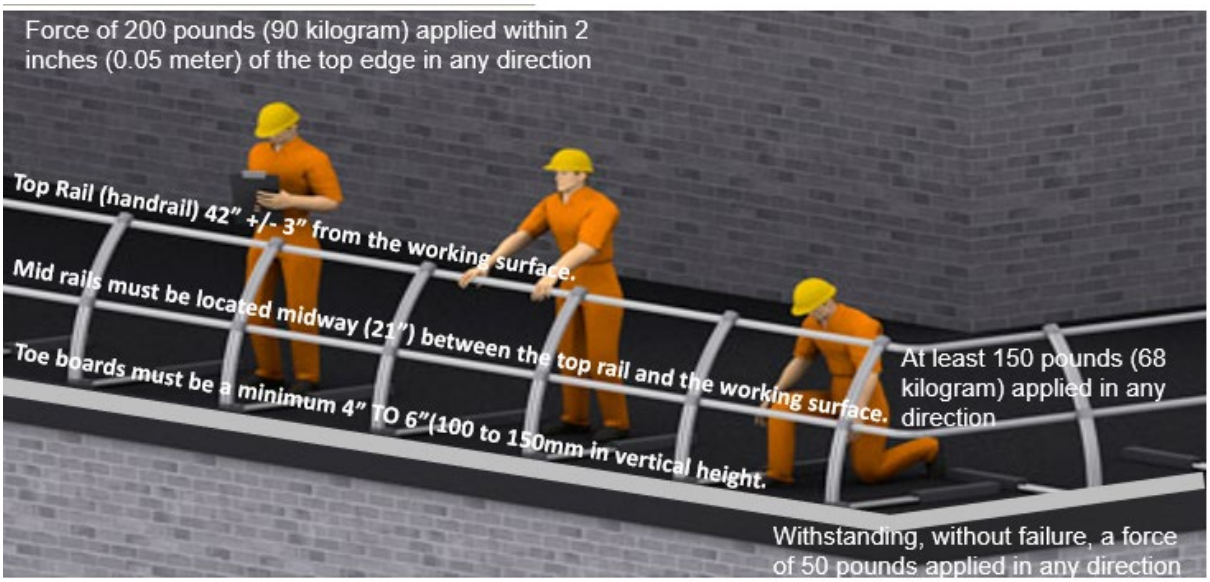


Figure-5 : Guardrail System

6.3.1.2 Warning Line/Barricading:

Warning line/Barricading is a passive system of fall prevention erected on a roof to warn employees that they are approaching an unprotected side or edge, designating an area in which work may take place without the use of guardrail, body belt or safety net.

Warning line should be used in conjunction with other fall protection measures and should be erected at least 15 feet away from the unprotected edge and should withstand 16 lbs (7.26 Kg) of tipping force.

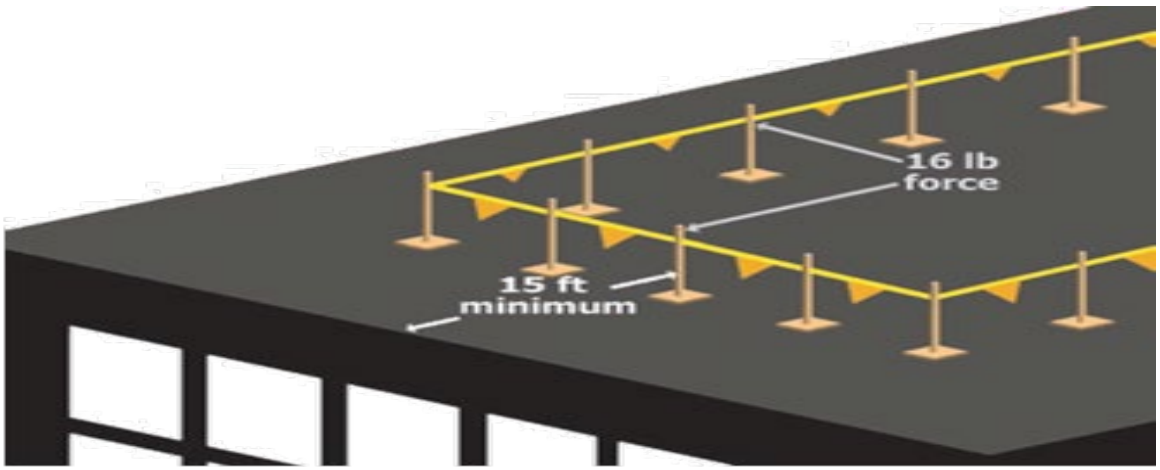


Figure-6 : Warning Line/Barricading

6.4 FALL PROTECTION SYSTEM:

A fall protection system is an assembly of components intended to protect the user against falls from a height.

A fall protection system is generally consisting of the following:

- A body holding device – a full body harness, sitting harness, work positioning belt, rescue harness, rescue loop; and
- An attachment system, including an anchor device which can be connected to a reliable anchorage point.

The main types of personal fall protective systems and their roles are:

- **Restraint systems:** prevent the user from reaching a zone where the risk of falling from height exists.
- **Fall arrest systems:** stop the falling and at the same time reduce the impact force exerted upon the user's body.
- **Rescue systems**: ensure that a person can rescue herself or rescue other persons in such a way that a free fall is prevented.

6.4.1 Fall Restraint System

A fall restraint system consists of the equipment used to keep an employee from reaching a fall point, where personnel are required to work where fall from open edge is anticipated. Personnel should use personal fall restraint equipment such as a fixed lanyard and harness as a minimum which will prevent them from falling over the edge**.**

Prevention of a fall can be achieved by use of physical barriers or a fall restraint system which ensure that workers cannot reach a position where a fall could occur.

Physical Barriers (such as guardrails) are the preferred type of fall prevention systems. If guardrails are not practicable, each worker can use a full body harness attached to a securely anchored lanyard or lifeline. Fall restraint systems consist of a fixed length or adjustable lanyard connected to an anchor point or a fall restraint lifeline. No energy absorber is needed, as being a correctly designed fall restraint system, there is no

possibility of a fall. Fall restraint systems should be rigged to allow the movement of workers only as far as the sides and edges of the working surfaces. So, when an adjustable lanyard is used, the worker needs to ensure that the lanyard length cannot be extended to permit entry into an area where a fall is possible.

Typical uses of fall restraint systems include:

- Fall restraint of workers inspecting an open slope edge
- Worker's cleaning tips in underground haulages
- Workers working on a low angle (not greater than 5 degrees) pitched roof or within an immediate open edge or opening from where a fall could occur.
- Working with a pole strap around a pole.
- Working at the edge of a floor where guardrails had to be removed to raise or lower equipment using a crawl beam.
- Location where workers are working near an edge where a fall from height could result in injury.

Workers using fall restraint systems should:

- Be trained and assessed as competent in the use of such equipment.
- Perform a visual check on the full body harness prior to fitting it. If any faults are found the equipment should be tagged "Out of Service" and arrangements made for a competent person to conduct a formal inspection. Ensure that the full body harness has been fully inspected and tagged within the previous 6 months by a competent person.
- Perform a visual check on the lanyard for any cuts, abrasions, or heat damage. If any faults are found the equipment should be tagged "Out of Service" and arrangements made for a competent person to conduct a formal inspection. Ensure that the lanyard has been fully inspected and tagged within the previous 6 months by a competent person.
- Perform a visual check on the anchor point that will be used. If it has corroded, has loose or missing bolts, has been bent or damaged, or if found unsuitable in any other way, it should not be used as an anchor point.
- Connect to the anchor point prior to undertaking any work activity.
- Ensure that the diameter of the "D" hook on the belt exceeds the throat depth of the attachment hook on the lanyard to prevent "roll out."
- Only use a retractable lanyard where its maximum length does not allow approach to a position where a fall is possible.
- Ensure that all components of the fall restraint system are compatible.

6.5 FALL ARREST SYSTEM

Fall arrest system is a form of personal protective equipment that safely stops personnel in the event of fall from a height.

6.5.1 Anchorages & Anchorage Connectors

Standard anchorage of sufficient capacities shall be used and comply with the regulatory requirements or codes and standards. Anchorage provided with manufacturer's certification shall be used. The anchorage to be able to support at least 2268 Kgs (5000 lbs.) and should be designed, installed, and used as part of complete fall arrest system per person.

The anchorage shall be located at a height that ensures the fall is arrested before the worker falls, minimizing the free fall distance, and reducing the risk of injury. Anchorages used for fall restraint should be designed to withstand a tensile force of at least 4 times the intended load (such as the weight of the employee plus tools and equipment). Fall arrest anchorages should be capable of withstanding a force of 2268 kg (5000 lbs.) per person.

Whenever possible, select anchorage points and lanyard lengths that limit the free fall distance to less than 0.6 meters (2 feet). This is a key factor in minimizing the impact forces on the worker during a fall.

The anchor points for lanyards, harnesses, and vertical lifelines should meet the following requirements:

- **Support Capacity:** The anchor point should be able to safely support a person falling from any height, ensuring the fall is arrested effectively.
- **Secure Installation:** The anchor points should be installed in a manner that prevents accidental disengagement from support structures.

- **Inspection:** Anchor points should be inspected periodically by a competent person to ensure they remain in good condition and capable of supporting the required load.
- **Attachment and Detachment:** Anchor points should be placed in locations where attachment and detachment of fall protection equipment can be done safely and without risk of damage to the equipment or the worker.
- **Height Considerations:** Anchor points should be placed above shoulder height whenever possible to minimize fall distance.
- **Sharp Edges:** The anchor point should be free of sharp edges or other hazards that could damage or cut the lanyard or other fall protection equipment.

Anchorage for fall arrest should be designed to withstand a tensile force of 2268 Kg (5000 Pounds), 22.6 Kilo Newton per person.

As per IS standards, the minimum width and thickness of webbing for waist straps should be 40mm and 3mm, respectively. The waist belts shoulder straps, hoisting straps, sole straps and all type of belts and harnesses should not break under a minimum tensile load of 2268 kgs (5000 lbs.). The anchorages and connectors should meet the following requirements:

i. Anchorages used for the attachment of personal fall arrest equipment should be independent of any anchorage being used to support or suspend work platforms or equipment's.
ii. Anchorage connectors should be used as recommended by the equipment manufacturer and separate anchorage connector should be used for each person attached to an anchorage. Anchorage connectors should be subject to the same capacity criteria as the anchorage.
iii. Anchorages should be inspected for obvious defects or deformities prior to use.
iv. The anchorages such as steel trusses, equipment structural attachments (such as lifting lugs and eye bolts), rigging (such as hoist hooks, beam clamps, and slings) are conditionally acceptable.
v. Scaffolding can be used as an anchorage point for personal fall arrest systems during the erection, dismantling, and use of scaffolds, but only when no other feasible anchorage is available. Prior to use, scaffolding should be evaluated by a competent person to ensure its structural integrity and suitability as an anchorage point. This evaluation should confirm that the scaffolding can safely withstand the forces associated with a fall. If scaffolding is used as an anchorage, it should meet all relevant safety standards, and it should be appropriately identified and marked for use in this manner. Scaffolding should never be used as an anchorage unless explicitly approved by the competent person and in accordance with the manufacturer's guidelines.

Each Site/Business should review the anchoring points requirements, installed, or identified. The anchoring points inventory list should be developed and maintained. Under no circumstances, the equipment cables, wire ropes, supports etc. (irrespective of the equipment running condition) should not be used as Anchorages and Anchorage connectors unless OEM specifically indicates and adequate marking or signages provided on the equipment or in equipment manual.



Figure-7 : Anchorage and Connectors

6.5.2 Lifelines

After the anchorage point, the integrity of the lifeline that supports the lanyard of the full-body harness is crucial for fall prevention. While many standards permit the use of 7/8 inch wire-core manila rope (in situations involving potential exposure to cutting or abrasion), or 3/4 inch manila rope or its equivalent, with a minimum breaking strength of 2500 kg (5400 pounds), all JSW sites will require the use of a minimum 8mm diameter, 1x19 construction, 316 stainless steel marine-grade cable with a maximum breaking strain of 40 KN for the lifeline support.

This lifeline should be installed in such a way that it minimizes the risk of injury in the event of a fall. It is important to ensure that all lifeline systems are inspected regularly for signs of wear, damage, or corrosion.

The Electrical Safety Standard JSW/GHS/GS-11 should be followed when working with electrical hazards in proximity to lifelines. This standard outlines the precautions that need to be taken to prevent electrical incidents while working at height, especially when lifelines may be in proximity to exposed energized equipment or electrical sources.

If vertical beams are used, the anchor point should be directly above a horizontal member to prevent slippage. However, if anchor has sharp edges that may cut a standard lanyard when exposed to the forces generated in a fall, column wraps should be used to protect the lanyard.
The following are not to be used for anchorage points:

- Conduit and support
- Pipe and pipe support, hangers.
- Cable trays and support
- Electrical conductors.

i) Purchase specifications for all Fall prevention and protection equipment should meet relevant IS/EN standards.
ii) Design specifications should confirm to EN standard for Horizontal, Vertical, inclined systems or Anchor points. Moreover, emphasis will be given to compliance of product beyond EN norms.

The points to be considered should be as follows:

1. Vertical System Specification

The vertical system should comply to **EN353-1** Standards and Specifications.

It should consist of the following components:

- 8mm Dia 1x 19 construction 316 stainless steel Marine grade cable maximum breaking strain of 40 KN.
- A top anchor assembly 316 stainless steel capable of taking 15 KN, including 18mm Dia hole to attach swage toggle.
- Swage toggle unit with castle head nut and bolt, with locking split pin 316 stainless steel. Swage toggle should be capable of taking 75 tons of swaging (3 x 25-ton swages).
- A slip indicator swage with 25 tons (25-ton press x 10,000 PSI pressure/ 700 bar).
- Intermediate wire guides 316 Stainless Steel, with Helix wire guides to allow the cable to be fitted. The Fall Arrestor should pass through the wire guides without any manual intervention totally hands free. The 8mm Dia cable is to be fitted with an 80mm distance from the ladder climbing rung maximum load 13 KN.
- The whole system should be tensioned at the bottom anchor with a friction disc, an indicator and the system should be tensioned to 80kgs tension. The bottom anchor tensioning system, friction disc and cable clamp should be manufactured from 316 Stainless Steel. The cable clamp device should have 3 x Allen key tensioning screws. Two 30mm across flat tensioning nut, one used as a locking mechanism.
- The systems should have more than 6,000 hours of salt spray test to prove its worthiness for more than 20 years.
- The wire rope used in the system should have RIBE cycling test to ensure that the wire can withstand metal fatigue for 20 years.
- The spacing between intermediates should be well supported by an independent test such as for the wake galloping effect.

2. Horizontal System Specification

The Horizontal Fall Arrest Systems should comply to **EN 795** Standards It should consist of the following components.

- 8mm Dia 7x7 construction 316 stainless steel cable maximum breaking strength of 40 KN.
- Two end anchors 316 Stainless steel with 2 x 14mm Dia holes in each anchor and a 16mm Dia hole for the entry terminal/ shock absorber (H- X Tenda) static strength of 45 KN.
- Intermediate "D" Rings 316 Stainless Steel with 14mm Dia hole complies with **EN 795** Class A1 and C anchorage device minimum static strength 45 KN.
- Intermediate hanger 316 stainless steel static strength 50 KN complies to **EN 795** Standards
- H-X Tenda with swaging, tensioning friction disc with threaded section 1/2 "- UNF R/H 93mm long. Manufactured from 316 stainless steel, static strength 52kn, normal preset tension 80kgs. With a maximum extension of 135mm peak force of 4.93 KN over 175ms.
- Threaded swage L/H 179mm long, 316 stainless steels. For 8mm/5/16" 7x7 construction cable swage section 80mm, threaded section 80mm long. Diameter 12.7mm
- Turnbuckle body forged bronze-chrome plated ultimate load >60kn; 165mm long, threaded section 51mm long left hand and right- hand threaded sections.
- Entry terminal 316 stainless steel with 73mm swage section to take 3 x 25 tons, 6mm Hex DIE swages. Ultimate load 50kn complete with entry gate made of nylon, clevis pin made of 316 stainless steel and an arrow tape vinyl black and yellow in color.
- Proven through calculations that in case worst case scenario fall the horizontal deviates not more than by 15 degrees.
- Proven through suitable load calculation of systems of different length and differing span lengths (including 90-degree corner), line deflection and tension. It is proven accordingly if we permit 2 or more users to use the system simultaneously.
- The travelling device should be made of 17/4 pH Stainless Steel and should pass through intermediates without any manual intervention.
- There should be 2 different versions of the travelling device: one which is removable and another non-removable.

3. Anchor Points for Rope Access

- The Anchor Points should be made of 316 stainless steel and electro polished. 102.2mm x 71.7mm x 60.4mm in diameters.
- The Anchor Point should be certified to EN795 Standards and Specifications.
- It should have a 18mm DIA hole to accommodate M16 A4/80 bolt with a sheer of 75kn, and a pull- out strength for M16 A4/80 bolt of 50kN.
- 100% dye penetration and x-ray inspected.
- Batch conformances test minimum static strength of 45 KN.

4. D-Ring For maintenance work

- Static Strength greater than 24KN in all working directions
- Should be certified as per BN ES 795 Class A1.
- Always use M12 Bolts minimum grade A4/70 fixings.
- If used as a single point anchorage, then a warning notice should be used.
- 100% dye penetration and x-ray inspection
- Minimum Static Strength 45KN
- Should be made of SS 316 L grade.
- The outer and inner diameter of D-rings should be 58.00 mm and 38.8 mm.

5. Overhead Single Span System

- The system should be capable of spanning 60m without any requirement for an intermediate support.
- The system should be capable of being used by up to three users.
- The product should be clearly marked with CE mark and an individual serial number to ensure traceability.
- The system should be independently evaluated by a notified body in accordance with the European Standard EN795 for Protection against falls from height – anchor devices – requirements and testing.
- The traveler device on the system should comply with EN 362:1992. Personal protective equipment against falls from a height. Connectors.
- The system should use 1x19 stainless steel, diameter 8mm, with a breaking strain of 40 kN.
- The system should use an in-line constant force energy absorber, ensuring that the maximum load in the system does not exceed 18kN in the event of a fall.
- The system cable should be tensioned to 5kN to prevent cable sag and whiplash in the event of a fall.
- The system should incorporate a visible system tension indicator.
- The system should have the capability of incorporating intermediate supports, which the traveler should pass through easily without the need for disconnection.

- The product should be installed by a Registered Installer strictly in accordance with the manufacturer's requirements and specification.
- The system should hold an EC declaration of conformity.
- The manufacturer should hold a valid ISO9001 certificate.
- The manufacturer should provide evidence that batch conformance tests using periodic X-rays of components and periodic static and dynamic tests are conducted to prove component quality.
- The manufacturer should provide evidence that batch conformance tests using periodic X-rays of components and periodic static and dynamic tests are conducted to prove component quality.

6. Overhead Multi Span System

- The Travelling device is designed to be installed permanently captive to the cable.
- Only 8mm 1 x 19 construction stainless steel cable falling in the limits of 7.92mm to 8032mm (0.312in to 0.327in)
- 100% visual inspection on all critical items,100% inspection gauging,100% visual inspection of sub and final assemblies. Batch conformance evaluated to 15kN. no deformation in direction of main load.
- The Travelling device should be made of Stainless Steel fully heat-treated condition grade C, AISI 440c corrosion resistant bearing steel and/or Marine grade 316 stainless steel.
- The intermediate bracket should be installed onto the system in the correct orientation to allow the device to pass through the bracket correctly.
- The system should be capable of being used by up to 2-3 users.
- The product should be clearly marked with CE mark and an individual serial number to ensure traceability.
- The system should be independently evaluated by a notified body in accordance with the European Standard EN795 for Protection against falls from height – anchor devices – requirements and testing.
- The traveler device on the system should comply with **EN 362:1992**. Personal protective equipment against falls from a height.
- The system should use 1x19 stainless steel, diameter 8mm, with a breaking strain of 40 kN.
- The system should use an in-line constant force energy absorber, ensuring that the maximum load in the system does not exceed 18kN in the event of a fall.
- The system cable should be tensioned to 5kN to prevent cable sag and whiplash in the event of a fall.
- The system should incorporate a visible system tension indicator.
- The system should have the capability of incorporating intermediate supports, which the traveler should pass through easily without the need for disconnection.
- The product should be installed by a Registered Installer strictly in accordance with the manufacturer's requirements and specification.
- The system should hold an EC declaration of conformity.
- The manufacturer should hold a valid ISO9001certifcate.
- The manufacturer should provide evidence that batch conformance tests using periodic X-rays of components and periodic static and dynamic tests are conducted to prove component quality.
- Left Hand Threaded Swage Should be used in conjunction with the extended turnbuckle body to give an overall adjustment of 450mm (18 inches).
- Extended Long run line tenser should be used in conjunction with the extended turnbuckle body to give an overall adjustment of 450mm (18 inches).
- The tension indicator disk spins freely at a load of 5kN.
- The turnbuckle body should be made of SS 316. The left- and right-hand threaded nuts provided to lock the turnbuckle in position on the threaded shafts.

7. Lifeline System for Roofs

- The post should be an aluminum polyester powder coated base plate, secured to the external roof top sheet via 4 x aluminum split clamps, Self-thread screws or Bulb rivets that allow for the thermal movement of the roofing system.
- The powder coated post body, containing the stainless-steel energy absorbing coil, is to be manufactured from aluminum with an electro polished stainless-steel dome. Both the base plate and body need to be evaluated to the following standards and results:
- 1000 hours Salt Spray to ASTM D1186 Method B – With the result being: No signs of corrosion or disbandment or reduction in gloss.
- 1000 hours Acetic Acid Salt Spray in accordance with BS EN ISO 2360:2003 – With the result being: No signs of corrosion over any area of the coating.
- The complete system to be capable of supporting three users working simultaneously at any point along the 8mm 7x7 stainless steel cable, even in the same span.

- The manufacturer should demonstrate that an individual post can absorb a direct dynamic load of 300kg dropped through 1.5m and limit the force to the roof to 10kN in shear without damage to the roofing substrate.
- The manufacturer should demonstrate that the individual post works primarily in a shear force condition and not with a turning moment force, which could seriously damage the roof.
- The manufacturer should demonstrate that each post can absorb a static load of 20kN held for three minutes.
- Once installed, the post should be capable of absorbing the above load requirements in any direction and evidenced by full scale testing.
- The energy absorption of an individual post should not be less than 5000J.
- All posts will be placed at a minimum of 6m to a maximum of 10m apart from each other.
- All top fittings, brackets, integral tension indicator and critical castings are to be manufactured from stainless steel and electro polished where applicable.
- The travelling device will allow for hands free operation either side of the line without detachment from the system.
- The post should be installed by a Registered Installer strictly in accordance with the manufacturer's requirements and specification.
- The system should hold a valid CE Mark and should hold EC declarations of conformity.
- The product should be independently evaluated by a notified body in accordance with the European Standard EN795 for Protection against falls from height – anchor devices – requirements and testing to both EN795 Class A & Class C.
- The manufacturer should hold a valid ISO9001 certificate.
- The manufacturer should provide evidence that batch conformance tests using periodic X-rays of components and periodic static and dynamic tests are conducted to prove component quality.

- The supplier or designer should be provided with following information:
  - Written purchasing specification
  - Engineered drawings and schematics.
  - Pre-Commissioning inspection checklist
  - Extracts from relevant legislative requirements
  - Relevant safety standards or engineering standards
- When working at height equipment is fabricated by the operation, a competent engineer should review it at the design stage and when fabrication is completed to assess and approve the equipment before it is permitted for use.
- Anchorage points and static lines should be fitted by a competent person to ensure that they are positioned appropriately and can take 15kN load per person.

6.5.3 Lanyards

A lanyard is a flexible rope, wire rope, or strap with connectors at both ends used to attach a body belt or body harness to a deceleration device, lifeline, or anchorage point. Lanyards should be maintained in a clean and intact condition, and inspected before each use for wear, tear, or any signs of activation of the fall arrest (energy-absorbing) system.

When using lanyards, the following requirements should be adhered to:

- Always use the shortest lanyard length that is practical, ensuring minimal free-fall distance.
- Single lanyards are prohibited at JSW sites.
- Lanyards should be anchored in a manner that limits the free fall distance to no more than six feet (1.83 m).
- Lanyards should be used with a shock absorber, unless the fall distance is reduced sufficiently to limit the fall force to 1,800 pounds (816 kg).
- Ensure that lanyards are free of knots or tangles.
- No more than one worker should be attached to a single lanyard.
- Use dual or "Y" lanyards when necessary to achieve 100% fall protection, especially in situations where workers need to remain tied off while moving.

- When not in use, secure the lanyard to avoid creating a tripping hazard or allowing it to become entangled in equipment.
- Do not use flexible steel cable lanyards for work on or near electrical equipment. A non-conductive lanyard should be used in such situations.

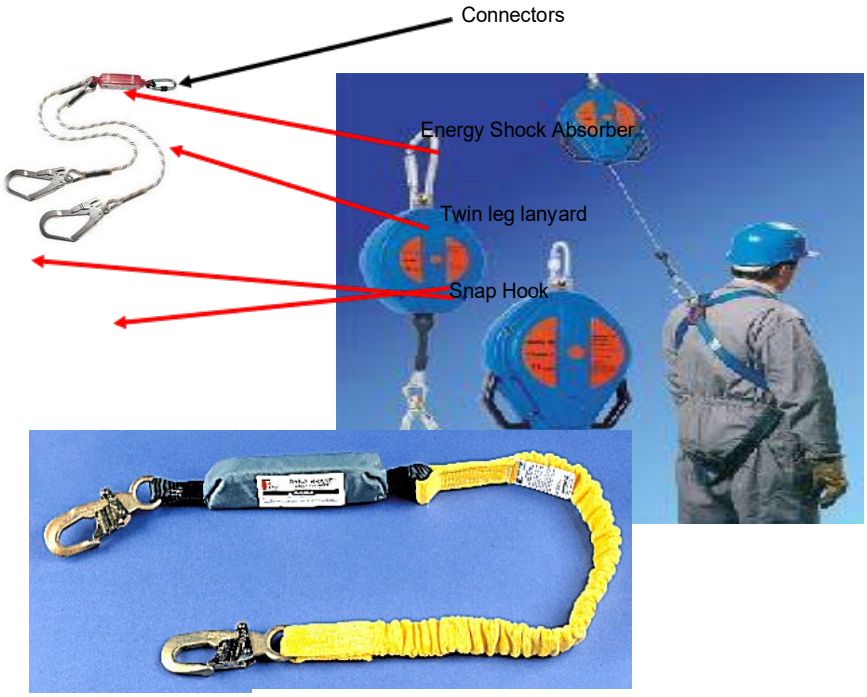


Figure-8 : Lanyards

6.5.4 Inertia Reels

An inertia reel (or retractable lifeline) is a specific type of vertical lifeline that works somewhat like the seatbelt of a car. The lifeline is coiled inside a protective housing. As a worker moves up or down, the lifeline extends or retracts. The line is under constant tension and leaves no slack. The moment a worker falls, the lifeline locks and stops the fall after a short distance. Many inertia reels have fall indicators on their protective housings. Do not use the lifeline if the indicator shows that a fall has occurred. After a fall, the manufacturer should reset the lifeline.

Inertia reels should only be used for fall arrest and are not designed for continuous support. They should not be used as a working support. These devices are effective in arresting falls, but they may be less effective in certain situations, such as stopping a fall on an inclined surface, like a pitched roof, where a sharp pull is needed to activate the mechanism.

After a fall, the inertia reel should be inspected, and if the fall indicator shows activation, the device should not be used until reset by the manufacturer.

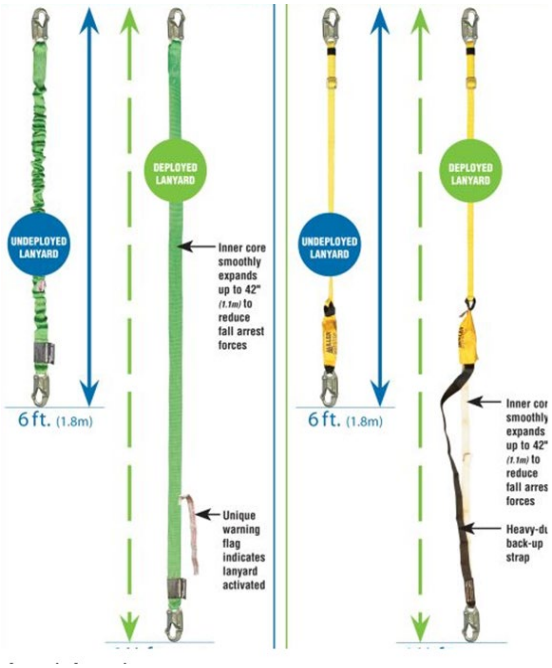


Figure-9 : Inertia Reel

6.5.5 Fall-Arrestor (Rope Grab)

The fall-arrest device should meet the following requirements:

- Should have an end-of-life cycle indicator.
- The carabiner should rotate 360º to prevent the rope from twisting.
- It should include an anti-locking protection spring.
- The mobile fall arrestor should have a double safety lock and a simultaneous locking mechanism at two points of the lifeline.

6.5.6 Snap Hook

Snap hooks, or spring hooks, have a spring mechanism to prevent accidental unhooking. When using snap hooks in the fall protection system, the following requirements should be met:

- Only self-closing, self-locking snap hooks are allowed for fall protection.
- Snap hooks should open and close properly and be fully closed around the anchorage point before use.
- Locking mechanisms of snap hooks should be checked for proper functionality before each use.

6.5.7 Shock Absorbers (Deceleration Devices)

Shock absorbers or deceleration devices are essential components of fall protection systems. These devices reduce the impact forces on both the worker and the anchorage point in the event of a fall. Common types include shock-absorbing lanyards, self-retracting lanyards, and rip-stitch lanyards.

- Shock-absorbing lanyards should be used if the free-fall distance is greater than 6 meters (18.5 ft.), to prevent the risk of the worker hitting the ground.
- All shock-absorbing lanyards should come with the manufacturer’s certification.
- Inspect the outer portion of the shock-absorbing pack for any signs of damage, such as burn holes or tears.
- Check stitching on the shock absorber pack, especially where it attaches to the D-ring, belt, or lanyard, for any loose strands, rips, or deterioration.

6.5.8 Retractable Devices and Self-Retracting Lifelines

Retractable devices are designed to arrest a fall within 2 feet (0.6 m) and sustain a minimum tensile load of 1,360kg when fully extended. When using Retractable devices, the Site should ensure that:

- Locking mechanism should be evaluated before each use.
- Lifeline should be pulled out and inspected for cuts, fraying, or other signs of damage.
- Ensure to use taglines to make the device accessible from the ground.
- It should be ensured that taglines are used to prevent the uncontrolled retraction of these devices.
- It should be ensured that retractable devices should only be attached to overhead anchorage.
- It should be ensured that retractable devices attached to fixed anchorage should be used with the wearer at less than a 45-degree angle from the device. This will reduce the hazards of a swing fall.
- Ensure that retractable devices bearing current manufacturer's certification should be used.

6.5.9 Full Body Harness

A full body harness is an essential personal fall protection device, designed to hold the wearer upright in the event of a fall from height. If worn correctly, a full body harness will distribute the energy generated during a free fall evenly across the wearer's body, thereby reducing the potential for serious injury.

- The Site should ensure that full-body harnesses is worn and properly anchored when workers are working from aerial lifts, scissor lifts, suspended work platforms, suspended scaffolds, and similar equipment.
- It should be ensured that the full-body harnesses fit properly and should be worn with the straps tucked so as not to be caught on equipment or otherwise cause a hazard. Chest straps should be worn between the chest and collarbone and the rear D-ring should be worn between the shoulder blades.
- The Site should ensure that body belts should not be allowed for fall arrest.

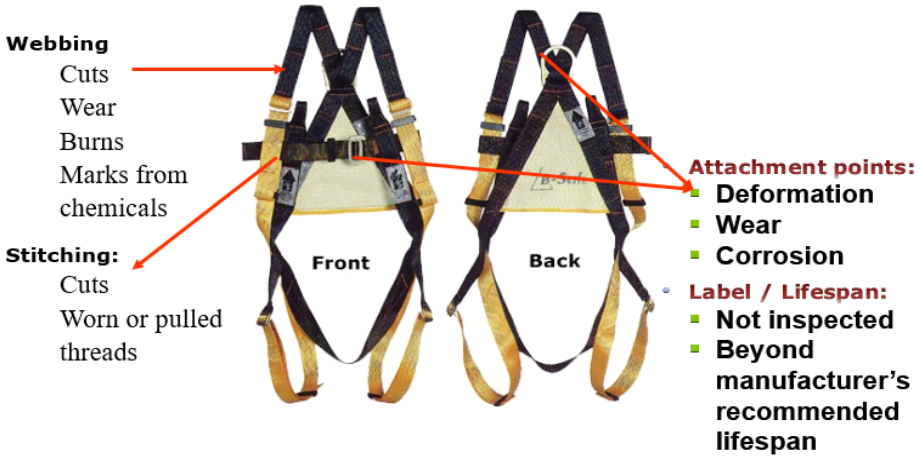


Figure-10: Full Body Harness

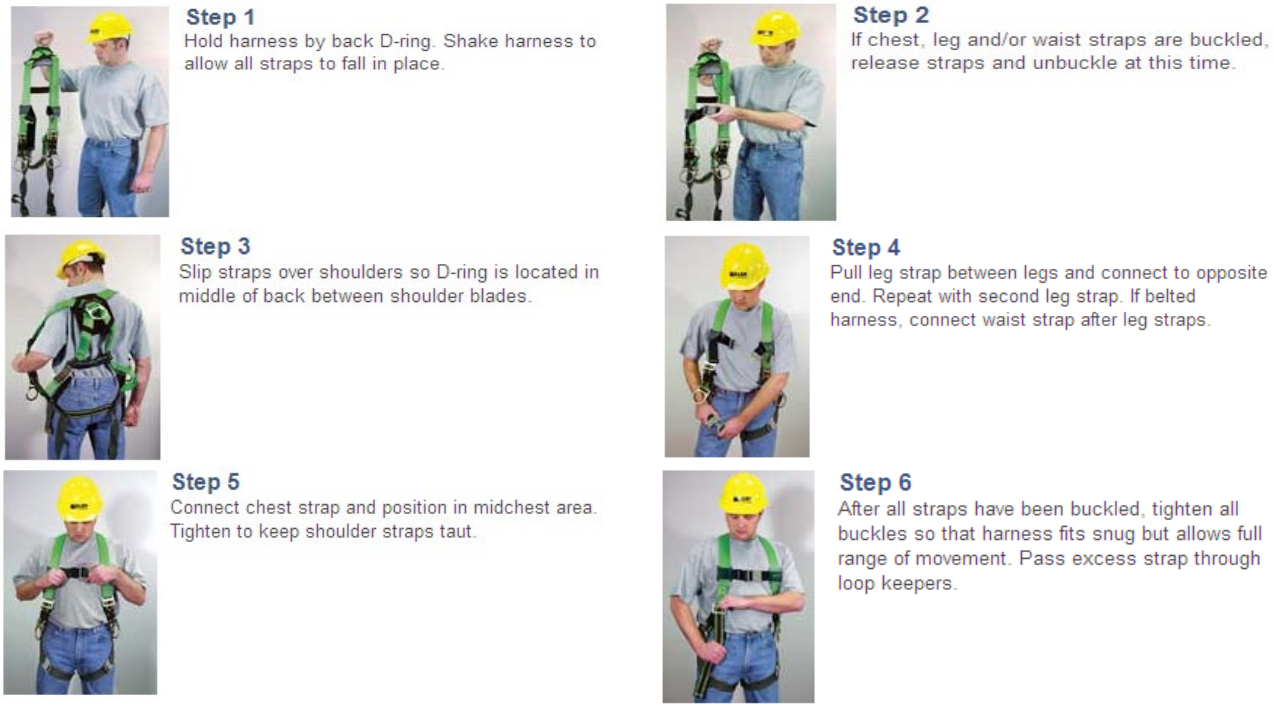


Figure-11: How to Wear Full Body Harness

Table-1 : Work at Height Equipment and Their Uses

Description	Use	Equipment
Work Restraint	Prevents the worker from reaching a point where a fall could occur. Note: Restraint equipment should not be used for fall arrest.	• Anchor Devices • Work restraint belt or full body harness. • Restraint lanyard/belt
Fall Arrest	Safely arrests any fall from height	• Anchor Devices • Full body harness • Connecting devices (e.g.: energy absorbing lanyard)
Work Positioning	Designed to hold and support a worker in place allowing a hands-free position	• Anchor Devices • Suspension harness • Full body harness with positioning belt • Work positioning lanyard

6.5.10 Safety Net System

Safety net can be defined as a net to protect workforce from injury after falling from heights by limiting the distance they fall and deflecting to dissipate the impact energy. It also refers to devices for arresting falling or flying objects for the safety of workforce beyond or below the net.

JSW Site should ensure to provide safety nets when workplaces are more than 25 feet (7.6 meters) above the ground or where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines, or safety belts is impractical.

When using a safety net system, the Site should ensure to comply but not limited to the following provisions:

- Safety nets should be installed as close as practicable under the surface on which workers are working, but in no case more than 25 feet (7.6 meters) below.
- Safety nets should be extended outward from the outermost projection of the work surface as follows.

Vertical distance from working level to horizontal plane of net	Minimum required horizontal distance of outer edge of net from the edge of the working surface
Up to 5 feet (1.5 meters)	8 feet (2.4 meters)
5 to 10 feet (1.5 to 3 meters)	10 feet (3 meters)
More than 10 feet (more than 3 meters)	13 feet (4 meters)

Safety nets should be installed with sufficient clearance to prevent contact with the surface or structures under them when subjected to an impact force equal to the drop test described in below point:

- Safety nets and their installations should be capable of absorbing an impact force equal to the drop test described in below point.
- Safety nets and safety net installations should be drop-tested at the jobsite:
  - After initial installation and before being used
  - Whenever relocated.
  - After major repair
  - At 6-month intervals if left in one place

- The drop test should consist of a 400-pound (182 kilogram) bag of sand 28-32 inches (0.7-0.8 meters) in diameter dropped into the net from the highest surface at which workforce are exposed to fall hazards, but not from less than 42 inches (1 meter) above that level.
- In cases where drop-test could not be performed, The Site should ensure that a designated competent person certifies that the net and net installation have sufficient clearance and impact absorption. This should be done by preparing a certification record prior to the net being used as a fall protection system. The certification should include:
  - Identification of the net and net installation
  - Date on which it was determined that the net and net installation were in compliance.
  - Signature of the person making the determination and certification
  - It should be ensured that the certification record for each net and net installation is updated and made available at the jobsite for inspection.
  - Defective nets should not be used, and defective components should be removed from service.
  - Objects which have fallen into the safety net, such as scrap pieces, equipment, and tools, should be removed as soon as possible from the net and before the next work shift.
  - Maximum mesh size should not exceed 6 inches by 6 inches (0.15 x 0.15 meters). All mesh crossings should be secured to prevent enlargement of the mesh opening, that should be no longer than 6 inches, measured centre-to-centre.
  - Each safety net should have a border rope for webbing with a minimum breaking strength of 5,000 pounds (2268 kilogram).
  - Connections between safety net panels should be as strong as integral net components and should not be spaced more than 6 inches apart.
  - All safety net systems should meet the requirements of Indian Standard (IS: 5175). For Europe applications, all safety net systems should meet the requirements of European Standard (EN 1263-1)
  - Safety Net should be with a minimum breaking strength of 705 pounds (320 kilogram) per mesh, and mesh size 2.5 inches (64 mm)

Use of Safety Nets as Part of a Safe System of Work

Safety nets can be used as part of a safe system of work to arrest a person's fall. They reduce injury because they absorb a large proportion of any impact energy, which they do by suffering plastic deformation when impacted. They provide a safety system that is collective (i.e. protecting multiple workers at the same time) and passive (i.e., one that requires no input and little co-operation from the workers it is being used to protect).

Safety nets are typically used:

- to minimize injury due to falls from leading edges, through liner panels or through temporarily fixed materials in new build roofing.
- to guard roof lights and fragile roof materials during cleaning, maintenance and replacing the roof; and
- to minimize injury from falls during roof support erection, e.g., when fitting diagonal bracing.

Nets should never be used where sharp-edged objects and objects more than 33 pounds (15 kilogram) (i.e. capable of damaging the net and affecting its performance) can fall into them. If such objects are being used, then alternative arrangements need to be put in place.

Selection & Erection of Safety Nets

The selection and erection of safety nets should only be done by trained, qualified and competent personnel.

Safety nets should conform to relevant standards (e.g. *BS EN 1263-1:2002 - Safety nets. Safety requirements, test methods*). BS EN1263-1 specifies two classes (A and B) and two mesh sizes (60mm and 100mm) and although both are suitable for use in roof work, the 100mm mesh net is lighter and will, therefore, have a lower initial sag. All nets should have sacrificial test meshes / cords which are removed every 12 months for testing. At all times there should be written evidence that the net has been tested within the last 12 months. (E.g. a certificate and / or a label from the testing facility). The only time when it is valid for a net not to have a test mesh is during the last year of its life.

Nets should be set up in accordance with the requirements of *BS EN 1263-2:2002Safety nets. Safety requirements for the positioning limits* and used only in accordance with the manufacturer's instructions.

Nets should be fitted as close as possible to the underside of the working platform to minimize the distances and consequences of a fall. Adequate clearance should be allowed below the net (including allowing for

deformation) for it to function properly and prevent a person from striking the floor or other objects in the case of a fall.

Wherever possible, rig nets to prevent falls of 2 m or less. If they are to be used to arrest falls greater than 2 m, they should have:

- an area greater than 35 m2.
- a minimum side length (width) greater than 5 m; and
- maximum support spacing of 2.5 m.

Where these criteria cannot be met then a Class B net should be used.

Safety nets can be connected to the structure by tie ropes, attachment devices or specially designed attachment points on the structure. When rigging safety nets, it is important to maintain their energy-absorbing characteristics. Too many fixing points and the net will become more rigid and imposes larger loads on the user, the structure, and the net itself. Too few fixing points and the net will sag and deflect too much under load. The manufacturer's recommendations and BS EN 1263-1 should be followed on the number and spacing of fixing points. It should also be checked that the supporting structure can resist the expected anchorage loads.

6.5.11 Ladders

A ladder safety system meeting regulatory requirement or national standards (Such as ANSI ASC A14.2-2017 or IS 3696-2 etc.) should be used. Ladder should be permanently installed ladder or rigidly installed portable ladder. The system should provide continuous protection while a person ascends or descends the ladder by automatically locking and arresting a fall.

It is worth noting that working from ladders should be discouraged and rope ladders should not be used for working at height.

Portable ladders should be used for works which require one hand, for light work and short duration. Mobile scaffold should be considered as priority for jobs such as street light repairs, painting, and façade cleaning etc.

Following three types of ladders are used in industry:

6.5.12 Fixed Ladders

Fixed ladders are vertical or near-vertical ladders fixed to a structure. If a series of fixed ladders is used to gain access to a surface, landing platforms should be provided at no more than 6 meters apart. Fixed ladders higher than 16 feet (5 meters), fixed to vertical walls or frames or having an inclination greater than 75 degrees, should be provided with a means to protect a worker from falling. This may consist of a ladder cage or a fall arrest system starting from 2.50 m height from the floor or working surface.

A ladder cage is a permanent structure attached to a ladder that provides a barrier between the worker and the surrounding space. It serves only as a support to a worker if the worker needs to rest against the barrier. It does not provide complete fall protection on its own.

However, it could be used in conjunction with a full body harness and lanyard. The worker would be able secure to the rung or side rail of the ladder at any time during the climbing of the ladder. This still does not provide complete fall protection.

A much better approach is to provide a complete fall arrest system in the ladder design. This could be a permanently installed metal rail or wire rope anchoring system with an automatic fall arresting device.

The automatic fall arresting device would travel freely on the rail or cable, allowing the worker to use both hands while climbing up or down. Should the worker slip or fall, the device would lock instantly and limit the worker's fall to a matter of centimetres.

Fixed ladders should be placed clear of roadways, and clear of the path of any mobile equipment such as overhead cranes. Finally, a risk assessment based on the height of the ladder and the frequency of use will determine the need of installing a fall arrest system for a fixed ladder.

The issuance of a work permit will depend on the severity of the hazard and the risk involved.

Workers using fixed ladders should:

- Visually check the condition of the ladder prior to climbing and continuously check its condition whilst climbing it.
- Ensure that no more than one worker is on any section of the ladder at one time.

- Ensure that materials are lifted and lowered in an approved manner.
- Ensure that access to, and egress from the ladder, is always unobstructed.

6.5.13 Portable Ladders

Extension or single ladders should be used only as a means of access or egress from a work area. They should not be used as working platforms, many falls resulting in death and serious injury take place when people attempt work from portable ladders. Mobile ladders should meet general design characteristics set in regulation EN 131 -2013

Any portable ladder used at a workplace should be set-up on a surface that is solid and stable, and set-up to prevent the ladder slipping. Slipping of ladders can be prevented by:

- placing single and extension ladders at slope of at least 4 to 1.
- securing single and extension ladders at both the top and bottom.

Timber Portable Ladders should not be painted (this can hide cracks or defects in the timber).

Metal Portable Ladders should not be used when carrying out work on live electrical equipment. They should also not be painted as this can hide defects in the welds – and to guarantee the periodical inspection of the ladder.

6.5.14 Step Ladders

Step ladders should be used only in their fully open position, and a worker should not carry out work from a step ladder if they are standing higher than the third rung from the top.

- When working from a step ladder, with height less than 6 feet (1.8M) above the floor, use of fall protection equipment is not required, unless working backward.
- If working on a stepladder with height 6 feet (1.8M) or higher above the floor, fall protection equipment should be used. Fall protection equipment used should be anchored to anchoring point independent of Step ladder.
- When working from a ladder where harnesses are not being used, the person on the ladder should avoid stretching to reach objects. A rule of thumb is to not stretch so far that your belt buckle is outside the rails of the ladder.
- Ladders should not be used for jobs where leaning over ladder is required.

Note: Fall protection (harness and lanyard) should always be attached to an anchor point before tying off the ladder. It should be detached only after untying the ladder. If no tie off point is available, the ladder should be continuously held by a second person to provide added stability.

The following safety measures should be taken for the use of ladders:

i. Fall protection should be used. If no tie-off point is available, the ladder should be held by a second person to provide added stability.
ii. When working from a ladder where harness is not being used, the person on the ladder should avoid stretching to reach objects. A rule of thumb is to not stretch so far that the belt buckle is outside the rails of the ladder.
iii. Ladders should not be used for jobs were leaning over ladder is required.
iv. Portable metal ladders and wooden ladders with metal reinforcements should not be used for any electrical work or work in substations, switch yards, or in any area where contact can be made with energized circuits.
v. Provision should be made for routine inspection and maintenance of all ladders (at least once in six months). Ladders should have stickers with the date of inspection, name of the person who inspected, and the date of next inspection due. Broken or damaged ladders should be promptly removed and destroyed.
vi. All ladders should be placed on firm ground, secured at top and intermediate positions to maintain them rigidly in place and to support the loads imposed on them.
vii. Ladders will not be used as work platforms or scaffolding or as structural members of scaffold or walkways. Ladders should not be used in horizontal position.
viii. Persons working on ladders should always ensure three-point contact.

ix. Persons should face the ladder when working from it. When it is not possible to work facing the ladder or when performing some tasks having requirement of both hands, fall protection should be worn and properly anchored.

x. Ladders should be placed with an inclination of 1 in 4 of the working height.

7. SPECIAL REQUIREMENTS

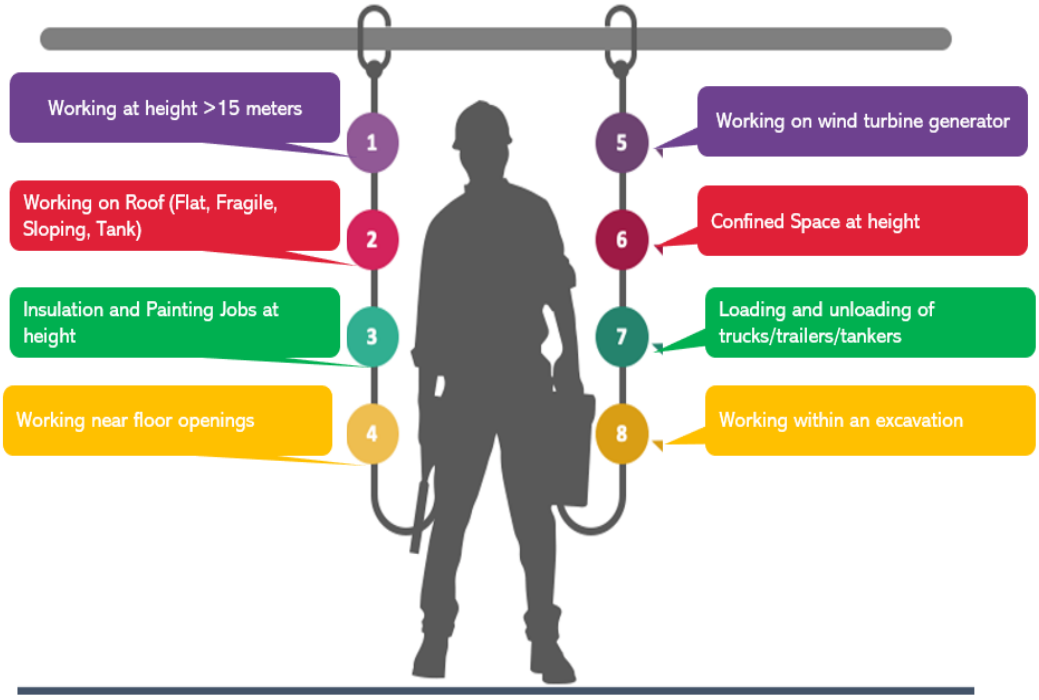


Figure-12: Special Requirements to be taken care of when Working at Height as explained below

7.1 SPECIAL CONDITIONS, ABOVE 15 METERS

When performing lift operations above 15 meters (50 feet), all personnel in the personnel basket (platform) should always wear a full-body double harness with the lanyard tied off to an approved anchor point (e.g., attached to the boom or to the basket). Only the tie-off points provided by the manufacturer of the equipment should be used. Anchoring the lanyard to the personnel platform (work basket) itself is not allowed. Securing the lanyard to an adjacent pole, structure, or equipment while working from a lift is prohibited.

Note: Never use a chain pulley block to lift the personnel cage.

7.2 CHERRY PICKER/HYDRAULIC BOOM/LIFT

An elevated work platform, also known as a cherry picker, boom lift, man lift, or basket crane, is designed to provide temporary access to work at heights that are difficult to reach using conventional means (e.g., ladders). These lifts feature a hydraulic boom arm with a platform or bucket at the end to carry workers, tools, and equipment to the necessary height.

Key Safety Requirements:

- **Operator Training:** Ensure that workers operating aerial lifts are properly trained in the safe use of the specific equipment.
- **Pre-Use Inspections:** Before use, inspect the aerial lift, checking that all controls are clearly marked and functional.
- **Legislation Compliance:** Aerial lifts should meet all applicable local legislative regulations.
- **Do Not Override Safety Devices:** Never override hydraulic, mechanical, or electrical safety devices.
- **Operating Instructions:** Always maintain and operate the lift according to the manufacturer's instructions.

- **Stand Firm:** Workers should always stand firmly on the platform floor. Do not sit, climb on the edge, or stand on the rails of the basket.
- **Lift Deficiencies:** Do not operate an aerial lift with noted deficiencies until repairs are made and the equipment is authorized for use.
- **Platform and Ground Controls:** Aerial lifts should have both upper controls (on the platform) and lower controls (at ground level) for emergency use. Lower controls should only be operated in an emergency or with permission from the worker on the platform.
- **Never Use Planks:** Do not use planks, boxes, or other items inside the platform to extend the reach.
- **Ground Stability:** Ensure all wheels are on a solid base, engage outriggers (if provided), set brakes, and use wheel chocks when on an incline. Do not exceed the lift's load limits (include workers, tools, and materials).
- **Wind Conditions:** Always check for safe wind conditions before use.
- **De-energize for Maintenance:** De-energize and lockout-tagout aerial lifts before performing any maintenance or repairs.

7.3 SCISSOR LIFT

A scissor lift provides a stable elevated platform. However, there are several hazards to consider when using scissor lifts:

Potential Hazards:

- **Weather:** High winds or adverse weather conditions can cause the lift to fall or topple.
- **Ground Conditions:** The lift can become unstable if positioned on soft, uneven ground or weak utility covers.
- **Overloading:** Overloading the lift can lead to accidents.
- **Uneven Terrain:** Driving over uneven or unstable ground can cause the lift to become unsafe.
- **Improper Braking:** If the lift's brakes are not properly set, it may move unexpectedly.

Safe Work Practices:

Inspect Equipment: Inspect controls, components, and the work environment before use.

Stable Surface: Only use the scissor lift on firm, level surfaces, and away from hazards like drop-offs, slopes, or obstacles.

Clear of Power Lines: Always ensure the lift is positioned at least 3 meters (10 feet) from overhead electrical hazards.

Overloading: Never overload the lift.

Weather Conditions: Operate the lift only in safe weather conditions, avoiding high winds, rain, or snow.

Stabilization: Set the brakes and stabilize the lift before raising it.

Work from Platform: Work only from within the guardrails; never remove or stand on the guardrails for extra height.

Report Malfunctions: Report any issues or malfunctions immediately to a supervisor.

Control Operations: All controls should be operated by the person on the lift. In case of emergency, authorized personnel may operate the controls from the ground to lower the platform.



Figure-13: Scissor Lift and Boom Lift

7.4 SUSPENDED PLATFORM

The use of crane, winch suspended personnel platform and man cage should be limited as far as possible unless there is no other safer, practical, and conventional means of access to an elevated work area.
Ladders, Scaffolds, stairways, aerial lifts, and personnel hoists should be considered. If these options are more hazardous or not possible because of structural design or worksite conditions, only then, the hoisting from a person from a crane suspended man-cage should be conducted with adequate precautions. Any work conducted at height should only be performed from an approved and certified temporary working platform. Never use a chain pulley block to lift the man cage.

Requirements for safe crane operation
Any crane that hoists a person should conform to the following requirements:

- Be placed on a firm foundation.
- Have a minimum safety factor of ten for the load line (wire rope) of the crane.
- Move the personnel platform slowly and cautiously without a sudden jerking.
- Put the brakes and locking devices “ON” when the personnel platform is occupied, and the crane is in a stationary working position.
- The combined weight of the loaded personnel platform and its rigging should not exceed 50 percent of the rated capacity of crane.
- Two-way communication between the personnel and the crane operator should be ensured.
- Independent lifeline should be provided with rope grab arrestor for individuals.
- Cranes with telescoping booms should be equipped with a device to clearly indicate the boom’s extended length.

The load radius to be used should be accurately determined prior to hoisting the personnel.

Design and Construction of Crane Suspended Personnel Platform

A qualified and competent engineer in structural design should design the man cage used for lifting personnel. The man cage should be designed to:

- Support platform weight at least five times the maximum intended load.
- Prevent tools, materials, and equipment from falling on employees below by having a standard enclosure/guardrail system that is enclosed from the toe board to the mid-rail.
- Have rotation-resistant rope with a minimum safety factor of ten.
- Keep the platform free of sharp edges, which may cause laceration to the occupants.

Safety Precautions

The crane suspended personnel platform should have the following:

- Positive locking safety latch.
- Structurally sound inboard guardrails and a locking gate.
- Permanent marking or plate that clearly indicates the platform’s weight and rated capacity o maximum intended load.
- Access gate, if provided, that does not swing outward during hoisting and is equipped with a restraining device to prevent accidental opening, and

- Adequate headroom for workers.

Load restrictions for crane suspended personnel platform.

The loading of personnel platforms should conform to the following requirements:

- Personnel platforms should not be loaded more than their 50% of the rated load capacity or maximum intended load as indicated on permanent markings.
- Only personnel required for the task to be performed along with their tools, equipment, and materials needed for the job should be allowed on the platform.
- All materials and tools should be secured and evenly distributed to balance the load while the platform is in motion.

Rigging for Suspended Personnel Platform

- The man-cage is connected to the crane hook by four slings and D Shackles.
- Legs of sling should be connected to a master link or shackle so that the load is evenly positioned among the legs.
- Associated rigging for attaching the personnel platform to the hoist line should not be used for any other purpose.

Load Function Test

Crane suspended man cage should be load evaluated to 150 percent of the platform's rated capacity in the following circumstances:

- When initially brought to a job site?
- After any repair or modification.
- Prior to hoisting personnel.

Load testing is achieved by holding the loaded platform, with the dead weights that are calibrated to within a safe tolerance and load evenly distributed, in a suspended position for 5 minutes. Then a competent person should inspect the platform and rigging for defects. If the competent person detects any problems, they should be corrected, and another proof test should be conducted.

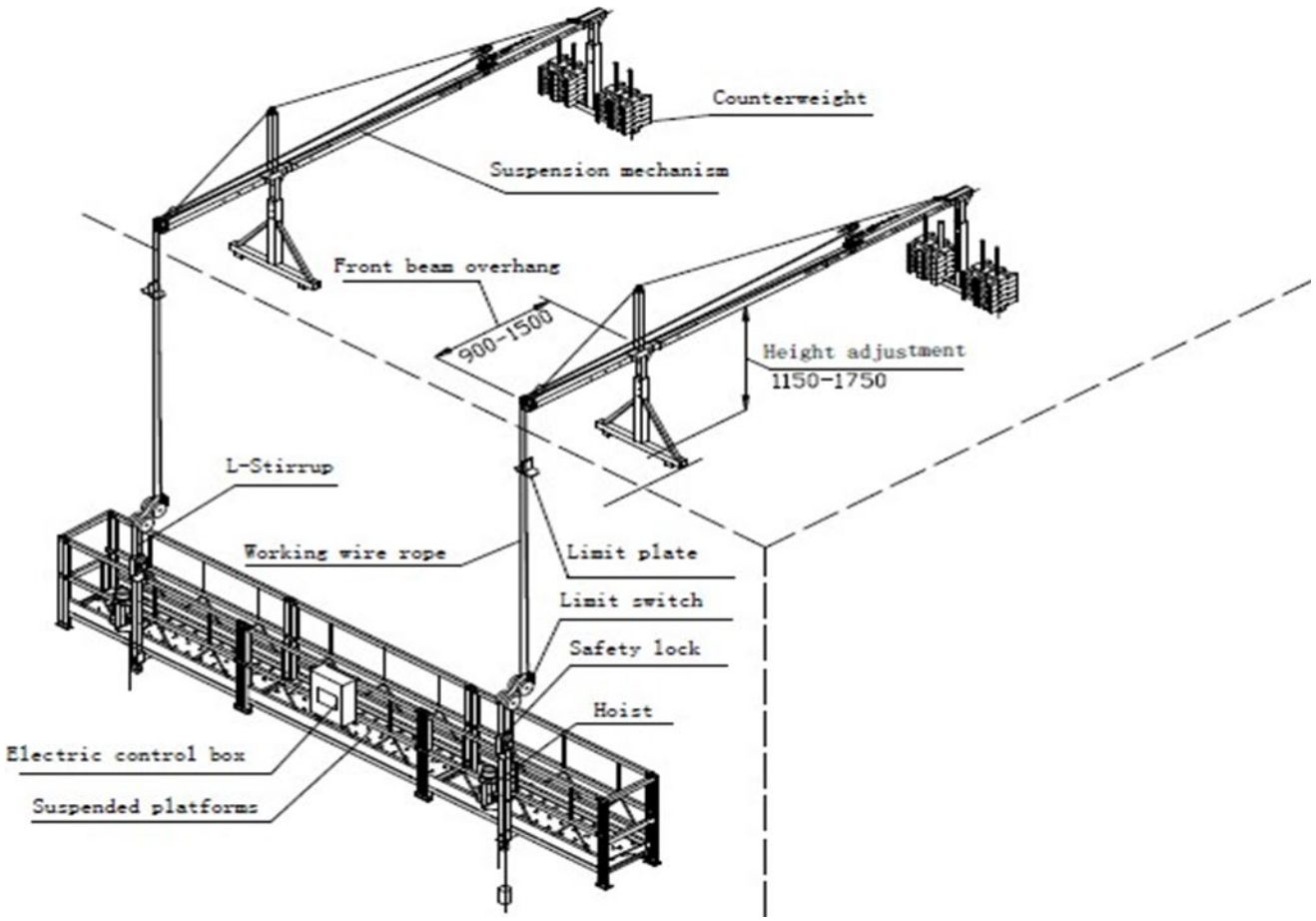


Figure-14: Sketch Showing Typical Suspended Working Platform Arrangement with Suspension, Counterweights

7.5 WINCH OPERATED MAN-CAGE AND SUSPENDED PLATFORM

Use of winch operated man-lift calls for stringent inspection and incorporation of safety features. As a minimal, following precautions should be taken:

a) The man lift should be certified by an approved agency and load test certificate should be obtained. The frequency of test should be as per the applicable legal requirements.
b) The winch rope should be inspected daily at both ends, starting at the winch as well as at the top. A register should be maintained for recording the inspections.
   - The winch operator should be certified for competency for winch operations.
   - The pulleys around the winch rope should be firmly and securely anchored. The pulleys should be subject to regular inspection and the findings should be recorded.
   - The man lift should have a secondary fall arrest system; man, lift should be fitted with limit sensors and emergency stop.
   - The man-lift should have a speed sensor for regulating speed of movement.
   - The man-lift should have a proper deck and railing system at the top.
   - Movement of personnel around the man lift and material lift should be strictly prohibited. A watcher may also be assigned for the purpose.
   - Emergency alarm as well as walkie-talkie sets should be provided for the operation.
   - Movement of man-lift under strong wind conditions should be prohibited.

7.6 SPECIAL HAZARDS

In case of hazard of honeybees, birds, monkeys, and any other, appropriate risk assessment need to be done. Person who will work at height to remove the beehives should wear appropriate PPE. Example PVC apron with hood, including full face mask. Similarly, hazard of bird hit, monkey attack should also be considered when working at heights.

As a rule, the risk assessment process should identify any potential for exposure to chemical or physical or biological agents or fire/explosion while work at height is conducted, including any potential exposure to asbestos containing materials located on the roof (e.g., asbestos containing materials in the roof slabs).

7.7 FLAT ROOF, FRAGILE ROOF, SLOPING ROOF, TANK ROOF

7.7.1 Flat Roofs

Roofs in horizontal plane, not fragile in nature.

- For any job within six feet (1.8M) from the edge of the roof, use of lifeline on any fixed structure for anchoring the lanyard is should. Warning signboards should be displayed all around. Access to the flat roof should be provided if not existing in the absence of staircase.
- All roofs should be treated as fragile until a competent person has confirmed that they are non-fragile.

7.7.2 Sloping roofs

Before working on a sloping roof, ensure that anchor points are available for attaching the lifeline with a retractable fall arrester system. If anchor points are not provided at the design stage, they should be installed prior to work commencing.

For roofs with a pitch greater than 30 degrees, standard guardrails and toe-boards should be provided at any point where a person could fall. Ideally, this should be incorporated into the roof design.

In cases where the roof pitch is steeper, or the surface is slippery, crawling ladders or boards should be used to provide safe access for workers.

A barrier should be installed at the lower edge of the sloping roof, or work should be performed from a securely supported working platform that is at least 430 mm wide, with guardrails and toe-boards in place.

Full edge protection at the eaves level is typically required for work on sloping roofs. The edge protection should be strong enough to withstand the force of a person falling against it. The steeper the slope and the longer the roof, the more robust the edge protection needs to be.

A properly designed and installed independent scaffold platform at eaves level is generally sufficient. Less substantial scaffolding barriers may not be strong enough, especially on larger or steeper roofs.

On large roofs with steep pitches, it may be necessary to install intermediate platforms to prevent workers from sliding down the roof and hitting the eaves protection.

When working within 2 meters of gable ends, additional edge protection should be installed at these points to prevent falls.

Powered access platforms (such as scissor lifts, cherry pickers, etc.) can serve as an effective alternative to fixed edge protection. These are particularly useful for short-duration tasks and during demolition work, when gaps or openings are created in the roof.

Storage of materials, tools, or equipment on the roof is strictly prohibited. All materials, hand tools, and equipment should be removed at the end of each workday.

For work on larger roof surfaces (size considered "large" based on a site-specific risk assessment), and where hot work is expected, the following minimum requirements should be met:

Two means of egress from the roof should be clearly identified, ensuring safe evacuation during an emergency.

An emergency lighting system should be provided to illuminate the location of emergency exits.

7.7.3 Fragile Surfaces

All roofs should be treated as fragile (a surface which would be liable to fail if any reasonably foreseeable loading were applied to it) until a competent person has confirmed that they are non-fragile. The following roofing material should always be treated as fragile:

- fiber-cement sheet
- roof lights.
- liner panels.
- metal corrugated sheets.
- glass; and
- chipboard.

Wherever possible, (as with all work at height) work should be planned to avoid the need for people to access fragile surfaces (e.g. by working from above or below the surface on a mobile elevating work platform or other suitable platform). If, however, work needs to be done on or near fragile surfaces, no matter how short the duration, then this should be done after a specific risk assessment. Controls could include combination of crawling boards/roof ladders (appropriately positioned and secured), fall restraint, fall arrest and/or other fall prevention/protection measures such as anchoring safety belts to lifelines.

It is recommended to use crawl ladders along with anchoring safety belt to lifelines while performing work on fragile roofs.

7.7.4 Tank Roofs

Standing, walking, or working on the tops of tanks/vessels with standard handrails, mid rails and toe boards is only allowed when the following conditions are met:

- The tank/vessel inspection and documentation are reviewed.
- The tank/vessel should be capable of supporting the intended load (personnel, tools, etc.) particularly Acid and Caustic storage tanks and corrosive & chemical tanks.
- If it is necessary to stand, walk, or work on the top of a vessel or tank to build scaffolding or a working platform, all the provisions in this section should be met before building it.

7.8 INSULATION AND PAINTING JOBS AT HEIGHT:

For work involving painting jobs on equipment, pipelines, structures, buildings, roofs, and insulation jobs on equipment / pipelines requiring persons to work from elevations where risk of fall is anticipated, proper scaffolds or portable hydraulically elevated work platforms should be provided and used, if there is no permanent provision is available to work safely. All the precaution for working at height should be included for these types of jobs. No body should take any supports on small bore piping (less than 2-inch NB) and on Non-metallic piping/fixtures. Ladders and other makeshift devices should not be used for painting and insulation jobs.

7.9 CONFINED SPACE AT HEIGHT

When working at height in a confined space, the use of a rescue harness and a self-retracting full-body harness is mandatory.

Painting outside building/structures at > 15 meters' height

An attendant will be provided for such jobs. Means of communication between attendant and people working at height should be established before start of work. Work and rescue plan should be prepared before start of work A) Cherry Picker/ Hydraulic Boom/Lift.

All precautions included in Confined Space Standard should be reviewed for implementation before commencing activities presenting confined space at height.

7.10 LOADING AND UNLOADING OF TRUCKS/TRAILERS/TANKERS ETC:

Site should create specially designed access platform for safe and secure access to top of the trucks, trailers, or tankers. Person involved should use full body harness tying lanyard from platform support or even from other support if the railing is not available.

Procedure

- Ensure your vehicle's load space and the condition of its load platform is suitable for loading required quantity.
- Good quality of sisal and manila ropes should be used only for securing tarpaulins. These ropes are easily damaged and constant examination is required to ensure they are serviceable.
- Ensure you have enough lashings and that they are in good condition and strong enough to secure the load.
- Use platform to access top of the vehicle.
- Wear full body harness and attach it with the flexible lines or anchoring point before climbing/landing on truck.
- Get assistance if required because most tarpaulins are quite heavy and bulky.

7.11 FLOOR OPENINGS

During shutdown activities or construction of multi-floor structure, floor holes may get generated due to openings left out for ducts, chutes, cyclones, cale routing, etc. All such holes need to be temporarily closed with plate/suitable protection device to prevent the fall of persons, tools & tackles, or materials. Specifically, any wall openings that allows the passage of persons presenting a risk of falling due to a difference in level of more than one meter (and not closed with plate), should be provided with a solid barrier/rail of a minimum height of 100 cm and a toe-board of at least 15 cm, to minimize the fall risk. Protection plate should be made of sound material of construction and fixed rigidly to avoid the movement of plate by wind or push by person.

Table-2 : Floor Hole Cover Protocol

Hole Cover Specification		
Type	**Size**	**Specification for cover**
Round	25mm-200mm	Round MS plate 5mm thick Dia minimum 100 mm more than hole size, vertical angel => floor size welded at bottom side.
Round	200mm- 2mt	Round MS plate 5mm thick Dia minimum 250 mm more than hole size,15 - 50 mm angel frame welded at bottom side.
Round	2mt and above	Round MS plate 6mm thick Dia minimum 300-500 mm more than hole size,300 mm angel / beam frame welded at bottom side.
Square	Up to 100 mm	MS plate 5mm thick and Plates should be minimum 100mm more than actual size of the hole vertical angel => floor size welded at bottom side.
Square	100 mm - 2mt	MS plate 5mm thick and Plates should be minimum 250mm more than actual size of the hole vertical angel => floor size welded at bottom side.
Square	2mt and above	MS plate 6mm thick and Plates should be minimum 300 to 500mm more than actual size of the hole vertical angel => floor size welded at bottom side.

7.12 WORKING ON WIND TURBINE GENERATOR

Wind turbines are typically located 100 meters above the ground, which requires maintenance personnel to safely climb between 100 to 300 feet to reach the turbine's mechanical drive in the power generation area. Some maintenance tasks may take an extended period of time. To ensure safe operations, maintenance activities should first be classified into the following categories:

Short Maintenance: Tasks such as inspecting for oil leaks, checking for cracks, and brake pad wear inspections.
Long Maintenance: Tasks such as changing the gearbox or addressing generator problems.
For maintenance that will take longer than 8 hours in total, it is recommended that the work be performed on the ground by transporting the turbine components via crane, in line with the elimination hierarchy of controls. This minimizes the need for work at height and reduces associated risks.

For shorter-duration maintenance tasks, a crane with a platform should be used. The following precautions should be observed when accessing the wind turbine generator:

- Assess the conditions of the ladder, ladder safety system, and ladder safety device before climbing.
- Use compliant personal fall protection systems such as a safety harness, specifically designed for the wind energy industry (lightweight, non-conductive, strong, and comfortable), and a fall protection lanyard.
- Always maintain three-point contact with the ladder while climbing.
- Two qualified persons should climb the wind turbine generator. One person should be qualified in working at height (as per Global Wind Organization training standards) and have an IRATA certification, while the other should be qualified in first aid/CPR.
- Climbing is prohibited when the average wind speed reaches 15 m/s (54 km/h or 33.5 mph) or higher, in accordance with industry best practices and safety guidelines.
  Tool fall protection should be in place to prevent tools from falling. This can be achieved by setting a boundary on the ground using scaffolding or by placing a "Keep off – Maintenance in Progress" sign to warn people from entering the area.

8. WORKING AT HEIGHT EQUIPMENT MAINTENANCE & INSPECTION

All equipment used for working at heights should be inspected. The specific requirements, inspection intervals and discard criteria vary, and should be obtained from applicable legislation or from the OEM.

8.1 LANYARDS AND PERSONAL ENERGY ABSORBERS

Pre- Use Inspections:

- Inspect the lanyard before each use. Check the rope or webbing, the connectors, and the manufacturer's label for additional user information.
- Inspect lanyards put under a slight tension on a regular basis.
- Check all components for abrasion, discoloration, cracks, and torn stitching.
- If there is any sign of deterioration, burns, or broken or damaged strands, or if there is any reason to suspect the lanyard, do not use it.
- Check that the personal shock absorber cover is intact.

Competent Person Inspections:

- A competent person other than the user, or an internal team as defined by site, should inspect lanyards and personal energy absorbers at least every six months.
- Care, Marking and Inventory:
- Wash lanyards and energy absorbers on a regular basis to remove dirt and grit, which can abrade the fibers.
- Store away from sunlight in a cool place.
- Metallic items should be stored in a dry place.
- All equipment should be kept as clean as possible.
- Lanyards and energy absorbers should have a permanently attached label indicating the manufacture's name, serial number/lot number, manufacturer date, maximum elongation, maximum arresting force, maximum free fall, and capacity.
- Use and review equipment logbook provided with the equipment to determine the age of the lanyard and energy absorber.
- A register should be retained for recording inspections.

Certification and Re-Certification:

- A certified external agency should certify the integrity of all lanyard and energy absorbers annually.

8.2 HARNESSES AND OTHER WEBBING EQUIPMENT

Pre use Inspections:

- Inspect daily or before each use for frayed threads, cuts, tears, or loose connections.
- Check the buckles, the webbing, the D-rings, and the manufacturer's label for additional user information.
- Look for wear, frayed, cracked, cut, burned, or damaged webbing, and loose or broken stitching.
- Check for distortion or corrosion of hardware.
- Check correct function of buckles.
- Look for bent, cracked, nicked, or gouged rings.
- Inspect the stitched areas thoroughly.
- Look for burn holes from welding or other heat sources.
- Ensure harnesses are not painted.
- If the harness is damaged or worn, do not wear it.

Competent Person Inspections:

- A competent person other than the user, or an internal team as defined by site, should inspect the harness periodically, but at least once in six months.
- A register should be retained for recording inspections.

Certification and Re-Certification:
- A certified external agency should certify the integrity of all harness and webbing equipment annually.

8.3 ROPES

Pre use Inspections:
- Inspect rope before use for broken fibers, severely worn areas, or change in the consistency of the core.
- Inspect rope under slight tension and check for soft areas, bulges, or excessive stiffness.
- Check for cuts and abrasion damage.
- The rope should have a uniform feel along its length.
- A register should be retained for recording inspections.

Competent Person Inspections:
- A competent person other than the user, or an internal team as defined by site, but at least once in six months.
- A register should be retained for recording inspections.

Certification and Re-Certification:
- A certified external agency should certify the integrity of all ropes annually.

8.4 CONNECTORS

Pre use Inspections:
- Connectors should be checked on a regular basis and before each use.
- If sprung latches are not closing properly, they should be cleaned and lubricated carefully and discarded if the problem cannot be resolved. Triple-lock connectors are particularly prone to closure failure.
- Check for damage, deformities, or excessive wear.
- Damaged connectors should be tagged and removed from service and the inventory list.
- A register should be retained for recording inspections.

Competent Person Inspections:
- A competent person other than the user, or an internal team as defined by site, should inspect the connectors periodically, but at least once in six months.
- A register should be retained for recording inspections.

Certification and Re-Certification:
- A certified external agency should certify the integrity of all connectors annually.

8.5 INERTIA REEL

User Inspections:
- They should be inspected before each use according to the manufacturer's instructions.

Competent Person or OEM Inspections:
- A competent person other than the user, or an internal team as defined by site should inspect inertia reels once every six months.

Certification and Re-Certification:
- A certified external agency should certify the integrity of all inertia reel annually.

8.6 LADDERS AND LADDER CLIMBING SYSTEMS

Pre use Inspections:
- Inspect on a regular basis and as per equipment manufacturer’s requirements or regular intervals determined by local operating conditions.
- Inspect thoroughly as soon as practicable, and prior to further use, following an occurrence that may have affected the stability or adequacy of the ladder e.g., fire, collision, overloading.
- Prior to use following repairs or modifications.
- The sleeve should run freely without hand operations or guidance.
- Check cable and rails for abrasions, wear, looseness, and cracks.

- Before climbing, check integrity of cable, systems, and ground level.
- Ladders should not be used as planks to span across openings or scaffolding.
- A register should be retained for recording inspections.

Competent Person Inspections:
- A competent person other than the user, or an internal team as defined by site should inspect ladder and climbing system periodically, but at least once in six months.
- A register should be retained for recording inspections.

Certification and Re-Certification:
- A certified external agency should certify the integrity of all ladders and climbing system annually.

8.7 ANCHOR POINTS

User Inspections:
- Anchor points should be inspected by the user before each use.
- Pay special attention to any cracks developing around the anchor points.
- Inspect all components of the anchor point systems.
- Check if the anchor points are unstable or loose.
- Observe any abrasions, wear points, damaged threads, or swags in the sling material before use. For synthetic slings and anchor straps inspect all sewing and loops for wear, chemical damage, burn damage, and/or ultraviolet deterioration.
- Inspect cable slings for excessive damage to the steel fibers or kinking.
- Do not tie-off to suspect or unsafe anchor points.
- Bring suspect or unsafe anchor points it to the attention of the competent person.

Competent Person Inspections and Proof Loading:
A competent person other than the user, or an internal team as defined by site should inspect Anchor points every 6 months.

Certification and Re-Certification:
- They should be checked annually by proof testing, in accordance with the Manufacturer's instructions.
- proof load testing should be done at intervals not exceeding 3 months.
- A register should be retained for recording inspections.
- Depending on the design, type, location, and the size of the structural member the anchor point is connected to, the environment and weather conditions dictate how often such anchor points should be inspected and re-certified by a qualified person. For general indoor areas not exposed to the weather, re-certification should be done at intervals not exceeding 3 years. In aggressive chemical or outdoor areas, re-certification may be required at intervals of only 6 months. The certified external agency doing the certification should recommend when the next re-certification is required.

8.8 LIFELINES

User Inspections:
- Maintenance of lifelines will depend on frequency of use and where they are used.
- All components should be checked prior to use, paying particular attention to any fraying, cracking or cuts in the rope or cable.
- The attachments should be checked for distortion, cracks, or sharp edges where the rope contacts.
- The lifeline should be checked for tightness and kinks.

Competent Person Inspections:
- Maintenance of permanent lifelines should incorporate integrity checking of the cable and proof testing of the anchors by a competent person or an internal team as defined by site at intervals not exceeding six months. Greater inspection frequency should occur in aggressive environmental conditions.
- A register should be retained for recording inspections.

Certification and Re-Certification:
- They should be checked annually by proof testing, in accordance with the Manufacturer's instructions by a certified external agency.

8.9 EQUIPMENT STORAGE

The Site should develop a dedicated place for the storage of the fall protection equipment. This should ensure that equipment is safely stored when not in use. The equipment storage area should be accessing controlled and only authorized person should be allowed to maintain the stock and storage.
The Site management may consider referring to the handling and storage considerations prescribed by the fall protection equipment manufacturer (if any).

- The Fall protection equipment should be stored in a clean dry location. The storage area should be adequate to protect the equipment from:
- Contamination.
- Loss or damage.
- Exposure to harmful substances such as chemicals, ultra-violet rays, radiations *etc.*
- Exposure to dampness, water intrusion, sunlight.
- Exposure to mechanical, thermal injuries.
- Full-body harnesses should be hung by the D-ring for storage.

9. MEDICAL FITNESS

All JSW businesses should ensure that individuals working at height are fit to perform the tasks assigned to them.

Medical Surveillance is recommended on an annual basis or at a frequency determined by the occupational physician of the company. This medical surveillance should include, at a minimum, the following assessments:

- Electrocardiogram (ECG)
- Otolaryngology Exam (to evaluate for conditions that may cause dizziness)
- Spirometry (lung function test)

Attention should be given to personnel who have medical conditions such as vertigo, epilepsy, or any other conditions that may affect their ability to work safely at height. Additional considerations should also be made regarding the weight of the person using a harness, as many harnesses have a maximum weight limit (e.g., 136 kg/300 lbs.). In such cases, additional monitoring or precautions may be required.

The use of alcohol or drugs is strictly prohibited for workers involved in work at height. Personnel suspected of being under the influence of alcohol or drugs will be immediately removed from the worksite.

Height Pass Test (HPT):

A Height Pass Test (HPT) certificate (as per the template in Annexure-3) should be issued to individuals who clear the required medical examination.

The Height Pass Test should be indicated on all job specifications for employees expected to work at height and considered in all medical and psychological assessments/surveillance.

Where applicable, medical certificates should indicate any restrictions or cautions regarding an individual's ability to work at height, particularly due to conditions such as acrophobia. These restrictions may be a recommendation or an absolute prohibition for work at height.

Key Considerations:

Acrophobia and Medical Conditions: Subject to the medical assessment, on-the-job assessment, and the working at heights risk assessment, employees (and contractor employees) may be prohibited from working at height due to medical conditions such as acrophobia, vertigo, epilepsy, or any other conditions that could compromise safety while working at height.

Site Approach for Fitness to Work at Heights Assessment:

The site should adopt a medical fitness assessment approach for both permanent and contract employees working at height, which includes the following:

Annual Medical Assessments: An annual medical evaluation should be conducted to assess the worker's fitness for work at height. This assessment aims to identify any medical conditions that may pose a risk to the worker or others while performing work at height.

Doctor's Assessment and Communication:

The worker should ensure open communication with their treating physician about their work responsibilities and any medical conditions. This includes disclosing specific aspects of the work environment, such as ladders, roofs, scaffolding, and other elevated work locations.

The physician should consider the worker's medical condition and any medications they may be taking that could affect their ability to work safely at height.

Medical Form: The medical form should include assessments for the following:

Musculoskeletal system: Normal/Abnormal

Fear of Heights: Yes/No

History of Vertigo: Yes/No

History of Epilepsy/Fits: Yes/No

History of High Blood Pressure/Diabetes: Yes/No

Blood Pressure (mmHg):

Blood Sugar (F/PP/R):

Haemoglobin:

This medical form is used to document the worker's health status, and any potential restrictions related to working at height.

Safety Orientation and Training:

New employees, including contractors, will undergo safety orientation training that includes information on the risks of working at height and the safety measures required.

Following successful completion of the orientation, workers will undergo the Height Pass Test (HPT) to assess their physical and medical suitability for working at height.

Medical Fitness Assessment Records:

Records of the Height Pass Test and medical assessments should be retained in the individual's personal record until the next scheduled examination, as per the frequency determined by the company physician.

Precautions:

Prior to conducting any work at height, it is essential that workers undergo the required medical assessments. If a worker is identified with a medical condition that may impair their ability to work safely at height, appropriate restrictions will be placed on their work duties.

Acrophobia (fear of heights) should be addressed in the medical assessment. Workers who have a history of acrophobia or similar conditions that could compromise their safety should be considered for alternative tasks or prohibited from working at height altogether.

10. EMERGENCY RESPONSE AND PLANNING

Every site should have an Emergency Response Plan (ERP) in place, which includes a **rescue plan** to be initiated immediately if a worker falls while working at height. Workers suspended in fall arrest harnesses should be rescued as soon as possible to prevent **suspension trauma**.

10.1 EMERGENCY RESPONSE PLAN REQUIREMENTS

An Emergency Rescue Plan should be developed and established prior to any work involving fall arrest systems. This plan should ensure that emergency response personnel are trained, familiar with site-specific rescue procedures, and able to act swiftly to rescue workers who fall. The plan should also include regular rehearsals to ensure preparedness.

Suspension Trauma occurs when a worker is suspended in a harness for an extended period, restricting blood flow and leading to potential life-threatening conditions such as fainting, renal failure, or even death. This can happen within 10-15 minutes, depending on the individual and environmental conditions like heat and dehydration.

The plan should cover the following essential points:

- Rescue plans should be developed for each work activity involving heights.
- **Immediate Rescue:** Workers should be rescued promptly after a fall to avoid suspension trauma.
- **Rescue Personnel and Equipment:** Ensure that workers involved in height activities are trained in rescue procedures and familiar with available rescue equipment.
- **Training:** All workers should be trained in emergency rescue techniques and the potential risks of suspension trauma.
- **First Aid:** The rescue team should include trained first aiders, and first aid facilities should be readily available.

10.2 KEY ELEMENTS OF THE RESCUE PLAN

A comprehensive Rescue Evacuation Plan should address the following:

- **Timeframe:** Define the maximum time for carrying out a rescue (aim for as quickly as possible, ideally within minutes).
- **Site Details:** Include specific site details such as building numbers, floor levels, and other information for quick location identification.
- **Rescue Equipment:** Ensure that rescue equipment, including ropes, harnesses, and aerial lifts, is available and accessible.
- **Self-Rescue and Aided Rescue:** Workers should be capable of performing self-rescue if possible or be assisted by trained personnel.
- **Medical Facilities:** Ensure the availability of first aid services and the contact details of emergency services like fire brigade and ambulances.
- **Communication:** Ensure an effective means of communication is available, including direct contact details for emergency services.
- **Rescue Equipment Location:** Indicate locations of key equipment (e.g., lifts, keys for access) for fast access during emergencies.

10.3 TYPES OF RESCUE PROCEDURES

10.3.1 Self-Rescue

If a worker has fallen and is suspended in a harness, they should attempt self-rescue if possible. With proper training and fall protection equipment, 90% of workers may be able to perform self-rescue, which includes:

Climbing: Attempting to climb back to a safe working level (a few inches to 2-3 feet).

Self-Relief: If climbing is not possible, workers should try to shift their body to relieve pressure on the legs (if equipment allows).

Post-Fall Procedure: After any fall, the worker should remove all impacted fall arrest system components from service and document the incident for equipment inspection.

10.3.2 Assisted Rescue (Mechanically Aided)

When self-rescue is not possible, the worker will need assisted rescue. The following methods can be used:

Hauling/Rope System:

- A rescue and descent device should be secured to an anchor rated for at least 3,000 lbs.
- The worker should connect to a rescue lifeline or D-ring with verification from a trained rescuer.
- The worker is then raised or lowered to safety.

Mechanically Aided (Unconscious):

If the worker is incapacitated, a fully assisted rescue is necessary.

The rescue team should attach the haul line to the worker’s harness and lower them to safety.

10.3.3 Aerial Lift Rescue

In cases where a mechanically aided aerial lift is available, use the following procedure:

- A rescuer in the aerial lift should ensure they are wearing a secondary fall protection system (shock-absorbing lanyard or self-retracting lifeline).
- The lift should be positioned under the suspended worker for safe access.

- The rescuer should disconnect the worker from their fall protection system and lower them to safety.

10.3.4 Ladder Rescue

If aerial lifts are not available, use ladders to rescue the fallen worker:

- Rescuers should access the worker with a ladder, securing their own fall protection.
- If the worker is unconscious, a minimum of two rescuers should assist in lowering the worker safely.
- Once on the ground, first aid should be administered, and transportation to medical facilities should be arranged if necessary.

10.3.5 Important Considerations

Availability of Rescue Equipment: The site should evaluate the availability of rescue equipment, including aerial lifts, ladders, ropes, and trained personnel, prior to work at height.

Worker Isolation: Workers should not be left alone while working at height. In case of an emergency, a site supervisor or rescue team should take immediate control of the situation.

Rescue Team: Ensure that trained rescue personnel (minimum of two) are always available during work at height activities.

Response Time: Rescue efforts should begin immediately to minimize the risk of suspension trauma.

Incident Documentation: After any fall incident, all impacted fall protection equipment should be tagged and documented for inspection.

11. TRAINING

The Site should ensure that Fall arrest system/ Fall Protection system training needs assessment has been done based on the type of activity the person is supposed to perform and this should be linked with the workplace risk assessment. Workplace risk assessment constitutes a foundational reference to link appropriate Personal Protective Equipment (PPE) with the activities undertaken. It should be ensured that a person receives training for the PPE that he/ she may use at the Site.

It should be ensured that the trainings are provided to personnel with an opportunity to handle the PPE, have it fitted properly, test its face-to-face piece seal, wear it in normal air for long familiarity period and, finally, to wear it in a test atmosphere. The users should be discussed on the importance of the usage of PPE at the workplace detailing on the various protections that the PPE should provide to the individual worker.

Training on the following points (but not limited to) should be provided:

- The fall hazards for which protection is required.
- Fall preventive measures.
- Reasons of selection of PPE.
- Proper use of anchor points as per requirement.
- The limitations of the PPE.
- How to wear, use and remove each equipment.
- Pre-use checks for the protective equipment.
- Demonstration how to fit, adjust and use the PPE and practice by the worker for that.
- How to clean, repair and maintain in good condition the PPE.
- How to inspect for damaged equipment to ensure adequate protection.
- Location of the equipment before and after use (i.e., storage).

The Site should ensure documentation of all fall protection training. Documentation should be signed and dated by the worker (who has received the training) and instructor. It should be maintained in the Site management's safety training record.

The Site should consider providing retraining when previous training is rendered obsolete due to:

- Changes in the activity/workplace,
- Changes in the fall protection equipment/system, or
- A demonstrated improper use or misunderstanding of fall protection systems.

11.1 ASSESSMENT

Competence should be assessed and confirmed by a worker qualified and authorized for the purpose. When assessing competence, consideration should be given to an individual's psychological and physical capacity to take care their own and their colleagues' health and safety perform when working at heights. All personnel should be reassessed yearly. Assessments should be conducted by following written evaluation, and demonstrative evaluation of competency either through skill assessment by third party or by inhouse safety/HR/Admin.

12. RACI MATRIX

Table-3 : RACI Matrix

Activity Description	Area Supervisor/ Shift In charge	Executing Department	Site HSE	Fire & Rescue Department
Identify Work at Height	A	R	C	
Apply Hierarchy of controls	A	R	C	
Eliminate Fall hazards	A	R	C	I
Minimize fall exposure	A	R	C	
Select Anchorage points	A	R	C	
Select Appropriate fall protection system	A	I	R	C
Develop Rescue Plan	A		I	R
Inspect fall protection system		A	I	
Apply for Permit	I	A	I	
Barricade area	I	A	C	
Execute Work Safely		A	C	

Note:

R=Responsible		expected to participate in the activity and contribute the best of his/her abilities
A	=Accountable	ultimately responsible for the results
C	= Consulted	contributes towards decision making
I	= Informed	kept informed but need not participate in the effort.

13. MANAGEMENT OF RECORDS

Site shall ensure records related to work at height should be maintained for a minimum of five years (or as required by local regulations and organizational standards). The following documentation should be retained:

Site Permits and Audit Checklists: Approved permits for work at height activities, including details such as nature of work, duration, location, and assigned personnel.

Inspection and Maintenance Records: Logs of periodic inspections for fall protection devices, including:

Harnesses.

Lanyards.

Safety nets.

Records for ladder inspections and load testing of lifting equipment.

Logs for the maintenance, inspection, and certification of rescue equipment (e.g., stretchers, ropes, and rescue harnesses).

Training Records: Documentation of safety training sessions conducted for personnel, including:

Use of fall protection systems.

Emergency procedures.

Equipment operation.

Risk Assessment Documentation

Detailed reports of risk assessments for work at height activities, including identified hazards, risk evaluation, and control measures implemented.

PPE Records

Records of personal protective equipment (PPE) issued to employees, including full-body harnesses, lanyards, helmets, and other fall protection gear.

Incident Documentation

Reports of incidents or near-misses, including root cause analyses and corrective actions.

System Design and Compliance Records

Documentation of the design, installation, and modification of fall protection systems, including specifications, approvals, and compliance with regulatory requirements.

14. LEGAL AND OTHER REQUIREMENTS

JSW site shall access, identify, evaluate, and keep up to date the Work at Height requirement as per prevailing law in operation.

15. KEY PERFORMANCE INDICATOR

To ensure conformance to the requirements of this STANDARD, the following key performance indicators (KPI's) should be identified, communicated, recorded, and monitored:
Indicative list of KPI'

- Number of SWP/JSA prepared for working at height.
- Compliance to Work at Height Management Standard.
- Number of Safe work platforms
- Number of Work at Height Assurance/Audit Program
- Number of trained personnel-authorized employees
- Safety Observations on Work at Height.

Depending on the type of work at height program, each JSW site should identify and monitor additional KPIs as appropriate.

16. ASSURANCE

Each site should conduct self-assurance program to ensure compliance with this STANDARD as part of its Safety assurance program. Third party system audit should be conducted by Group Safety or external consultants to ensure compliance with the standard.

17. DEFINITIONS

Term	Definition
100% Tie- Off	Use of double lanyards, ensuring at least one lanyard is always attached.
Aerial Lift	Mobile work platforms include equipment to allow working at height such as scissor lift, telescopic lift, boom lift and similar equipment that may or may not allow travel while personnel are in the work basket, platform or similar devices mounted to the forks of lift trucks.
Arresting (Catching force)	The amount of force applied on any employee when a fall protection system stops the fall, usually the highest force experienced during the fall.
Anchor	The attachment of lanyard connector to an anchorage.
Anchorage/Anchor Point	A secure point of attachment for lifelines, lanyards, or retractable lifelines capable of supporting at least 2300 KG for each employee connected or should be designed, installed, and used as part of a complete personal fall arrest system.
Anchorage Connector	A component or device that is installed on an anchorage and is specifically intended for attaching a fall arrest system to the anchorage.
Attendant (Work group number)	A person at the perimeter of the work area who is assign the role of monitoring and communicating with the authorized workers, controlling access to the area, maintaining design conditions as specified on the permit, and initiating the rescue plan.
Body Harness (Full)	A combination of straps that can be secured around the body in a manner that will distribute the fall arrest forces over the thighs, pelvis, waist, shoulders, and hips and that can be connected to other components of an approved personal fall arrest system.
Carabineer	A trapezoid or oval shaped connector component with a gate or similar arrangement that remains closed until it is intentionally opened for connection or disconnection.
Competent Person	A person who can identify existing and predictable hazards in the surroundings or other working conditions which are hazardous or dangerous to employees and has the authorization to take prompt corrective measures to eliminate them. Competent persons should be suitably qualified and authorized.
Connector	An approved device which is used to couple parts of the personal fall arrest system and positioning device system together. It may be an independent component of the system, such as carabineer or a buckle, D-ring sewn into a body harness, or a snap-hook spliced to a lanyard or self-retracting lanyard.
Continuous Tie-off	The requirement that a person be always tied off when working in an elevated area where the potential for fall exists.
Deceleration Device	Any mechanism such as rope grab, lanyard, specially woven lanyard, automatic self-retracting lifelines etc. that serves to dissipate a substantial amount of energy during a fall arrest or otherwise limits the energy imposed on a person during a fall arrest.
Deceleration Distance	The additional vertical distance a falling person travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which the deceleration device begins to operate. The deceleration distance should not be more than 3.5 feet.

Term	Definition
Double Lanyard	A system utilizing two lanyards connected in a “Y” configuration, which allows one lanyard to be attached to an anchor point while the second lanyard is being moved to a new anchor point, thus providing protection from fall always.
Elevating Work Platform	Mechanical elevated working platforms such as scissor lifts, cherry pickers, boom lifts, and travel towers.
Fall Protection system	Method used to prevent exposure to elevation fall hazards such as floors, walls, guardrails, isolating an area or the use of a personal fall arrester system. • Personal fall arrest system: It is a system of components designed to function together to catch individual during a free fall and minimize the potential for injury. It should only be used when other options have been exhausted. • The fall system should be capable to limit maximum arresting force on an employee to 408 KG and 816 KG when used with a full body harness. • Should meet expectations of ANSI Z359.
Floor Openings	An opening in a floor or working surface that is 305 mm or more in its smallest dimension.
Free Fall	The act of falling before a personal fall arrest system begins to apply force to arrest the fall.
Free Fall Distance	The vertical displacement of the fall arrest attachment points on the employee body harness between onset of the fall and just before the system begins to apply force to arrest the fall. The distance excludes deceleration distance, the lifeline/lanyard extension before they operate and fall arrest occurs.
Height Pass	A document issued to a worker for working at height after imparting the necessary training, asserting contract worker medical fitness, and passing skill test.
Guardrail	A vertical barrier consisting of a top rail and a mid-rail secured to uprights and erected along the exposed sides and ends of platform. This barrier is erected to prevent personnel from falling off a working platform to a lower level.
Horizontal Lifeline	A rail, rope, wire or synthetic cable that is installed in a horizontal plane and used for attachment of a worker’s lanyard or lifeline device to allow movement horizontally.
Ladder Safety System	A system designed to eliminate or reduce the possibility of falling from a ladder. A ladder safety system usually consists of a carrier, safety sleeve, lanyard, connectors and full body harness.
Lanyard	A flexible line of webbing, rope, cable to secure the wearer of a safety harness to a lifeline or fixed tie-off points. It may be 6,4 or 2 feet long.
Lifeline	A line between two fixed anchorage points, independent of the work surface, to which lanyard is secured.

Term	Definition
Mobile Elevating Work Platform (MWEP)	Power operated elevating work platforms designed to provide a temporary working surface which can be easily moved from one location to another. The height of MEWP's can be adjusted using articulation, scissor mechanisms, telescoping booms or towers. The platforms can be vehicle mounted, self-propelled, towed, or manually moved.
Qualified Person	One who, by possession of a recognized degree, certificate, or professional standing or by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to identify risks and solve or resolve problems relating to fall prevention and scaffolding erection. He/she is responsible for the design and installation of the fall prevention or protection system.
Rated Load	Rate load means the manufacturers specified maximum load to be lifted by a hoist or to be applied to a scaffold or scaffold component.
Risk Assessment	A systematic and Structured process whereby hazards, in this case, fall hazards, present in a workplace or arising from work activity are identified, assessed, and evaluated for risk and exposure, and protective measures are identified to reduce risks to acceptable levels. Risk Assessment can be formal or informal, depending on nature of task.
Retractable Lifeline	A fall arrest device that arrests a fall by locking onto a line, which allows free travel without slack rope but locks instantly when a fall begins.
Scaffold	A temporary elevated platform with guardrail used for supporting personnel and materials or both.
Shock Absorber	A device used in combination with lanyards that is designed to reduce the force when fall happens.
Stall Load	Means the load at which the prime-mover of a power-operated hoist stalls or the power to the prime mover is automatically disconnected.
Three Point Contact	The three-point rule to follow when working from a ladder (two hands and one foot, or two feet and one hand on the ladder always). This rule includes when climbing up and descending from a ladder.
Toe-Board	A low protective barrier that will prevent materials and equipment from falling to lower levels and provide protection from fall. Toe-boards vertical height should be minimum 89mm and can be up to 150mm but with no more than 6mm clearance above floor level.
Working at Height	Work in any place where, if there was no safeguard/control in place, a person could fall a distance likely to cause a personal injury or fall of material from a height likely to cause a personal injury for example, a fall from ladder or elevated platform, roof transport vehicle-truck, tanker, through a fragile roof, or a truck. Work at height is applicable wherever fall from height from one level to another level and requires additional control of fall arrest system. This includes working at height below the ground level.

18. ANNEXURES

ANNEXURE-1 FALL PROTECTION RISK ASSESSMENT FORM

PART-1: Assessment Details

Site & Location of Assessment:		**Date:**
Person Performing Assessment:		
List Work at Height Tasks:		
Persons Who May Be Affected:		
Workers Consulted:		
Facilities Service Review and Approval:		

PART-2: Hazard Identification

Identify Hazards	**Yes,**	**No**	**N/A**	**Comments**
Does the task expose workers to afall of 4 feet or 6 feet for construction related activities?				
Is the surface fragile, slippery, or potentially unstable?				
Is task being conducted on a sloping surface which is difficult to? maintain balance?				
Is the task being conducted within15 feet (5m) of an unprotected edge?				
Is the task being conducted close to a hole, pit, or trench in which a person could fall?				
Are there any other factors which increase the risk, or hazard, e.g., power lines, weather conditions, impalement hazards, work above? open waters, etc.?				
Are there any existing risk control measures and are they adequate?				

PART 3: Risk Assessment

Task	Likelihood	Consequence	Risk	Comments

Risk Analysis Matrix		Consequence Negligible	Minor	Serious	Major	Catastrophic
Likelihood	Almost Certain	Moderate	Major	Major	Major	Major
	Highly Likely	Moderate	Moderate	Moderate	Major	Major
	Likely	Minor	Minor	Moderate	Moderate	Major
	Unlikely	Minor	Minor	Minor	Moderate	Major
	Remote	Minor	Minor	Minor	Moderate	Moderate

CONSEQUENCE AND LIKELIHOOD CRITERIA	
Likelihood	**Consequence**
Almost Certain Expected to occur. Likely to occur several times per year. Likely to occur frequently	**Catastrophic** Significant injury of employees, contractors, or the public Significant public interest, media involvement or regulatoryintervention Significant impact on business reputation
Highly Likely Highly probable it will occur Might occur once in 5 years Likely to occur several times. **Likely** Possibility of occurring Likely to occur frequently Might occur once in 5 years	**Major** Injury or Hospitalization of employees, contractors, or the public.Moderate public interest, media involvement or regulatory intervention Moderate impact on business reputation **Serious** Medical treatment of employees, contractors, or the public. Some public interest, media involvement or regulatory interventionSome impact on business reputation
Unlikely Not expected to occur Possible, Might occur once in 10 years	**Minor** First-aid treatment of an employee, contractor, or a member of thepublic
Remote Not foreseeable Highly unlikely in the period of contract Might occur once in 100 years	**Negligible** Less than above

PART 4: Risk Control Plan

Hierarchy of Risk Control	Practical? Yes	No	Detail of Risk Control(s)
Level 1 **Elimination** Eliminate the risk of a fall completely, e.g., relocate the work to a safe working height, to the ground or existing solid construction with guardrail/walls, etc.			
Level 2 **Passive Fall Protection** If it is not reasonably practical to eliminate the risk of a fall, reduce the risk using passive fall protectionequipment e.g., guard-railing, scissor lifts, elevated work platforms, scaffolds,etc. Work from any mobile elevated work structure, should require the additional use of a Personal Fall Arrest System.			
Level 3* **Work Positioning System** If it is not reasonably practical to eliminate the risk or use passive fall protection, use work positioning systems. to physically prevent a fall from occurring.			
Level 4* **Personal Fall Arrest System** If it is not reasonably practical to use the above options, the use of Personal Fall Arrest Systems to arrest a fall after it occurs should be used. Body belts are not permitted for use as part of a Personal Fall Arrest System.			
Level 5* **Administrative Controls** If none of the above measures are reasonably practical, or the risk of a fall remains, the risk should be reduced using documented administrative controls that specify the procedures to beused to mitigate the risk, such as Warning Line System, Fall Protection Plan, Work at Heights Permit, Job Safety Analysis, etc.			
NOTE: *The selection and use of either a Work Positioning System, Personal Fall Arrest System, or Administrative Controls should be approved by the Supervisor in consultation with a Qualified Person.*			

ANNEXURE-2 SAMPLE FORMAT FOR RESCUE PLAN

RESCUE PLAN

DATE: _____ JOB DESCRIPTION _____

LOCATION _____

CONTACTS	RESCUE EQUIPMENT	CRITICAL RESCUE FACTORS
RESCURER'S ---------- COMPETENT PERSON ---------- EMERGENCY CONTACT ----------	Ladder Rescue Pole Rescue Rope Scaffold Crane Aerial Lift Alternating lifting & lowering device First Aid Kit Life ring Other	Anchor Point _____ Landing Area _____ Rescue obstructions or hazard _____ Other:

Check for YES

- Have alternatives to using fall arrest equipment been considered?
- Has rescue equipment been inspected and in good shape?
- Is equipment adequate for rescue plan?
- Have communication devices been identified, located, and tested?
- Are all rescuers familiar with the use of rescue equipment?

Describe the task that will be done prior to work to prevent a fall and step by step process to be followed in event of a fall.

ANNEXURE -3 HEIGHT PASS TEST CERTIFICATE

MEDICAL FITNESS TO WORK AT HEIGHT:

Name: Age: Yrs. Gender: Department:

Contractor Name: Vendor Code:

Date of joining: Date of Examination:

1. Musculo –skeletal system: Normal/Abnormal
2. Fear of Height: Yes/No
3. History of Vertigo: Yes/No
4. History of Fits /Epilepsy: Yes/No
5. H/O High BP/ Diabetes: Yes/No
6. Blood Pressure (mmHg):
7. Blood sugar F/PP/R:
8. Haemoglobin:
9. Straight Line Walking:
10. Romberg Test:
11. Nystagmus Test:
12. Dysdiadochokinesia (Alternative Hand Moment):
13. Finger – nose Test:

Remarks: Fit/Unfit

Signature of the Employee Signature of the Medical Officer

ANNEXURE -4 INSPECTION AND MAINTENANCE CHECKLIST

Inspection Checklist – Full Body Harness				
Make/Model:				Manufactured Date/Year:
Contractor Name				Date of Inspection:
Sr. No	Description	OK	NOT OK	NA
1	**VISUAL INSPECTION**			
	Harness belts and seams			
1.1	Manufacturer identification well readable			
1.2	Full Body harness complete in all respect			
1.3	Harness having ISI or CE Mark			
1.4	No fissures, wear or twisted straps, seams open			
1.5	Harness not soiled/damaged by chemical, paints etc.			
1.6	No change in harness strap due to heat (e.g. welding heat)			
	Metal Fittings			
1.7	Waist Buckle: No deformation corrosion			
1.8	Both leg strap buckle: No deformation corrosion.			
1.9	Metal D-ring at back for lanyard, no damage, corrosion			
1.10	Check any other metal fitting provided.			
1.11	Any other obstruction			
2	**FUNCTIONAL TEST**			
2.1	Check all buckle by inserting and pulling			
2.2	Harness shelf life not expired or manufacturing date with in three years			
3	**INSPECTION RESULTS**			
3.1	Harness safe for use			
3.2	Harness rejected and destroyed beyond use			
Remarks:				
	Inspection By (Name and Signature)			
	General Instructions:			
1	Inspection checklist to be filled for each harness by Authorized Person			
2	Checking to be done every three months, Records should be maintained for last 1 year.			
3	Tick in appropriate column, mark NA for checks not applicable			
4	Provide appropriate inspection tag/stickers			

INSPECTION CHECKLIST FOR LANYARD WITH SHOCK ABSORBER

Inspection Checklist – Lanyard with Shock Absorber				
Make/Model:				Manufactured Date/Year:
Contractor Name				Date of Inspection:
Sr. No	Description	OK	NOT OK	NA
1	**VISUAL INSPECTION**			
	Lanyard Rope			
1.1	Manufacturer identification well readable			
1.2	Lanyard completes in all respect with two hooks			
1.3	Harness having ISI or CE Mark			
1.4	No fissures, wear or twisted straps			
1.5	Lanyard not soiled/damaged by chemical, paints etc.			
1.6	No change in harness strap due to heat (e.g. welding heat)			
1.7	End of ropes secured. Splices in place if provided.			
	Shock/Energy Absorber packet			
1.8	No fissures in the protective sleeve or in lanyard.			
1.9	Seams between shock absorber, lanyard and hooks intact. No sign of opening of stitches			
1.10	Shock absorber has noy yet released			
	Snap Hooks			
1.11	No fissures, deformation, or corrosion			
1.12	Scaffold hook, mouth opening of 50mm			
2	**FUNCTIONAL TEST**			
2.1	Snap hook can be only opened by pushing the safety lever. It automatically snaps when lever is released.			
2.2	Lanyard shelf life not expired or manufacturing date with in three years			
3	**INSPECTION RESULTS**			
3.1	Lanyard safe for use			

Inspection Checklist – Lanyard with Shock Absorber				
3.2	Lanyard rejected and destroyed beyond use			
Remarks:				
	Inspection By (Name and Signature)			
	General Instructions:			
1 2 3 4	Inspection checklist to be filled for each harness by Authorized Person Checking to be done every three months, Records should be maintained for last 1 year Tick in appropriate column, mark NA for checks not applicable Provide appropriate inspection tag/stickers			

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JSW Group

MANAGEMENT STANDARD:
SCAFFOLDING
JSW/GHS/GS-13

MANAGEMENT STANDARD

Management Standard Title:	**Scaffolding**	**Date of Revision**	10.12.2024
Document	JSW/GHS/GS-13	**Revision**	01

Document Issue and Revision History		
Date	Revision Number	Change Summary
10.12.2024	01	Cross-references have been included. Updated Section 9.11.2 Made correction in scope instead of business specific to site specific requirements

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1. PURPOSE

JSW, as part of its Health and Safety Policy, commits to ensure that a safe working environment is maintained in all areas and that all persons who are involved in scaffolding erection, inspection, operation, alterations, dismantling, and training are fully aware of the hazards involved and have the competence, training, and awareness to undertake such activities.

The Purpose of the management standard is to provide standard requirements, guidelines, instructions, rules and precautions for scaffolding erection, inspection, operation, alterations, dismantling and training requirements.

2. SCOPE

This Standard applies to all JSW companies and subsidiaries, managed Business/Site/Locations, corporate/Regional offices, research and development facilities, new projects, merged and acquired entities. The standard applies to all JSW company employees and contractors. Conformance to the requirements in this standard is applicable to the entire lifecycle (including planning, assessment, exploration, evaluation, design, development, operation, and closure) of a Project/Business/Site/Location.

Each site shall develop and publish its own site-specific requirement as supplementary document to Scaffolding Group standard. National and local legislation shall be complied with when the requirements of National and local legislation concerning Scaffolding are more stringent than those specified in this Group standard.

In the Standard, the following verbal forms are used to indicate requirements, recommendations, permissions, or capabilities:

- “shall” indicates a requirement.
- “should” indicates a recommendation.
- “may” indicates a permission.
- “can” indicates a possibility or capability.

3. REVIEW

The Standard shall be reviewed at least every 5 years or when a serious incident or high potential near miss is recorded. The review shall include the evaluation of the following:

- Management and erection of scaffold, safe use and dismantling.
- Training records and programs for employees exposed to fall hazards.
- Learning from the incidents of Scaffold erection and collapse.
- Scaffolding material inspection records.
- Changes to industry standards, laws, and regulations.

4. PROCESS FLOW – SCAFFOLDING SAFETY MANAGEMENT

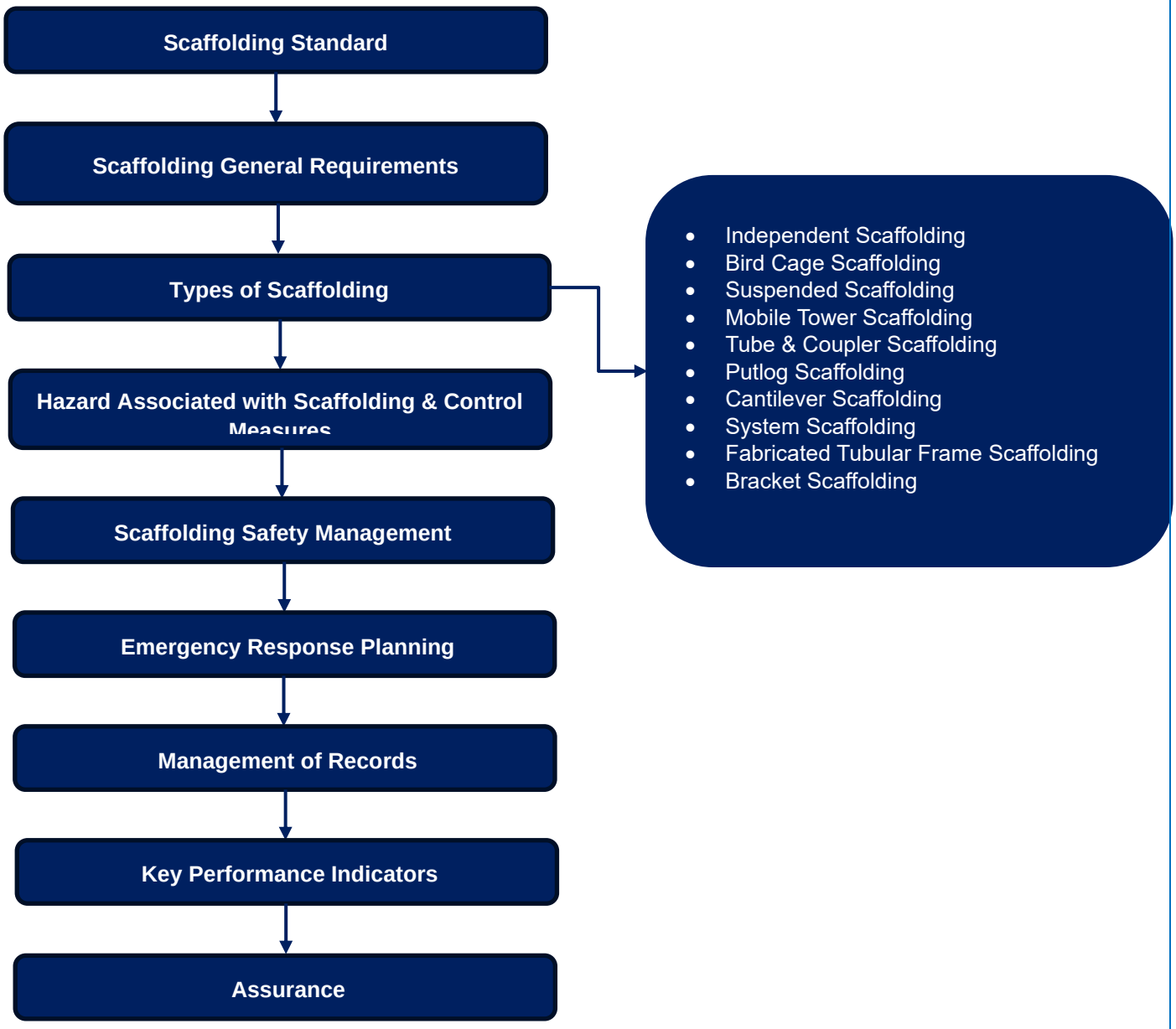


Figure - 1: Scaffolding Management Standard

5. SCAFFOLDING GENERAL REQUIREMENTS

The scaffolding program shall adhere to the following general requirements:

a. Scaffolds shall be provided for employees engaged in tasks that cannot be safely performed from the ground or from stable structures.

b. Only qualified individuals shall be employed for scaffold erection.

c. All scaffold erection, movement, dismantling, or alteration shall be conducted under the supervision of a qualified scaffold supervisor.

d. Each scaffold and its components should support their own weight and at least four times the maximum intended load. Scaffolds should not be loaded beyond their designated working load as indicated on scaffold tags.

e. Every scaffold shall have at least one designated access point for individuals to gain entry.

f. Scaffolds should not be erected or utilized within 3 meters (10 feet) of energized power lines to prevent contact between scaffold components and power lines.

g. Scaffold design should maintain a height-to-base width ratio of four to one (4:1). If this ratio is exceeded, measures shall be taken to secure the scaffold from tipping, including tying it vertically and horizontally to the building structure. Ties should be placed no higher than four times the minimum base width, with vertical ties spaced no more than 8 meters (26 feet) apart and horizontal ties at each end and no more than 9 meters (30 feet) apart.

h. Ensure all scaffolds are always plumb and level.

i. Scaffolds should be constructed at least two planks wide unless physically impossible due to location constraints.

j. A landing platform shall be provided for every 9 meters of height.

k. Scaffold members should overhang no less than 6 inches and no more than 12 inches on either end. They shall be securely fastened and laid tight using scaffolds and clamps.

l. Guardrails and toe boards should always be fitted and maintained in position.

m. Keep every platform, gangway, run, or stairs free from unnecessary obstructions, debris, and projecting rails.

n. All supported and suspended scaffolds be inspected by a competent person, and a proper certificate shall be issued before use.

o. Barricades should be positioned during scaffold erection and dismantling for structures over 1.8 meters in height.

5.1 SCAFFOLDING

A scaffolding is a temporary structure erected to support access or working platforms. Scaffolding is commonly used in construction/maintenance work so that workers have a safe and stable work platform when work cannot be done at ground level or on a finished floor.

5.2 SCAFFOLDING STRUCTURAL COMPONENTS AND DIMENSIONS

5.2.1 Basic Components

Basic scaffolding components include three (03) general components:

a) Standard

b) Ledger; and

c) Transom

a) Standard

A standard, also known as upright, is a long pipe or tube that connects the mass of the scaffolding directly to the ground and runs the length of the scaffolding. The base of each standard is connected to a base plate, which helps distribute the weight of each standard to the ground.

b) Ledger

A ledger is a long pipe or tube that runs horizontally between each standard and adds further support and weight distribution.

c) Transom

A transom is placed on top of ledgers at a right angle, runs horizontally and comes in several different forms. There are two (02) basic types of transoms:

I. Main Transoms: These transoms provide support for standards by holding them in position as well as supporting boards; and

II. Intermediate Transoms: These transoms are placed alongside main transoms to lend additional board support.

5.2.2 Other Supporting Components

There are several other supportive components that serve to reinforce the fundamental scaffolding. These components include:

(a) Braces

Braces, such as cross braces and facade braces, and additional couplers, can be used in varying combinations to support the structure in several ways.

(i) Cross braces run diagonally between ledgers and securely attach to standards to increase overall rigidity of a structure. However, they can also secure themselves to ledgers, in which case they are simply called ledger braces.

(ii) Facade braces help prevent a structure from swaying, and are attached on the face of the scaffold, running the length of the face of the structure, and securely attaching at every level.

(iii) Couplers help connect structural elements, and come in several variants:

- A right-angle coupler, used to join tubes right angle to each other, to connect a ledger or transom to a standard.
- A putlog or single coupler can be used to connect the ledger to the transom; and
- For any other angle of connection between scaffolding piping, a swivel coupler can be used.

(b) Node

A theoretical intersection point where two or more members are connected, although they are not actually in the same plane. It is usually the intersection between a standard and ledger.

(c) Guardrail

Guardrail is a member in scaffolding structure that prevents the fall of a person from a platform or access way.

(d) Base Jack

Base jack is used to hold the standard, adjust the height of the scaffolding, and increase scaffolding stability.

(e) Base Plate & Sole Board

A metal plate with a spigot for distributing the load from a standard or raker or other load bearing tube. Sole boards are boards placed under the base plates to support the scaffold on softer ground.

(f) Putlog

A horizontal tube with a flattered end, to rest in or on part of the brickwork or structure.

(g) Reveal Pin

A fitting used for tightening a reveal tube between two opposite surfaces.

(h) Reveal Tube

A tube fixed between two opposite surfaces by means of a threaded (expanding) fitting or by placing it across an opening in a structure to form an anchor to which the scaffolding may be tied.

(i) Toe board

A tube spanning across ledgers to form the support for boards or units forming the working platform, or to connect the outer standards to the inner standards.

(j) Brick Guard

Brick guard is a metal or other fender filling the gap between the guard-rail and toe board, and sometimes incorporates one or both of these components. These can be hung from the guard rails and should be prevented from outward movement.

(k) Ties

Ties provide a secure link between scaffolding and adjoining building or structure. Depending on the kind of scaffolding, the tie patterns and types of ties used can vary. For example:

- Through ties can be used to secure a scaffolding to a building by entering a building's open window.
- Box ties help secure a scaffolding by attaching to a building's external features, such as strong pillars.
- Lip ties (standard duty) consists of an L-shaped arrangement of tubes and couplers to hook the scaffold behind parts of the building.
- Reveal ties (light duty), in case where it is impracticable to open windows for tube and coupling ties, the attachment of scaffold may be made by reveal ties which rely on friction; and
- Masonry anchors, an anchorage can be provided by casting in a threaded socket into a part of the structure itself.



Figure- 2: Components of Scaffolding

(l) Ladders

The most common means of access to a scaffolding is by ladder.

6. TYPES OF SCAFFOLDING

The following are common types of scaffoldings. This standard focuses on scaffoldings constructed from prefabricated components such as tubes and couplers:

(i) Independent Scaffolding.

(ii) Bird Cage Scaffolding.

(iii) Suspended Scaffolding.

(iv) Mobile Towers Scaffolding.

(v) Tube and Coupler Scaffolding.

(vi) Putlog Scaffolding.

(vii) Cantilever Scaffolding.

(viii) System Scaffolding.

(ix) Fabricated Tubular Frame Scaffolding; and

(x) Bracket Scaffolding.

6.1 INDEPENDENT SCAFFOLDING

This type of scaffolding is usually used to provide a working platform to a vertical structure. It uses two sets of parallel standards: one close to the structure and the other set at the width of the work platform. It is erected so that it is independent from the structure and does not rely on it for its primary stability. However, it is usual to tie the scaffolding to the structure to prevent the scaffolding falling towards or away from the structure. This is referred to as an independent tied scaffold.

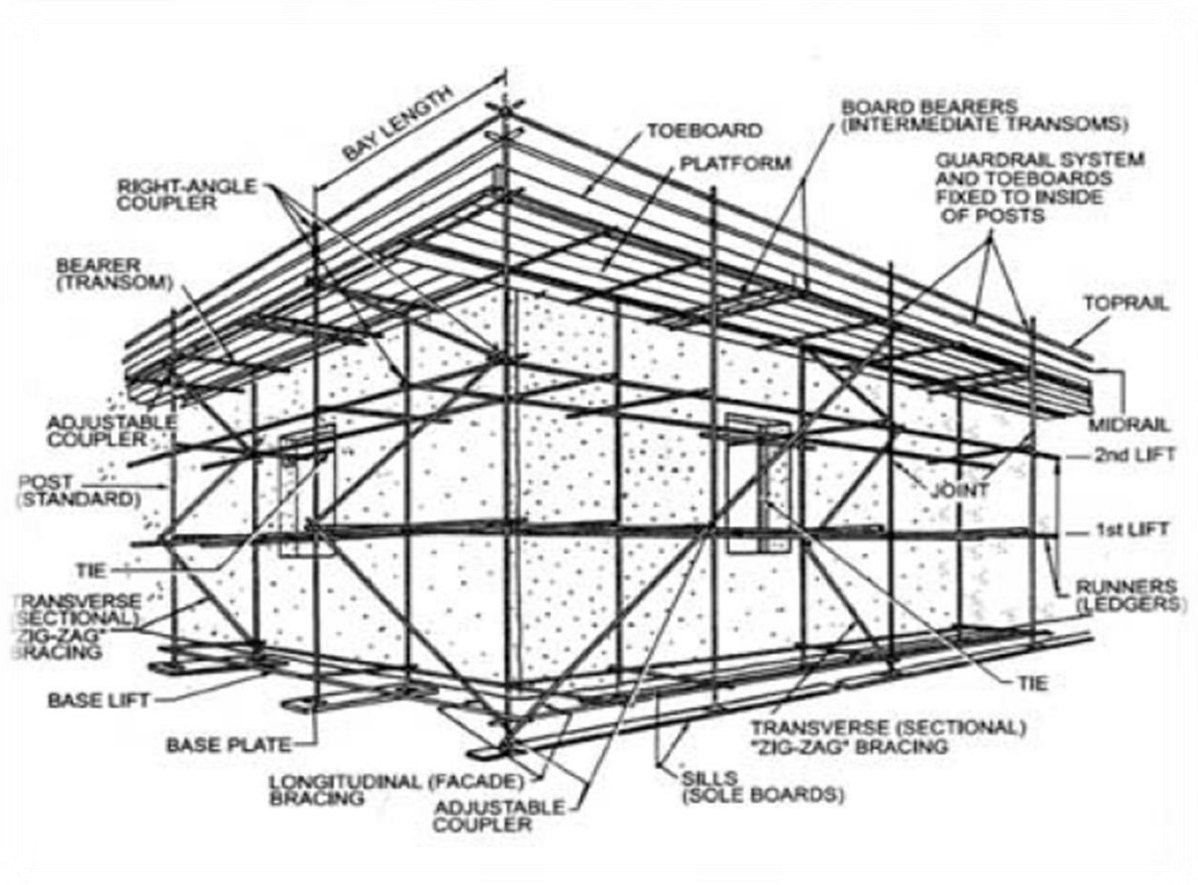


Figure- 3 : A Typical Independent Scaffolding (Illustration Purpose Only)

6.2 BIRD CAGE SCAFFOLDING

A birdcage scaffolding is also a type of independent scaffold. It consists of vertical standards arranged equally spaced apart. Bracing is provided by ledgers and transoms at each lift height on the bottom buck of scaffolding at a 45° angle. The access platform or top lift is boarded to provide a working area. A bird cage scaffolding may have one, or several lift heights.

The figures below provide some examples of bird cages:

Birdcages are typically used in buildings for work carried out on a single level and where access is required at high levels, for example ceilings.

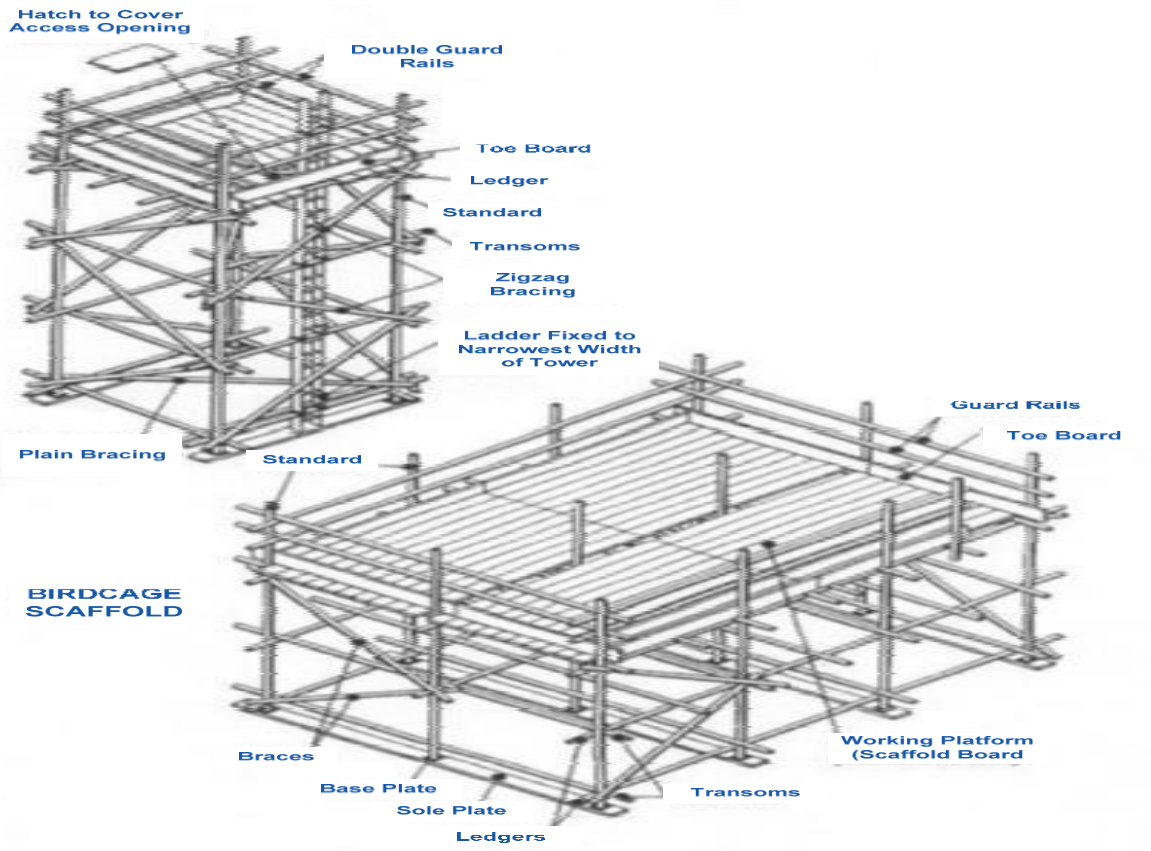


Figure- 4 : A Typical Bird Cage Scaffolding (Illustration Purpose Only)

6.3 SUSPENDED SCAFFOLDING

Suspended (also known as slung) scaffoldings are working platforms or cradles suspended by ropes, cables or other non-rigid means, from an overhead structure.

The most common type of suspended scaffolding is a two-point adjustable suspended scaffold. This is hung by parallel cables or ropes and connected to each end of the platform or cradle. There are usually controls to lower and raise the platform or cradle operated by personnel on the platform.

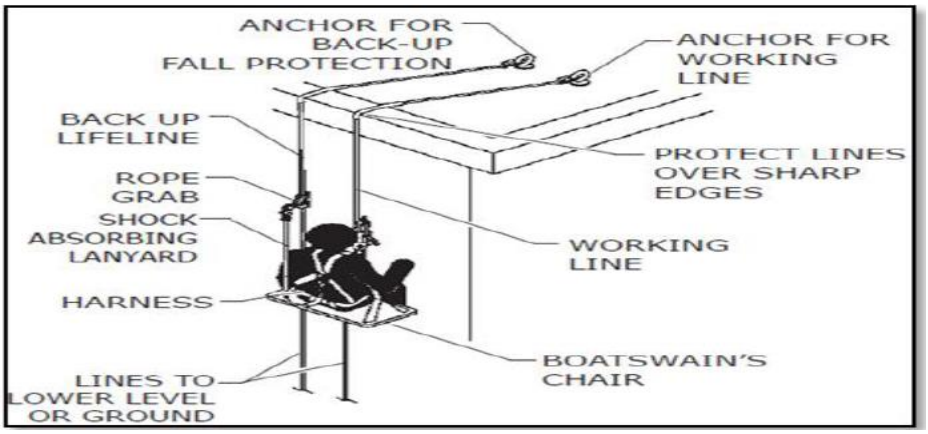


Figure- 5 : A Typical Suspended Scaffolding (Illustration Purpose Only)

Similarly, a single-point adjustable scaffolding is a platform or cradle suspended by a single cable or rope from an overhead structure. It will also have a means to raise or lower the platform by personnel on the platform. This is sometimes known as a boatswain's chair.

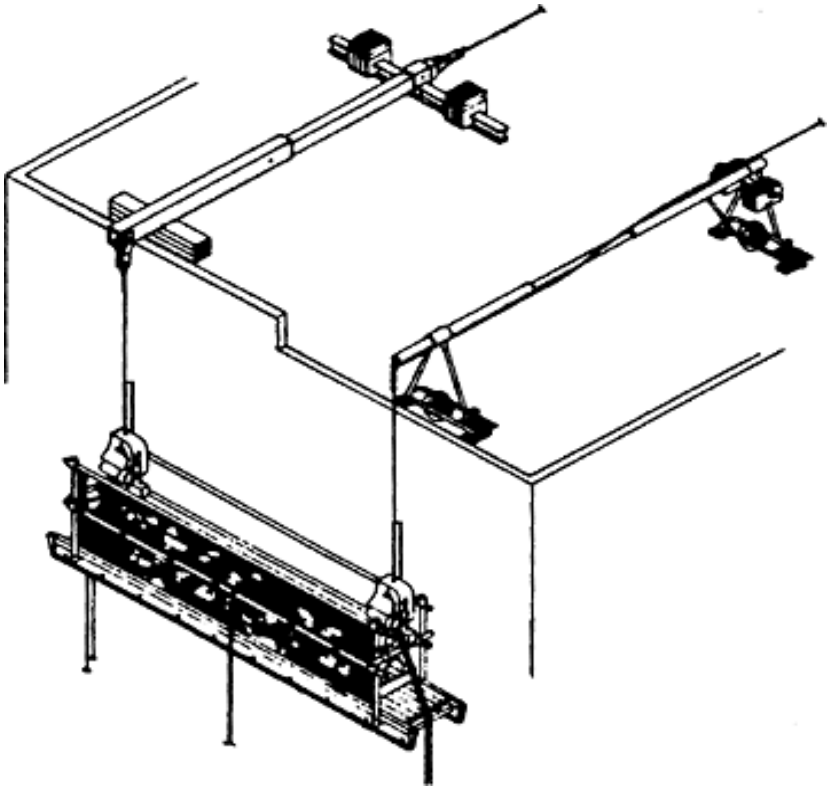


Figure- 6: Bostwain's Chair Arrangement

A multi-point adjustable scaffolding is a platform suspended by more than two ropes/cables from overhead supports. The platform will have a means to raise and lower the platform to desired work levels.

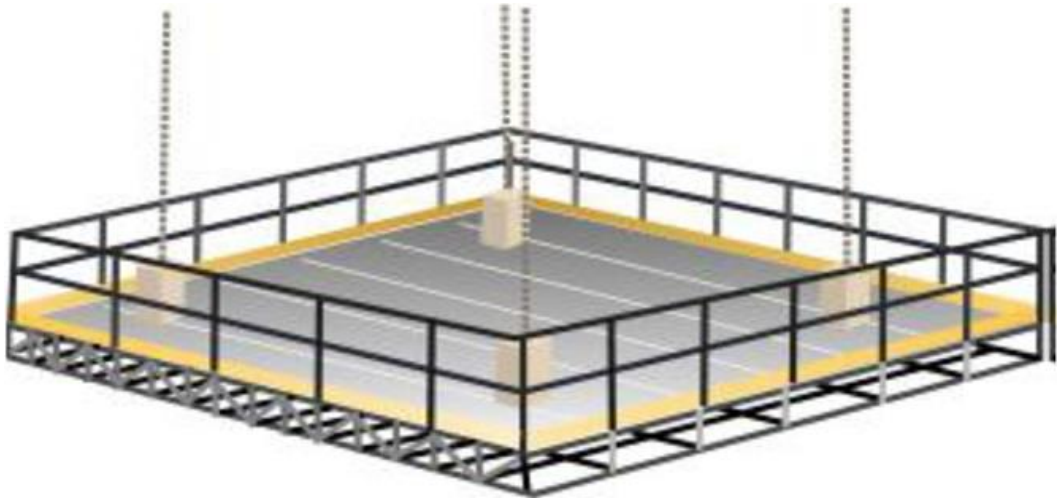


Figure -7 : A Multi-Point Adjustable Scaffolding (Illustration Purpose Only)

Suspended scaffoldings are mostly used for major outside maintenance and repair works such as window washing and repainting of multi storied buildings.

All suspended scaffolding support devices shall rest on surfaces capable of supporting at least 4 times the

load imposed on them by the scaffolding operating at the rated load of the hoist.

If a risk assessment specific to the physical location and to the work performed is not available, the competent person shall consider stopping work if wind exceeds 25 mph (40 kmph) for two-point systems and 20 mph (32 kmph) for single point systems.

6.4 MOBILE TOWER SCAFFOLDING

Tower scaffolding with castors is sometimes used to provide mobile access. They are widely used as they are convenient for work which involves frequent access to height over a short period of time in several locations that are spaced apart.

Mobile scaffoldings are mostly used with buildings for repair and maintenance activities and are easy to move from one place to another. Since work can be carried out in a safer and more spacious environment, workers generally find mobile scaffolding more productive, making this type of scaffolding a very cost- effective option.

Mobile scaffoldings shall not exceed a height to base width (including outrigger supports, if used) ratio of four to one (4:1). If that ratio is more than 4:1, those scaffoldings shall be restrained from tipping by guying, tying, bracing, or equivalent means.

The height to base width ratio of the scaffolding during movement is 2:1 or less.

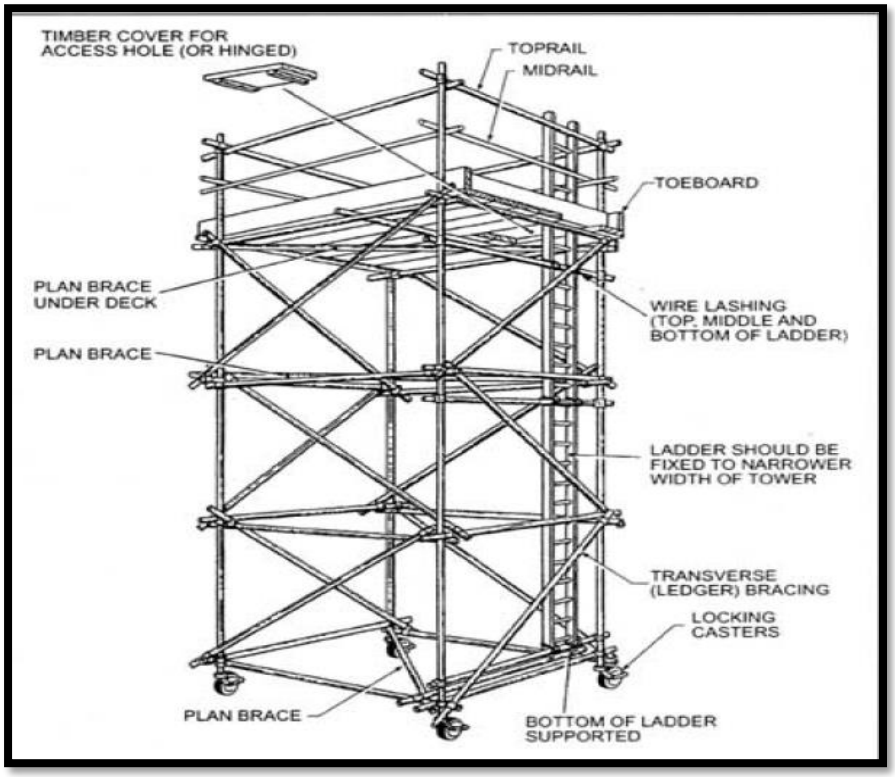


Figure- 8 : A Typical Mobile Tower Scaffolding (Illustration Purpose Only)

6.5 TUBE AND COUPLER SCAFFOLDING

A tube and coupler scaffolding has a platform supported by tubing, and is erected with coupling devices connecting uprights, braces, bearers, and runners as shown in figure below:

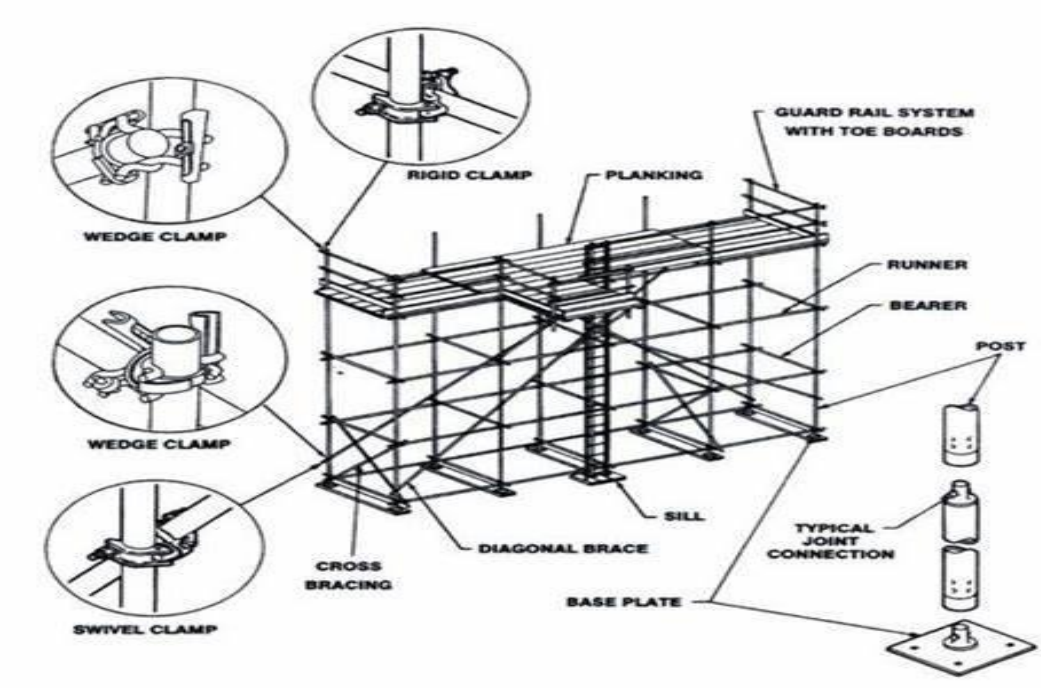


Figure -9 : A Typical Tube and Fitting Scaffolding (Illustration Purpose Only)

Due to their strength, these scaffoldings are frequently used where heavy loads need to be carried, or where multiple platforms should reach several stories high. These scaffoldings can be assembled in multiple directions, making them the preferred option for work surfaces with irregular dimensions and/or contours.

Such scaffoldings shall not exceed a height to base width (including outrigger supports, if used) ratio of four to one (4:1). If that ratio is more than 4:1, those scaffoldings shall be restrained from tipping by guying, tying, bracing, or equivalent means.

6.6 PUTLOG SCAFFOLDING

Putlog scaffolding (also known as a bricklayer's scaffold) involves using the wall of a structure being built as support for the working platform, as show in the figure below:

Putlog scaffolding ties to the actual building being constructed rather than free standing, making it more rigid and safer in high winds. In addition, it requires less material than an independent scaffolding.

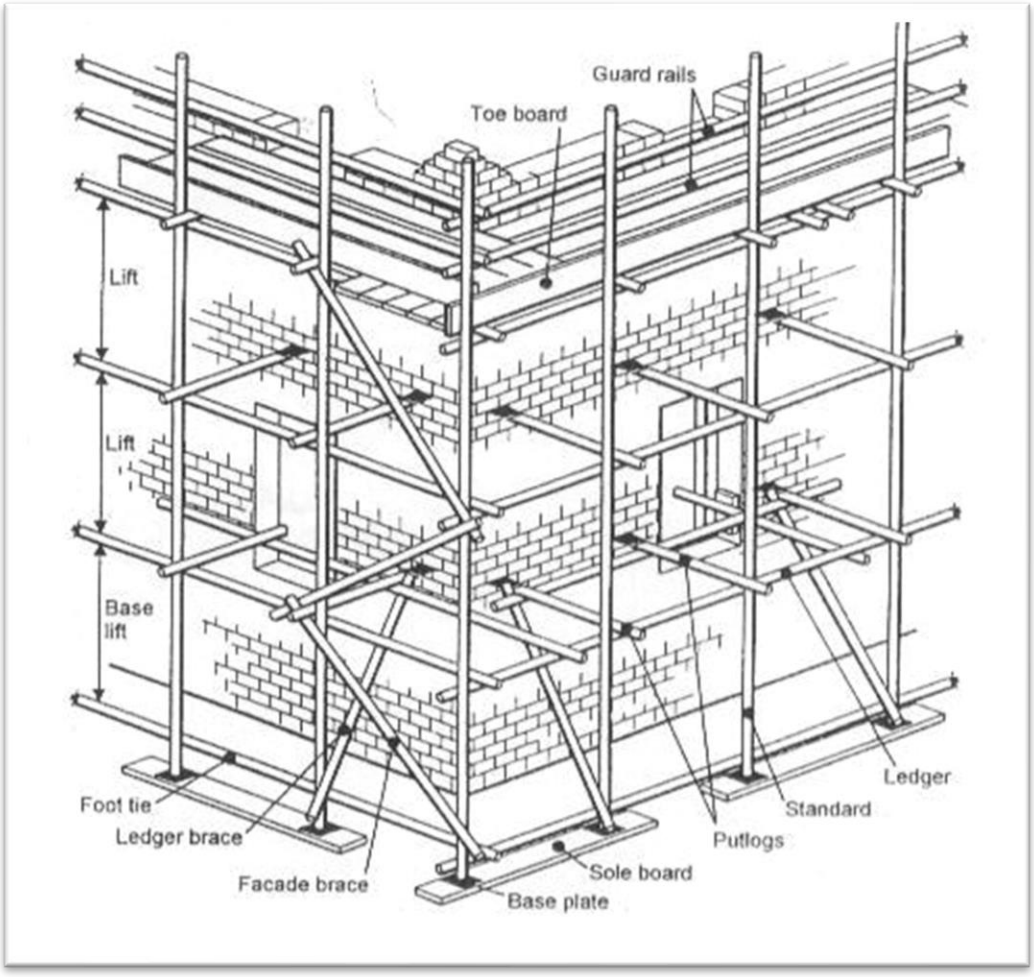


Figure -10 : A Typical Putlog Scaffolding (Illustration Purpose Only)

6.7 CANTILEVER SCAFFOLDING

Cantilever scaffolding is highly cost effective and time effective in situations where the surface does not allow for a regular scaffolding as shown in the figure below:

In normal circumstances where the ground surface is stable and levelled, erecting a conventional scaffolding system is possible. Conventional scaffoldings are usually erected on a frame or a base plate that rests on a stable surface. Where the surface is unstable or weak, cantilever scaffoldings are used. Examples of such a surface include glazed roof, sloping roof, and stairs.

Cantilever scaffoldings are commonly used on the tops of buildings and other heights that are hard to reach.



Figure- 11: A Typical Cantilever Scaffolding (Illustration Purpose Only)

6.8 SYSTEMS SCAFFOLDING

Systems scaffolding (also known as modular scaffolding) consists primarily of vertical and horizontal pre-engineered components that connect in a systematic manner.

Systems scaffolding is one of the most used scaffoldings. Some perform well in very highly loaded conditions and others are more suited to smaller repeated scaffolding structures.

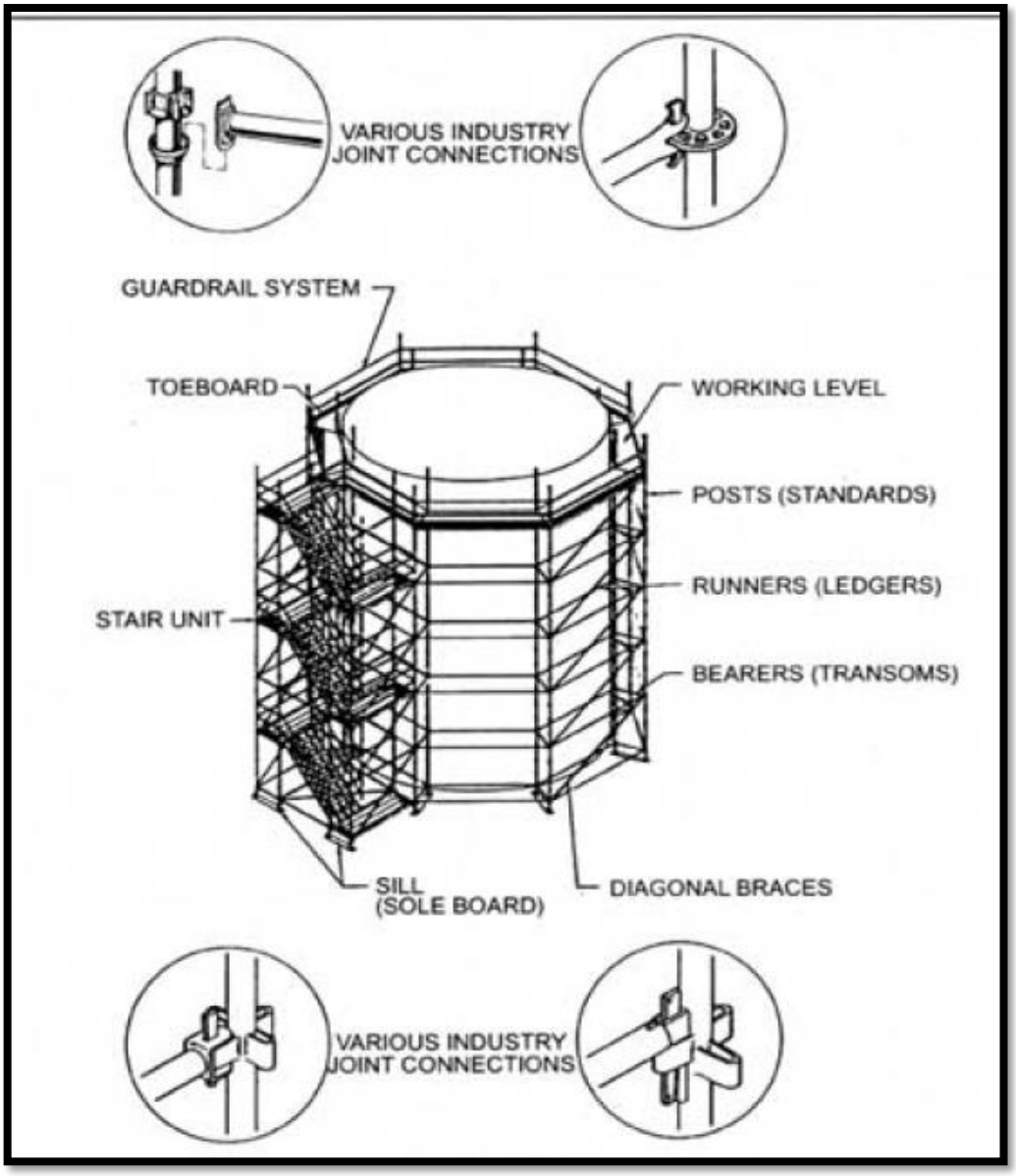


Figure -12 : A Typical System Scaffolding (Illustration Purpose Only)

6.9 FABRICATED TUBULAR FRAME SCAFFOLDING

Fabricated frame scaffoldings are the most common type of scaffolding because they are versatile, economical, and easy to use.

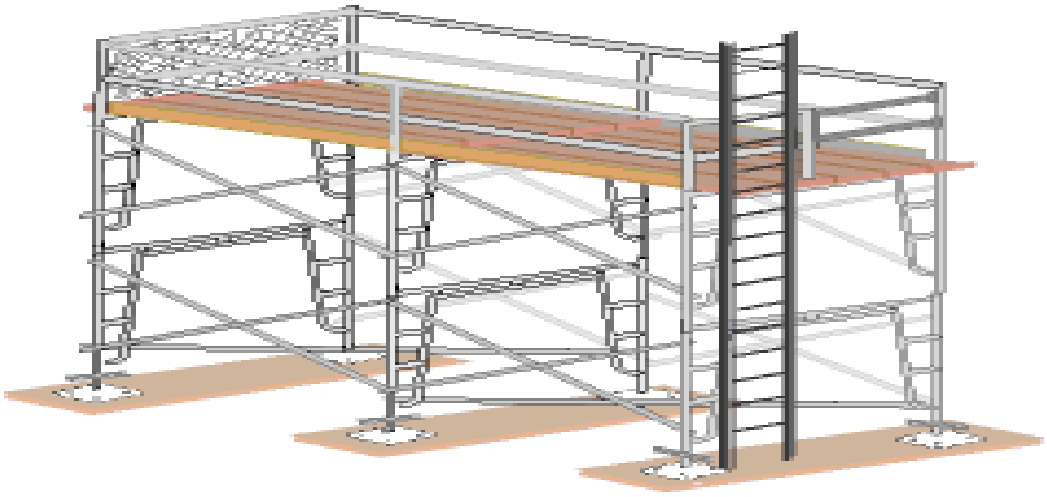


Figure- 13: A Typical Fabricated Tubular Frame Scaffolding

They are frequently used in one or two tiers, but their modular frames can also be stacked several stories high for use on large-scale construction activities.

6.10 BRACKET SCAFFOLDING

The bracket (also known as carpenters) scaffolding is built of a triangular wood frame. Each bracket is attached to the structure in various ways.

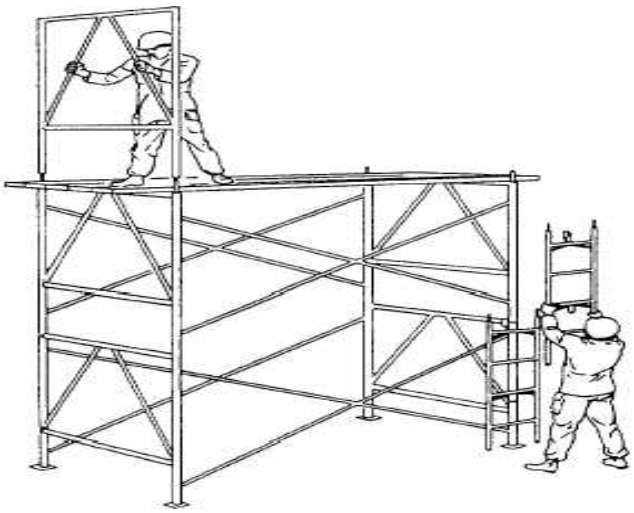


Figure -14 : A Typical Bracket Scaffolding (Illustration Purpose Only)

This type of scaffolding is used in tank construction mainly and can be especially useful for installing materials along the edge of the roof.

7. SELECTION OF SCAFFOLDING TYPE

A competent scaffolder shall decide which type of scaffolding structure shall be used in each situation. He will make an assessment based on the factors including:

(i) Work to be carried out.

(ii) Location.

(iii) Environment.

(iv) Weather conditions such as wind speed.

(v) Load bearing requirements.

(vi) Duration of the work access; and

(vii) Inherent risks from working at height.

For simple tasks of short duration on level ground, a mobile tower scaffolding will normally be suitable. For example, these are often used by painters, electricians and Heating, Ventilation and Air Conditioning (HVAC) personnel.

The table below provides scaffolding categories by loading per m^2.

Table 1 : Scaffolding Categories by Load (BS EN 12811)

BS EN 12811 Class	Typical Usage	Uniformly Distributed Load on Platform Kg/m^2
Class 1	Inspection access and painting	75
Class 2	Power cleaning, painting, light engineering	150
Class 3	Light engineering e.g. welding of electrical	200
Class 4	Heavy engineering, e.g. large pipework or structural	300
Class 5	As stated on design drawings	450
Class 6	As stated on design drawings	600

8. HAZARDS ASSOCIATED WITH SCAFFOLDING

Many Incidents associated with scaffolding are due to simple faults such as misuse of tools, a ladder left unsecured or a missing toe board. More serious incidents are caused by the partial or total collapse of the scaffolding which is normally preventable.

Hazards associated with scaffolding erection, alteration, operation, and dismantling include.

(i) Falls from height while working on scaffolding/ladder.

(ii) Being struck by falling objects.

(iii) The presence of nearby electrical line or process line (e.g., hot line, PSV discharge, vents, drains, etc.).

(iv) Manual handling of scaffolding material.

(v) Collapse of the scaffolding because of:

- Incorrect erection.
- Overloading.
- Uneven distribution of loads.
- Poor ground conditions.
- Adverse weather.
- Insufficient or inappropriate ties.
- Interference with ties.
- Vehicle collision.
- Incompatible components; and
- Unauthorized alteration.

8.1 CONTROL MEASURES

8.1.1 Work At Height

Before any work is carried out, the risks from working at height shall be assessed. All personnel who are required to work at height shall be trained to identify risks and take the necessary precautions as per the Work at height management standard (JSW/GHS/GS-12).

8.1.2 Falling Objects

a. As far as practicable barricades shall be provided by keeping a clear distance from scaffolding structure.

b. Mechanize shifting of material and tools such as by using rope, pulley, and bag; and

c. No material shall be kept inside the scaffolding pipe opening as it can fall during scaffolding dismantling.

8.1.3 Clearance From Electrical/Process Lines

a) Any part of operational or pressurized process line shall not be used as a support for scaffolding.

b) Clearance shall be defined in planning stage and maintained during erection and use of scaffolding for overhead electrical lines and nearby process lines.

8.1.4 Personal Protective Equipment

a) Personnel shall always wear standard PPE at work area.

b) Safety helmets with chinstraps shall be provided while working on scaffolding including erection and dismantling.

c) Personnel shall wear full body harness during erection & dismantling of scaffolding and on scaffolding after erection if there is a risk of falling from height and falling objects on a case- by-case basis; and

d) Personnel shall wear Personal Floatation Device (PFD) while working, erection and dismantling over water.

e) Personnel shall use adequate fall protection system as follows:

Fall Protection Systems for Scaffolds Type of Scaffold	Fall Protection System
Aerial Lifts, Boatswains Chair, Catenary Scaffold, Float Scaffold, Ladder Jack Scaffold, Needle beam Scaffold,	Personal fall-arrest system
Crawling Board (Chicken Ladder)	Personal fall-arrest system, or a guard rail system, or a ¾ inch (1.9 cm) diameter grabs line or equivalent.
Self-Contained Scaffold	Both a personal fall-arrest system and a guardrail system
Single point and two-point suspension scaffold	Both a personal fall-arrest system and a guardrail system
Support Scaffold	Personal fall-arrest system or guardrail system
All other scaffolds not specified above	Personal fall-arrest system and a guardrail system that met the required criteria

For more details, refer to the Personal Protective Equipment (PPE) standard (JSW/GHS/GS-05) when working with scaffolding structures.

8.1.5 Manual Handling

Safe manual handling practices shall be followed by all personnel when required to manually handle scaffolding material and equipment.

8.1.6 Unstable Base

Scaffolds should be constructed on a solid, firm surface. The ground should be level to prevent the structure from tilting or collapsing. If using a mobile scaffold, it's crucial to lock it in place before starting work. Personnel should avoid using unstable objects like barrels or boxes to support scaffolds as they can shift or collapse under the weight.

8.1.7 Unsafe Planks & Decks

All scaffold planks and decks should be robust enough to bear the load of the workers and their materials. Check for signs of damage, such as cracks, holes, or splinters, that could weaken the plank or cause injury.

8.1.8 Wobbly Scaffold

If a scaffold is unstable, it should not be used. the four legs shall firmly rest on a solid footing, and the braces should be tightly secured. Under no circumstance should personnel try to reach higher by standing on unstable objects such as chairs or stools atop the scaffold.

8.1.9 Missing Or Damaged Parts

Regular inspection of scaffolding parts is necessary. All parts, including base plates, cross braces, guardrails, and planking, should be in good condition. The scaffold should not be used until fixed if any part is missing or damaged.

8.1.10 Overloading

Every scaffold has a maximum load capacity, including workers' combined weight, tools, and materials. Ensuring this capacity is not exceeded is essential, as it can lead to a collapse.

Every Scaffold and scaffold component (including platform units) shall be capable of supporting, without failure, its own weight (dead load) and at least four (4) times the maximum intended load (live load) applied or transmitted to it (D+4*L). Self-weight of platform units (including planks) may be considered as dead load.

9. SCAFFOLDING SAFETY MANAGEMENT

Maintaining scaffolding in a safe and workable condition requires adequate management. During constructions, routine maintenance jobs and turnarounds, the frequent need of scaffolding together with associated risks require rigorous safety management to prevent accidents. Therefore, scaffolding safety shall be managed by a structured **Plan, Do, Check and Act (PDCA)** approach as per Figure-15 of Scaffold Safety Management.

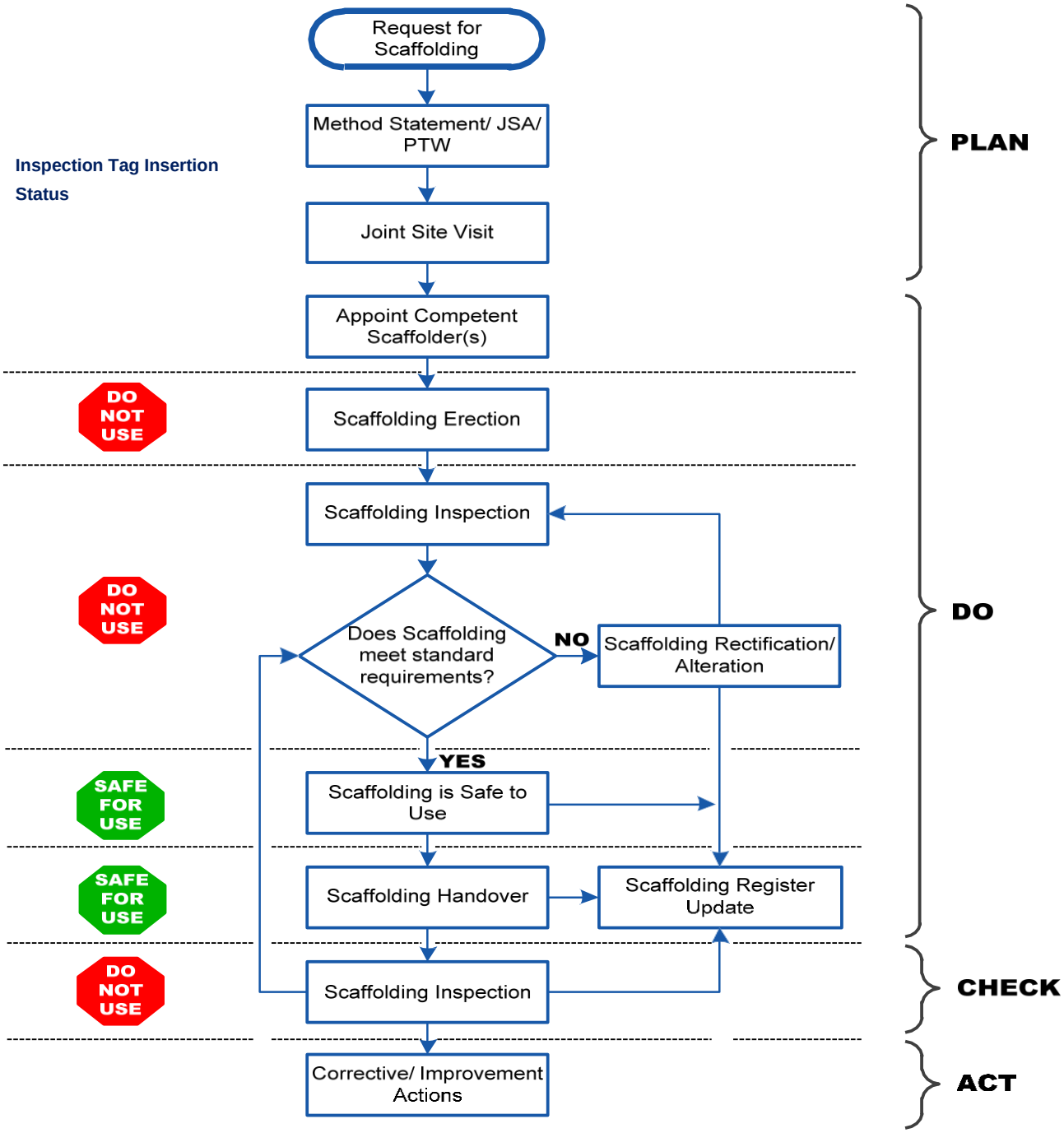


Figure 15 : Scaffolding Management System

9.1 STEP 1 – PLAN

The scaffolding erection and use shall be planned to effectively minimize the risks involved.

(i) The task/load requirements (Table 1) shall be defined for which the scaffolding is intended. The ground preparation, layout, scheduling, loading, access, tying arrangements and other requirements of the task shall be defined in the Method Statement.

(ii) The responsibilities shall be identified for individuals performing specific tasks and duties during erection of scaffolding.

(iii) Risk shall be documented as indicated in the Hazard Identification & Risk Assessment Standard (JSW/GHS/GS- 17).

(iv) After risk assessment, appropriate controls shall be defined for the task. In reducing the risk, engineering controls such as protective barriers that protect everybody from falling and administrative controls such as adherence to instructions or procedures. PPE shall also be identified such as safety harness, safety helmets etc.

(v) Clear standards shall be set for scaffolding design in line with the requirements of BS EN standards mentioned in **section 9.6** (e.g. Design basis, load calculations, supporting structure etc.).

(vi) A competent person shall undertake, on behalf of the scaffolding contractor, a survey of the location where the scaffolding is to be erected. The survey shall be carried out before the design or erection of the scaffolding and shall consider the risks that exist on site; and

(vii) Rescue plan shall be established as part of the planning process.

9.2 STEP 2 – DO

This involves transforming the planned activities into action.

a) Individual responsibilities for those assigned to perform related key activities, shall be clearly communicated and authority/resources given accordingly. Concerned individuals shall be held accountable for the safe execution of their duties.

b) The required training shall be identified and personnel performing the task shall have the appropriate level of training/certification.

c) Personnel involved in the activity shall be communicated with a minimum key information (e.g. design, scheduling, loading, etc.). For example, those performing periodic safety inspections need to know the maximum design-imposed load and the design maximum tie spacing. Also, those erecting the scaffolding shall need to have copies of risk assessment and task details.

d) Appropriate documentation shall be maintained on site. This shall include method statements, PTW, inspection records etc.

e) Competent person on behalf of the scaffolding contractor shall ensure the following:

- The approved method statement, risk assessment and design will be communicated to all involved in the contract.
- Personnel involved in the activity has understood and follows the applicable safe working procedure.
- Safe system of work in place & inspect the surrounding areas for any additional hazards which may not addressed in the risk assessment.
- Where necessary the work area shall be segregated by means of physical barrier from the general work area to prevent unauthorized access from third parties. Scaffolding incomplete signs shall be displayed during erection & dismantling.
- All emergency procedures have been communicated well to the workers through the Tool-Box-Talk (TBT) and necessary trainings.
- Safe weather conditions.
- All workers undergo Project Site Induction trainings.
- Scaffolders check ground conditions prior to erection.
- All the materials considered/selected to be used for scaffolding shall be appropriate (i.e. consider type of work, load, height, weather conditions).
- Scaffold is built to relevant standard/design; and
- Appropriate control measures shall be established for preventing the hazard of working at height/falling objects.

9.3 STEP 3 – CHECK

Periodic checking is necessary to determine if scaffolding has been erected as designed and planned as per the established standards and to enable early corrective action to be taken. This includes scaffolding inspection and tagging.

9.4 STEP 4 – ACT

This step involves reviewing the completed work to make each task a learning experience so that the next task can be performed more effectively.

9.5 INSPECTION OF SCAFFOLDING ERECTION SITE

Scaffolding erection site shall be inspected by Scaffolding Inspectors & Scaffolding management standard / Subject Matter Experts (SMEs), to review including but not limited to the following factors:

(i) Ground conditions for adequate support.

(ii) Overhead obstructions and power cables.

(iii) Wind conditions.

(iv) Expected adverse weather condition.

(v) The need for overhead protection.

(vi) Potential blockage of escape routes by scaffolding.

(vii) Requirement of fans over walkways to catch debris; and

(viii) Requirement of pedestrian and vehicle diversions.

Any specific concerns or hazards shall be included in the Method Statement.

9.6 SCAFFOLDING DESIGN

The scaffolding shall be designed based on calculation by a competent person, to ensure that it will be stable under all conditions and have adequate strength to cope with the expected loads.

9.6.1 General Design Requirements

Following requirements shall be complied with for all scaffolding designs:

a) Each scaffolding and its component shall be capable of supporting, without failure, its own weight and at least 4 times the maximum intended load applied or transmitted to it.

b) A written erection and dismantling procedure together with the scaffolding drawings and design calculations shall be provided to authority for approval.

c) Scaffolding components manufactured by different manufacturers shall not be intermixed unless the components fit together without force and the structural integrity of scaffolding is maintained by the user; and

d) Scaffolding components manufactured by different manufacturers shall not be modified to intermix them unless a competent person determines the resulting scaffolding is structurally sound.

9.6.2 Design Standards

All scaffoldings shall be designed in accordance with the latest requirements of the following standards or an acceptable equivalent as applicable to the type of scaffolding:

(i) BS EN 12811-1, Temporary Works Equipment. Scaffolds. Performance Requirements and General Design.

(ii) BS 5974, Planning, Design, Setting up and Use of Temporary Suspended Access Equipment.

(iii) BS EN 1004, Mobile Access, and Working Towers made of Prefabricated Elements. Materials, Dimensions, Design Loads, Safety and Performance Requirements.

(iv) BS EN 1808, Safety Requirements for Suspended Access Equipment. Design Calculations,

Stability Criteria, Construction; and

(v) BS 2482, Specification for Timber Scaffold Boards.

Annexure 1 provides key design requirements for scaffoldings as per the above-mentioned standards.

9.7 CHANGE MANAGEMENT

JSW sites shall ensure that there is a change management process in place in accordance with the procedure on Management of Change.

Following is some of the changes which can affect the scaffolding management.

a. Change in scaffold design other than approved one.

b. Change in scaffold tubes and pipes specification.

c. Change in team involved in inspection and certification system; and

d. Any variation in scaffold erection, place of erection or any change in proximate hazard.

9.8 MATERIAL STANDARDS

a) TUBE: Scaffolding requires robust steel tubing, with a nominal bore size of 1 ½ inches (40 mm), a heavy-duty thickness of 4 mm (±10%), weighing 4.37 kg/m, and meeting YST 22 grade specifications outlined in IS: 1161, adhering to IS: 2750 standards. The tubing shall be straight, square cut (perpendicular to its axis), galvanized, and devoid of cracks, surface flaws, or defects in accordance with the following pipe fabrication specifications and as specified below:

- ASTM A500, Grade B; Minimum yield stress of 290 N/mm² (30 kg/mm²) with nominal wall thickness options of 3.4 mm or 3.76 mm.
- ASTM A53, Grade B; Minimum yield stress of 240 N/mm² (24 kg/mm²) with a nominal wall thickness of 3.68 mm.
- BS 1139, Part 1, Section 1.1; Minimum yield stress of 235 N/mm² (24 kg/mm²) with a nominal wall thickness of 4.0 mm.
- EN 10219; Minimum yield stress of 320 N/mm² (32 kg/mm²) with a nominal wall thickness of 3.2 mm.

Available sizes include 6.0 m, 4.8 m, 3.6 m, 3.0 m, 2.4 m, and 1.8 m. Welded tubes formed by joining smaller lengths are prohibited, all Tubes produced shall meet the testing and inspection requirements of ASTM A500 including flattening test, actual yield and tensile strength shall be verified by purchaser of scaffold tubes by receipt from supplier and review of certified inspection test reports for each lot of tube produced from the same heat of steel. Tubes shall maintain straightness within 1/600 of their length, with straightening only performed on specialized equipment. Any deformed sections should be removed, and tubes should be kept clean and subject to regular inspection. Corrosion prevention involves applying a red oxide coat to the external surface.

b) FITTINGS: Scaffold fittings, such as couplers and clips, shall adhere to IS: 2750 specifications (constructed from mild steel per IS: 1570, Schedule II). Regular inspection is necessary to detect worn-out, damaged threads, cracks, or deformations in fittings. Moving parts should receive routine lubrication to ensure smooth operation. Bolts and nuts shall meet IS: 1362:1962 standards, with bolt holes drilled to accommodate shaped washers and protruding at least one thread length.

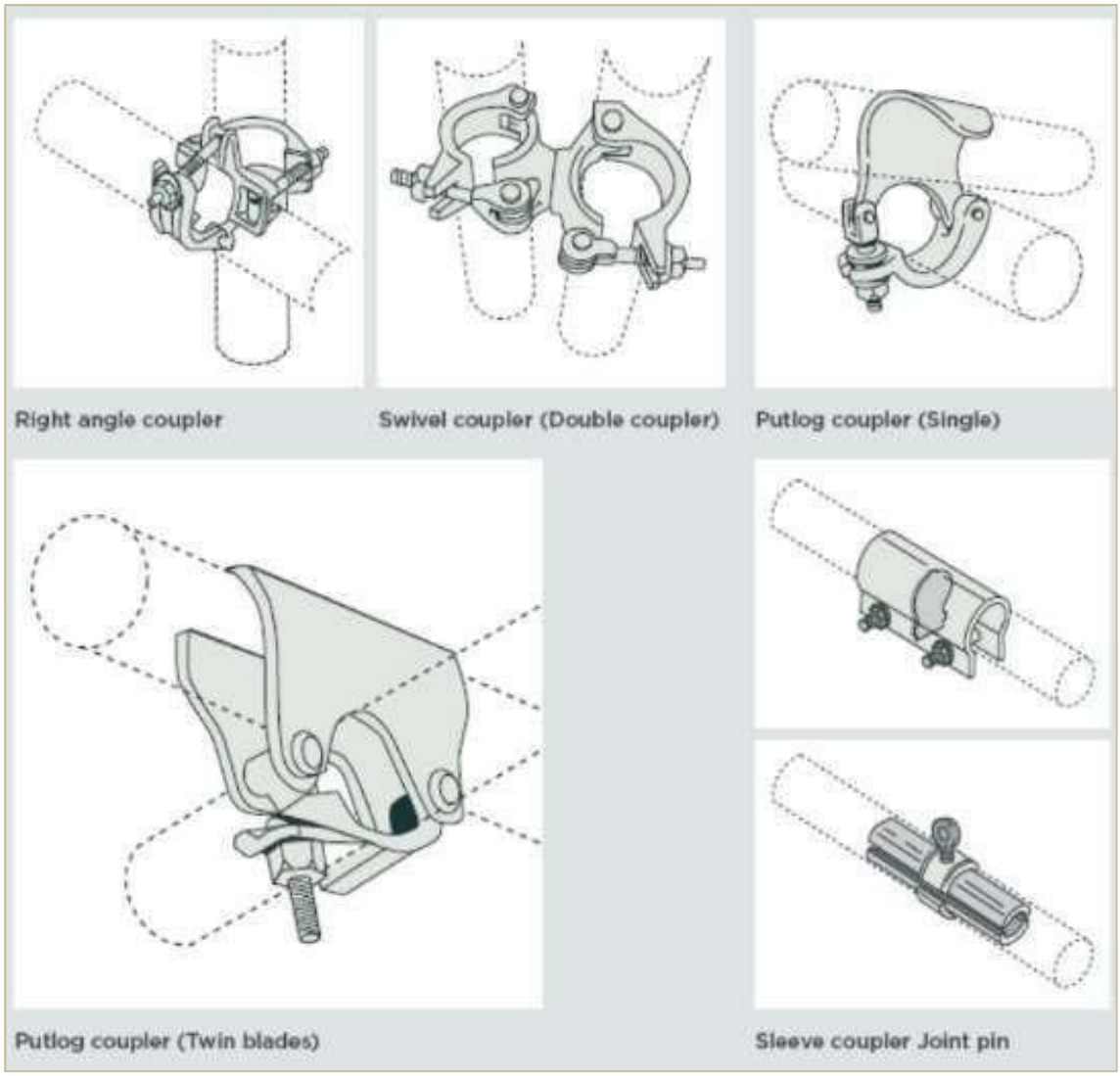


Figure- 16 : Type of Couplers

Threaded part of scaffold components and fittings shall be capable of attaining full thread engagement and shall be lubricated regularly. Individual couplers shall comply with the minimum safe working load in table 2. This shall be verified from the certificate/records submitted by the manufacturer/supplier.

The components used to assemble scaffold shall be inspected before each use and shall conform to requirements of this section regarding materials, strength, dimensions, etc., scaffold components manufactured by different manufacturers shall not be intermixed and modified.

Table 2: Type of Coupler

Type Of Coupler	Type Of Load	Min. BS EN 74 Class	Minimum Safe Working Load (SWL) * (*BS 5973: 1993, Table 17)
Right-angle Coupler, also known as Double or Loadbearing Coupler	Slip along a tube	A	SWL = 6.25 kN (1400 lb.)
Adjustable Coupler, also known as Swivel Coupler		A	SWL = 5.3 kN (1190 lb.)
End-to-End Coupler, also	Tension	B	SWL = 3 kN

Type Of Coupler	Type Of Load	Min. BS EN 74 Class	Minimum Safe Working Load (SWL) * (*BS 5973: 1993, Table 17)
known as Sleeve Coupler			(675 lb.)
	Bending	B	SWL = 0.59 kN-m
			(435 lb. ft)
Bearer Coupler, also known as Putlog or Single Coupler	Force to pull the tube axially out of the coupler	-	SWL = 0.53 kN (120 lb.)
Girder Coupler (drop forged)	Shear	-	SWL = 30 kN per pair (6740 lb.)

c) PLANKS: For JSW sites, steel gratings are recommended over wooden planks due to the prevalence of hot work. Grating specifications include mild steel conforming to IS: 3629, with openings no larger than 25 mm. Load-bearing capacity should match that of wooden boards 50 mm thick and 2000 mm wide. Gratings consist of 25 mm hollow square bars welded at both ends and supported at least three times along their length. A 1500 mm × 225 mm grating typically weighs between 16 to 22 kg.

Wooden planks may still be suitable for tasks like electrical work to prevent electrocution. Quality timber for wooden scaffold planks shall meet IS: 3629 standards. For boards between 32 mm to 50 mm thick, widths should be at least 200 mm, while those over 50 mm thick should be at least 150 mm wide. Planks thinner than 32 mm are unsuitable. Nails should penetrate the holding piece to a depth at least 12 times the nail diameter.

9.9 LADDERS

- When scaffolding platforms are more than 600mm above or below a point of access, ladders or similar access mechanisms shall be used. Cross braces shall not be used as a means of access.
- Ladders used for access to another level shall be tied and extend at least 1 m above the landing point to provide a secure handhold unless adequate handholds are provided.
- The vertical distance between landings shall not exceed 6m.
- Ladder angle shall be 4:1.
- Care shall be taken to ensure that there is adequate space between the rungs to give a firm foothold, and that there is no possibility of the foot being trapped between a rung and a ledger, transom, or brace tube.
- The landing area shall be kept clear of obstructions, stacked materials etc. and have guard rails and toe boards.
- The access opening shall be as small as practically possible; and
- Any scaffold over 8m high shall have the access ladder turned inside the framing, and alternate sides of landing.

9.10 SCAFFOLDING ERECTION

- Before scaffolding erection begins, a Permit to Work (PTW) should be obtained. Refer to the PTW standard (JSW/GHS/GS- 08) for the scaffolding checklist.
- Scaffolding components and equipment shall be inspected before use by a competent and experienced scaffolding inspector for any defects and damages.
- Unserviceable items should be clearly marked and removed from site to prevent their accidental use by others.
- The scaffolding erectors shall have the valid PTW displayed at the location of the scaffolding during the assembly and a copy of the Method Statement, which they should be conversant with.
- Scaffolding erection shall only be carried out by a competent person.

- All scaffoldings shall be designed & erected in line with the relevant international standard as mentioned in Section 9.6.2.
- All personnel shall wear full PPE, including site-specific and mandatory PPE during erection and dismantling activities.
- The scaffolding shall be barriered off and clearly displayed that it is unsuitable for use if it is left unattended during erection.
- Access to the incomplete scaffoldings shall be prevented by suitable physical means (e.g., barricades).
- To prevent access or use of incomplete scaffoldings by unauthorized persons, relevant warning signs identifying the areas or sections where access is not permitted shall be displayed at the access points to those areas; and
- All scaffoldings shall be erected on a firm level and consolidated base. No excavation shall be carried out near to any scaffolding supports.

9.11 SCAFFOLDING TAGGING AND VISUAL INSPECTION

9.11.1 Scaffolding Tagging

Once erected, the scaffolding shall carry a tagging mechanism at prominent location to indicate key details about the scaffolding such as:

a) Scaffold No.

b) Job Site.

c) Date Erected.

d) Erected by.

e) Date of last inspection; and

f) Inspected by.

The inspection tag shall be fitted at all access points to the scaffolding so that those are visible to anyone accessing the scaffold. They shall be in use as soon as the scaffolding is built and remain on the structure until it is dismantled. They can be fixed using the porthole on the inspection tag, locked in via a scaffolding clip or secured with a pull tie. The figure below provides a sample of Scaffold inspection tag:



Figure- 17: Inspection Tag (Illustration Purpose Only)

A green insert shall be completed and fitted inside the inspection tag when the scaffolding has been inspected and is safe to use. This shall be valid for one (01) week. Yellow caution inserts are used to provide caution for using or accessing the scaffolding. The figure below provides sample of green and yellow inserts:



Figure- 18 : Inspection Tag Green and Yellow Inserts (Illustration Purpose Only)

The green inspection tag indicates that the scaffolding is safe to use, but the user shall check that the date has not expired. Without the green or yellow insert, the empty inspection tag shall display a **DO NOT USE SCAFFOLDING PREFERABLY IN RED COLOUR TAG**. This indicates that the scaffolding has not been inspected or is not safe for use by anyone other than the scaffolder (for scaffolding completion/rectification work only).

9.11.2 Scaffolding Visual Inspection

Scaffolding shall be inspected by a competent person to ensure that it has been erected in accordance with the design requirements and safety standards. The inspection should identify any defects and corrective actions taken. These actions, even if resolved immediately, should be documented to help identify any recurring issues. The inspection checklist should be attached to the inspection report.

Scaffolding inspection shall ensure the following as a minimum:

Compliance with the approved design: The scaffolding shall be built according to the approved design specifications, ensuring all components are correctly placed.

Structural integrity of the scaffolding: The scaffolding structure should be sound, stable, and properly assembled. This includes ensuring that all parts, such as braces, ties, and base plates, are securely fastened and functional.

Adequacy of the supporting structure: The base and supporting structures should be strong enough to support the weight and forces placed on the scaffolding during use. This includes verifying the condition and suitability of the ground, foundations, or any other support elements.

Security and protection of the working platforms: All platforms used for working should be secured to prevent movement, with proper edge protection, guardrails, and toe boards to prevent falls or material drops.

Safe access and egress: There should be safe and adequate means for workers to access and exit the scaffold, such as ladders, stairs, or ramps, which should be free from obstructions.

Functionality and safety of the scaffold: The scaffolding should be suitable for the intended work and able to support the tasks safely, including tools, equipment, and workers.

Scaffolding inspection frequency will vary depending on factors like weather conditions, site-specific risks, scaffold size, and type. As a minimum, inspections should be conducted:

- By a certified scaffolding inspector.
- According to applicable standards and internationally recognized scaffolding guidelines.
- Following original equipment manufacturer (OEM) guidelines.
- Upon delivery of materials to the site.
- During erection to ensure that the scaffold conforms to the original plan and design specifications, taking corrective actions as needed.
- After completion of scaffold erection for certification purposes.
- Before the scaffold is taken into use.
- After modifications, exposure to adverse weather conditions, or after periods of non-use.
- At least every 7 days for scaffolds used over extended periods.
- After any event that could affect the stability of the scaffold (e.g., strong winds, storms, etc.).

In some cases, more frequent inspections may be required, as determined by the competent person.

Where defects are identified, they should be immediately rectified, and the root causes of recurring defects should be investigated. Corrective and preventive actions should be implemented to prevent future occurrences.

Scaffolding Inspection Records should be kept on-site as a Scaffolding Register, which should include the following details:

- Location of the scaffold.
- Erected by: Name of the team or person who erected the scaffold.
- Date and time of the inspection.
- Inspection status: Pass or fail, including any issues identified.
- Relevant design/specification reference: The design number, drawings, or specifications referenced.
- Details of the person who conducted the inspection: Name and qualifications of the inspector.
- Any remarks or observations related to the inspection, including required corrective actions.

Refer to **Annexure 2** for a typical scaffolding inspection checklist.

9.11.3 Scaffolding Handover

Once the scaffolding has been erected and inspected, it shall be handed over to the party who requested it. When the completed scaffold is handed over for use, it is the responsibility of the user to ensure its suitability for the required work and use within design limits.

9.11.4 Alterations To Existing Scaffolding

If an alteration is required, it shall only be carried out by a competent person. Depending on the extent of the modification, the design calculation may need to be repeated to ensure that the new design is still adequate. The altered scaffolding shall be re-inspected prior to use.

9.12 SHARED SCAFFOLDING

In some instances, scaffolding may be used simultaneously or consecutively for different jobs or by different groups or personnel at the same time. For each single group or party, it is important to be aware of any other parties who may be using the same scaffold, the nature of the work and to coordinate all activities including access.

When there are two or more parties using the scaffolding simultaneously or the scaffolding is to be used for more than one purpose, the following requirements shall be considered before the scaffolding is designed:

(i) Which party or group will the scaffolding be handed over to?

(ii) The duration of use by each party.

(iii) Ensure that the width of the working platform and access/egress routes are sufficient to cope with all workers.

(iv) Ensure that the scaffolding is designed to the higher class considering that all parties could be using the scaffolding simultaneously.

(v) Ensure that the scaffolding is designed to fulfil the requirements of all parties, so that alterations are minimized.

9.13 SCAFFOLDING DISMANTLING

The dismantling of scaffolding shall be planned so that the scaffolding remains stable, workers are prevented from falling from the scaffolding and others are protected from the risk of falling objects. Following requirements shall be considered for dismantling of scaffolding:

(i) Before dismantling of the scaffolding can start, a PTW shall be taken.

(ii) Scaffolding dismantling shall only be carried out by a competent person and supervised for the type of scaffolding.

(iii) The dismantling shall be planned so that stability is assured by providing adequate bracing and ties and by restricting the imposed loads due to stacked scaffolding components.

(iv) The procedure of dismantling shall be clear, in order, planned appropriately and dismantling proceed generally from the top in horizontal sections.

(v) The scaffolding shall be examined before dismantling to ensure that the foundation is adequate and that all ties and braces are in position and are effective and that there is no condition which can jeopardize safe dismantling operation.

(vi) Special care to the taken while dismantling defective sections of scaffolding.

(vii) PTW and job specific JSA shall be displayed at the location of the scaffolding during the dismantling.

(viii) Clear and prominent warning signs shall be in place and access to the danger zone shall be prevented.

(ix) All personnel shall be equipped with relevant PPE.

(x) During dismantling, no component, which can endanger the stability of the remaining structure, shall be removed.

(xi) Components shall be raised or lowered hand to hand in an orderly fashion or handled by crane, gin wheel or other suitable means.

(xii) Dismantled scaffolding components and materials shall be lowered to the ground and not stored on the scaffold.

(xiii) Workers shall be protected from falling during dismantling of scaffolding; and

(xiv) Workers and personnel in the vicinity shall be protected from the risk of being struck by falling scaffolding components.

10. EMERGENCY RESPONSE AND PLANNING

JSW Site shall prepare and maintain a comprehensive emergency response plan specific to scaffolding operations. This plan should address potential risks and hazards associated with scaffolding work and include:

- **Scaffolding collapses or instability** due to improper erection, weather conditions, or overloading.
- **Falls from height** during scaffolding assembly, dismantling, or use.
- **Falling objects** or tools from scaffolding platforms that may endanger workers below.
- **Structural failures** impacting scaffolding or nearby structures.
- **Fire or explosion risks** during scaffolding work near flammable materials or sources of ignition.

The emergency response plan should detail the necessary requirements, actions, and mitigation measures for each identified scenario. It should ensure clear and precise procedures for emergency preparedness and response, including:

- **Immediate evacuation protocols** for affected areas.
- **Rescue and medical response procedures** for injured personnel.
- **Coordination with local emergency services** when necessary.
- **Training and drills** to ensure readiness and effectiveness of the response plan.

This plan should be regularly reviewed and updated to address changes in site conditions, standards, or identified risks.

11. TRAINING

JSW Group Companies shall ensure that personnel involved in operations related to scaffolding erection, alteration, and dismantling such as Scaffolding Inspectors & Scaffolding management standard / subject matter experts (SMEs) are:

(i) Trained in scaffolding management standards.

(ii) Appropriately experienced; and

(iii) SME certification (Scaffolding Inspector/ Scaffold safety specialist) from JSW approved/recognized 3rd party agency.

(iv) JSW Group Company site supervisors shall seek and keep record of evidence of the certification to verify that training has been received. Periodic refresher training shall be provided where appropriate.

All personnel required to work on scaffolding shall receive basic awareness training and instruction in the safe use of the scaffolding. Awareness training shall ensure that scaffolding users:

(i) understand the types of scaffolding.

(ii) can recognize when a scaffolding is complete, e.g. guardrails and toe-boards present.

(iii) understand the warning signs or inspection tag in use.

(iv) can work at height safely.

(v) know what PPE are required to used.

(vi) do not interfere or make modifications to scaffolding.

(vii) know the maximum loading capacity of scaffoldings.

(viii) can report defects to a designated person.

(ix) do not throw materials from the scaffold.

(x) use the designated access points and do not climb the scaffold; and

(xi) egress in case of emergency.

12. RACI MATRIX

Table 3 RACI Matrix

Activity Description	Area Supervisor/Shift In charge	Executing Department	Site HSE	Fire & Rescue Department	Corporate Safety
Identify Scaffold erection site	A	A	C	C	-
Planning, Preparation, Risk assessment	R	A	C	C	-
Assign responsibility for implementing control measures	R	A	C	I	-
Protective and Rescue equipment plan	R	A	C	C	-
Scaffolding Design	R	A	C		I
Training and Certification	-	A	R	C	I
Audit/Inspection and monitoring for compliance	-	A	C	C	I
Identify Rescue Team	R	A	C	A	I
Apply for Permit	I	A	I	-	-

13. MANAGEMENT OF RECORDS

The retention period for inspection records and related documentation shall be defined based on the type of information, considering the following factors:

- Legal requirements
- Customer requirements
- Internal policies and procedures
- Records to be maintained for effective scaffolding management include:
- Inspection Records
- Periodic inspections of scaffolding components and various types of scaffolds.
- Training Records
- Documentation of training for individuals involved in scaffolding erection and work.
- Permit to Work (PTW) Records
- All closed PTW records, retained as per defined retention requirements.
- Incident and Injury Records
- Records related to injuries or incidents should be retained until statutory issues are resolved.

Record Retention:
Site permits and audit checklists should be retained for three years.

Retention periods for other records will be determined based on legal, customer, and internal requirements.

14. LEGAL AND OTHER REQUIREMENTS

JSW site shall access, identify, evaluate, and keep up to date the Scaffolding requirement as per prevailing law in operation.

15. KEY PERFORMANCE INDICATORS

To ensure conformance to the requirements of this STANDARD, the following key performance indicators (KPI's) shall be identified, communicated, recorded, and monitored:
Indicative list of KPI'

- Number of SWP/JSA prepared for scaffolding.
- Compliance to Scaffolding Management Standard.
- Number of Safe work platforms
- Number of Scaffolding Assurance/Audit Program
- Number of trained personnel-authorized employees
- Safety Observations on Scaffolding.

Depending on the type of Scaffolding, each JSW site shall identify and monitor additional KPIs as appropriate.

16. ASSURANCE

Each site shall conduct self-assurance program to ensure compliance with this STANDARD as part of its Safety assurance program. Third party system audit shall be conducted by Group Safety or external consultants to ensure compliance with the standard.

17. DEFINITIONS

Term	Definition
Bay	The portion of a scaffold situated between two adjacent pairs of standards measured longitudinally and extending the full height of the scaffold
Bay length	The longitudinal distance between the two adjacent pairs of standards.
Competent Person	A person who can identify existing and predictable hazards in the surroundings or other working conditions which are hazardous or dangerous to employees and has the authorization to take prompt corrective measures to eliminate them. Competent persons should be suitably qualified and authorized.
Contractor	A 'Contractor' is defined as an individual or organization having a contract/sub-contract with JSW Group for the provision of services, equipment, or performance of works. The term "Contractor" as used in the JSW Group Contracts Procedure is synonymous with the terms including but not limited to "Consultant", "Sub-Contractor", "Service Provider" or "Supplier"
Foreman Scaffolder	A trained, qualified, and experienced person with assigned duties, but not limited to, the supervision of scaffolding erections, alteration, dismantling, or staging in a safe manner
HVAC	Heating, Ventilation and Air Conditioning
JSA	Job Safety Analysis

Term	Definition
KPI	Key Performance Indicator
Lift	The assembly of ledgers and putlogs forming each horizontal level of a scaffold
Lift Height	It the vertical distance between two lifts, measured center to center
PDCA	Plan, Do, Check, Act
PFD	Personal Floatation Device
Scaffold Lift	The basic vertical construction of a scaffold, the vertical height of a level of scaffolding. The bottom-most level is the base lift
Scaffolding Inspector	An individual who has been trained and certified for conducting scaffolding inspection, certification and tagging

18. ANNEXURE

18.1 ANNEXURE -1 – SCAFFOLDING DESIGN INFORMATION

The requirements are provided for scaffoldings constructed from prefabricated components or from tubes and couplers, such as façade scaffolding.

General

Every area for access and working shall be so arranged as to provide a convenient working place, and to:

(i) protect people from the risk of falling.

(ii) provide safe storage of materials and equipment; and

(iii) protect those below from falling objects.

Attention shall be paid to ergonomic considerations. The area shall be fully decked and shall be provided with appropriate side protection when ready for use.

Connections between separate parts shall be effective and easy to monitor. They shall be easy to assemble and secure against accidental disconnection.

Width Classes

The width is the full width of the working area including up to 30 mm of the toe board. Width shall be selected as per seven width classes provided in following table:

Table 4 Width Classes for Working Areas

Width Class	Width in m
W06	0.6≤w<0.9
W09	0.9≤w<1.2
W12	1.2≤w<1.5
W15	1.5≤w<1.8

Width Class	Width in m
W18	2.1≤w<2.4
W24	2.4≤w

The clear distance between standards shall be at least 600 mm; the clear width of stairways shall not be less than 500 mm.

Headroom

The minimum clear headroom between working areas shall be 1.90 m.

Working Areas

(i) It shall be possible to secure platform units against dangerous displacement e.g. unintended dislodging or uplifting by wind forces.

(ii) Platform units should have a slip-resistant surface. A timber surface normally meets the requirements for slip-resistance. The risk of tripping from any method used to secure the platform unit or from overlapping should be minimized.

(iii) Each end of a platform, unless cleated or otherwise restrained by hooks or equivalent means, shall extend over the centerline of its support at least 150mm.

(iv) The gaps between platform units shall be as small as possible but not exceeding 25 mm; and

(v) Working areas shall be as level as practicable. If the slope exceeds 1 in 5, securely attached full width footholds shall be provided. Except that, where necessary, there may be gaps not exceeding a width of 100 mm in the center of the footholds to facilitate the use of wheelbarrows.

Principal Guardrail

The principal guardrail shall be fixed so that its top surface is 1 m or more above the adjacent level of the working area everywhere (absolute minimum height 950 mm).

Toe board

A toe board shall be fixed so that its top edge is at least 100mm to 150 mm above the adjacent level of the working area. Holes and slots in a toe board shall, except for handling holes be no larger than 25 mm in one direction.

Side Protection

Working and access areas shall be safeguarded by a side protection consisting of at least a principal guardrail, intermediate side protection and a toe board. The toe board may be dispensed with on stairways. Side protection shall be secured against unintended removal.

Base Plates and Base Jacks

The strength and rigidity of the base plates and base jacks shall be sufficient to ensure that it can transmit the maximum design load from the working scaffold to the foundations. The area of the end plate shall be a minimum of 150 cm^2. The minimum width shall be 120 mm.

Base plates made of steel shall conform to EN 74 i.e. their thickness should be at least 150 millimeters by 150 millimeters and 6 millimeters. For special scaffolds, the base plate shall be designed to support the maximum scaffold load. Timber sills shall be used where base plates may be exposed to corrosive material.

Base jacks shall be provided with a centrally positioned adjusting spindle of such dimensions that, in the unloaded condition, the greatest inclination of the axis of the shaft from the axis of the standard does not exceed 2.5 %. The minimum overlap length at any position of adjustment shall be 25 % of the total length of the shaft, or 150 mm whichever is greater. The thickness of the endplate shall be at least 6 mm. Shaped endplates shall have at least the same rigidity.

Access and Egress

Safe access to and egress from scaffolding during the erection, use and dismantling shall be provided by considering the following:

(i) temporary stair towers or portable ladder access systems installed at the start of erection, progressed with the scaffolding, and used by the scaffolder whenever reasonably practicable.

(ii) permanently installed platforms or ramps.

(iii) build-in access for mobile towers/system scaffolding.

(iv) mechanical personnel hoists used in conjunction with permanent stairs or temporary stair towers which are to be used in an emergency or in the event of a power failure; and

(v) using the existing stairs of a building, provided such access is safe.

18.2 ANNEXURE-2- SCAFFOLDING INSPECTION CHECKLIST

SECTION 1 – INTRODUCTION			
Scaffolding Ref No.:		Project/Task No.:	
Type of Scaffolding:			
Load Capacity:			
Site:		Location:	
Date of Erection:		Erection by:	
Date of Inspection:		Inspection by:	

SECTION 2 – SCAFFOLDING INSPECTION			
No.	**Checklist Items**	**Y/N/NA**	**Remarks**
1	Has scaffolding been designed for the environment, e.g.? • wind loading. • power lines. • ground conditions		
2	Have competent persons overseen erection?		
3	Generally, are scaffolding components in safe condition for use?		
4	Are all tubes. • straight? • free from cracks, splits, dents, and excessive corrosion? • cut square and clean at each end? • made of the same material?		
5	Are all standards. • vertical? • mounted on base plates and sole? boards? • mounted on a firm base? • spaced to support the load?		
6	Are all ledgers. • level? • fastened with double couplers? • fastened end to end by sleeve couplers? • constructed with staggered joints? i.e. joints in adjacent ledgers should not occur. • in the same bay?		
7	Are all transoms. • fastened to standards with double couplers, or alternatively fastened to ledgers with putlog couplers. • correctly spaced		
8	Are all braces. • connected to standards with swivel couplers, or connected to ledgers with double couplers? • fixed as close as possible to ledger/ standard connections? • fixed to alternate bays?		

SECTION 2 – SCAFFOLDING INSPECTION

MANAGEMENT STANDARD: SCAFFOLDING

No.	Checklist Items	Y/N/NA	Remarks
9	Is all bracing. • run from bottom to top of scaffold? • erected as close to 45° as possible? • fastened to each standard by a swivel coupler, or fastened to transoms by double couplers? • joined together by sleeve couplers?		
10	Are all boards. • graded for scaffolding use? • secured and undamaged end protection? • clean, free from nails, concrete etc.? • without splits decay or damage or large knots? • not warped or twisted?		
11	Has proper and safe access been provided?		
12	Is the frame spacing and base plate size capable of carrying intended loading?		
13	Are sole boards properly placed and adequate size?		
14	Is scaffolding level and plumb?		
15	Have screw jacks been used to level and plumb scaffold?		
16	Are base plates and/or screw jacks in firm contact with sole boards and plumb?		
17	Is guard railing in place on all open sides and ends?		
18	Has overhead protection been provided where necessary?		
19	Has scaffolding been tied to structure where required?		
20	Have freestanding towers been guyed or tied in order to be stabilized against overturning forces?		
21	Is scaffolding free of improvised devices or ladders to increase height?		
22	Are working platforms fully boarded between guard- rails?		
23	Are toe boards installed properly?		
24	Is the area below scaffold? • marked with warning signs? • cordoned off? • pedestrians and vehicles safely diverted?		
25	Have personnel been instructed in the safe use of the scaffold?		

19. REFRENCES

References Document	Full Title, Brief Description and Web Links
Occupational Safety and Health Administration (OSHA) 3150 Version 2002, A guide to scaffold use in the construction industry	OSHA is a part of the United States department of labor to ensure safe and healthful working conditions for workers by setting and enforcing standards by providing training, outreach, education and assistance. A Guide to Scaffold Use in the Construction Industry (osha.gov) 1926.451 - General requirements. | Occupational Safety and Health Administration (osha.gov)
Health and Safety Executive	The health and safety executive is Britain's National regulator for workplace health and safety dedicated to protect and prevent people and places HSE UK, HSG150, Health and Safety in Construction Health and safety in construction (HSG150) (hse.gov.uk)
OSHAD-SF Code of Practice CoP 26.0 – Scaffolding, Version 3.0, July 2016	Abu Dhabi Occupational Safety and Health System Framework OSHAD-SF - CoP 26 - Scaffolding (irena.org)
British Standard Institute	BSI is the business standards company that equips business with necessary solutions to turn standards of best practice into habits of excellence. BS-EN-12811-1-British-Standard-Scaffolding-Performance-Requirement.pdf (wm-scaffold.com)
Indian Standards	IS 2750 : Steel Scaffoldings IS 3696 : Safety code of scaffolds and ladders: Part 1 Scaffolds IS 3696 : Scaffolds and Ladders - Code of Safety - Part 2 : Ladders IS 4014 : Part 1 Code of practice for steel tubular scaffolding Part 1 Definitions and materials
National Authority for Occupational Safety and Health Ireland, Code of Practice for Access, and Working Scaffolds, 2009	Code of Practice for Access and Working Scaffolds - Health and Safety Authority (hsa.ie)

References Document	Full Title, Brief Description and Web Links
Occupational Safety and Health Service, Department of Labor, Wellington, New Zealand, Code of Practice for the Safe Erection and Use of Scaffolding	Scaffolding in New Zealand | WorkSafe
Safety Guidelines for Iron & Steel Sector	Ministry of Steel undertook extensive interactions with the stakeholders from the steel industry associations and the academic institutions of repute to evolve a set of common minimum guidelines for safety which can act as minimum safety benchmark for adoption by the Indian Steel industry. Safety Guidelines for Iron & Steel Sector | Ministry of Steel | GoI
8. Others	Occupational Safety and Health Branch, Labor Department, Code of Practice for Metal Scaffolding Safety, March 2013 CISRS, CAP 609, General Information Booklet BS 1139-2.2:2009, Metal scaffolding – Part 2: Couplers – Section 2.2: Aluminum Couplers and Special Couplers in Steel – Requirements and Test Methods Scaffolding, Shoring & Forming Institute Inc. Technical Bulletin, Wind Speeds and Swing Stages Safety Work Australia, General Guide for Scaffolds and Scaffolding Work National Access & Scaffolding Confederation (NASC) TG20:13, SG:4-15, SG 34:17, SG 15:14 Construction Industry Scaffolders Record Scheme (CISRS) Guidelines

JSW Group

MANAGEMENT STANDARD: CRANE & LIFTING
JSW/GHS/GS-14

MANAGEMENT STANDARD CRANE & LIFTING

Management Standard Title:	**CRANE & LIFTING**	**Date of Revision**	10.12.2024
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1. PURPOSE

This Standard aims to formalize the administration and management of all material lifting activities involving cranes and hoists. The primary goal is to foster an incident-free work environment by establishing a systematic approach for managing material lifting operations across all JSW business sites.

This Standard provides guidelines for the safe execution of material lifting using cranes and hoists.

To achieve a safe work environment, this standard outline the systematic procedures for managing material lifting activities. It emphasizes the required involvement and accountability of line management to ensure compliance and safety.

2. SCOPE

This Standard applies to all JSW companies and subsidiaries, including managed business sites, corporate and regional offices, research and development facilities, new projects, and merged or acquired entities. It is relevant to all JSW employees and contractors. The Standard governs the entire lifecycle of a project, encompassing planning, assessment, exploration, evaluation, design, development, operation, and closure.

Each business unit shall develop and publish its own business-specific requirements as a supplementary document to the Crane and Lifting Group Standard. Where national or local legislation regarding crane and lifting is more stringent than the Group Standard, compliance with these legal requirements is mandatory.

This Standard establishes procedures for:

- Procurement and hiring of material lifting equipment with respect to safety features.
- Inspection and maintenance of equipment.
- Operation of cranes and hoists.
- Qualifying personnel.
- Safe rigging practices, including those involving contractors and vendors.

And applies to all material lifting equipment, including cranes and hoists, whether owned, hired, or operated by JSW or its contractors under appropriate contractual arrangements. Equipment not conforming to this Standard shall be upgraded within a timeframe specified by the Rules and Procedure Subcommittee or as directed by the APEX Committee.

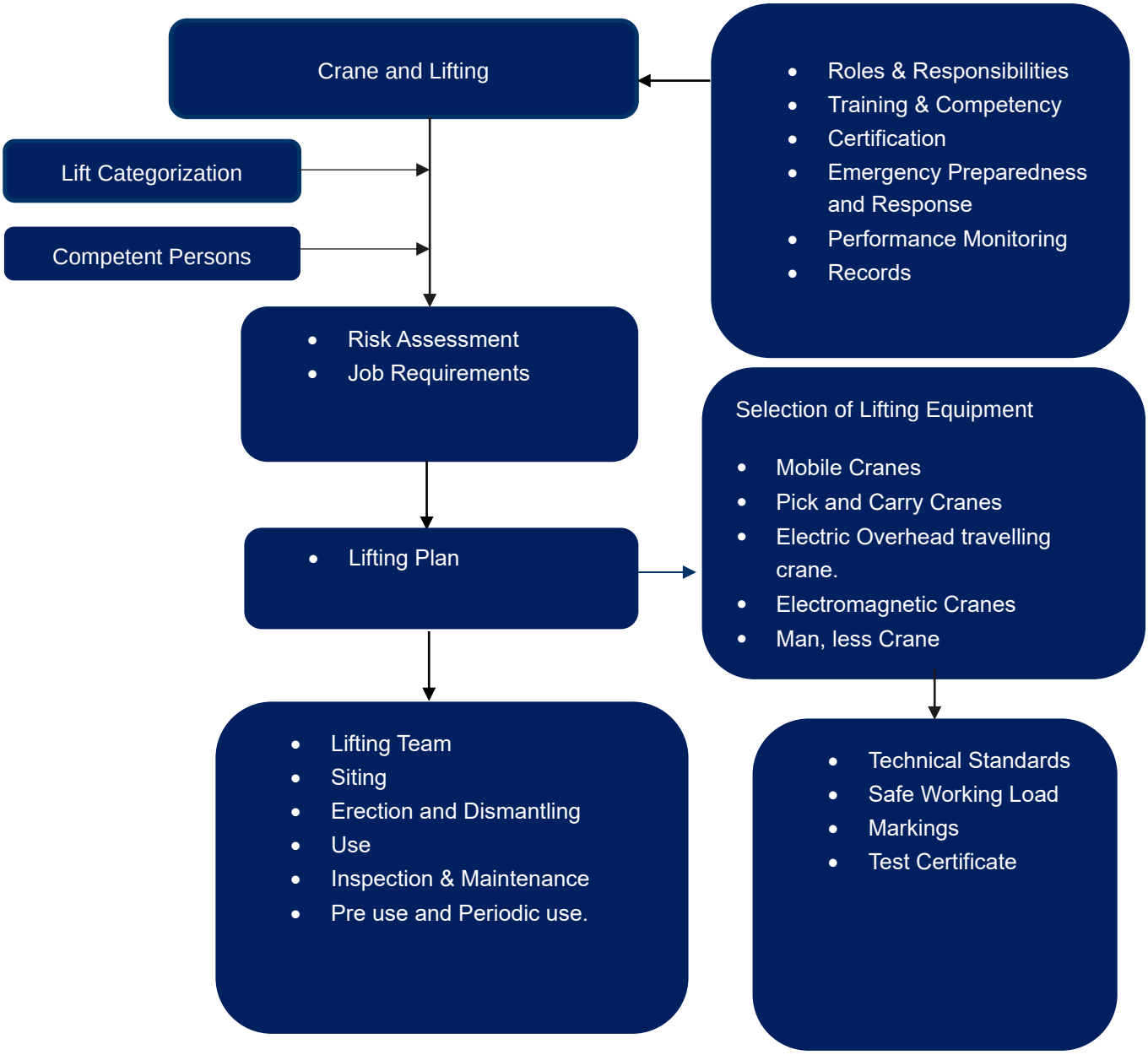
In the Standard, the following verbal forms are used to indicate requirements, recommendations, permissions, or capabilities:

- “shall” indicates a requirement.
- “should” indicates a recommendation.
- “may” indicates a permission.
- “can” indicates a possibility or capability.

3. REVIEW

The standard shall be reviewed at least every 5 years.

4. PROCESS FLOW



Functional Elements of Safe Lifting Management Program

5. ELEMENT 1: MANAGING HAZARD & RISK DURING MATERIAL HANDLING

JSW Business/ Site/ Location shall conduct a risk assessment to ensure the evaluation of load, selection of appropriate lifting methods, lifting equipment, and control measures for 'routine' and 'non-routine' lifting operations. Unless the task activity is eliminated or automated, the risk control provisions often count on multiple controls from engineering and administrative control options.

Routine lifting and rigging will be repetitive in nature and involve loads that are similar in shape, size, and weight. The lifting is carried out on a day-to-day basis as a part of regular operations. The underlying principle is that the risks involved in routine material handling are already known and mitigated. The Business/Site/Location shall conduct a risk assessment using HIRA and shall have SOPs, SMPs, and with pre-work checklists for day-to-day operations by clearly defining the standard operating conditions such as who will approve the lifting plan, load limits, the equipment to be used, skill, knowledge, and competence of those executing and supervising the lift.

The non-routine lifting and rigging refer to material handling operations that are carried out for the first time or periodically, use of hired lifting equipment and 'critical lift' (load exceeds 75 percent of the rated capacity of the lifting equipment or requires the use of more than one crane or derrick) or lifts over operating facilities or lifts involving personnel cages, Blind lifts, lifts under overhead powerlines and pipelines. Business/Site/Locations shall conduct the risk assessment for every such lift using the Permit to Work and JSA (safety protocol) process as per Permit to Work Standard JSW/GHS/GS-08. The non-routine assessment shall include a lifting plan developed and approved by a competent person.

The risk assessment shall consider the following criteria (but is not limited to):

i. Load characteristics - critical load, centre of gravity.

ii. Lifting equipment – crane, derricks

iii. Weather – visibility, wind, and other conditions.

iv. Competency – lifting or rigging planning expert, equipment operator, and signalling person.

v. Communication – hand signal or other means.

vi. Time of lifting – off hours, late evenings, and holidays

vii. Other workplace hazards - overhead power lines, utility lines, ground stability

viii. Executing agency shall evaluate and mitigate the other critical hazards associated with material handling:

   a. Load Path - Obstacles in the operator or load path shall be cleared before lifting. Nominated team members shall walk across the load path and remove obstacles prior to the lift.
   b. Traffic - People/Foot traffic around the load shall be barricaded from the work area.
   c. Blind zones - The operators of cranes or other lifting appliances shall have free visibility to the load in every working/crane position so that no areas where routine lifts are planned will have blind zones.

The results or outcomes of risk assessment shall be considered in selecting the fit-for-purpose lifting equipment and developing the safe lifting plan:

- Cultural, communication, and language difficulties
- Weight, Size, Shape, and Centre of gravity of load
- Availability of approved lifting points on load
- Method of slinging/attaching/detaching the load
- Overturning/load integrity/need for tag lines.
- Suitability and condition of lifting equipment to be used.
- Initial and final load positions and how it will get there.
- Ground and underground considerations
- Lifting over live equipment
- Number and duration of lift.
- Conflicting tasks in the area

- Environmental conditions, including weather and permissible limits.
- Lighting in the pick-up and lay-down areas.
- Proximity hazards, obstructions, path of load (e.g., potentially live electrical, hydraulic, or pneumatic lines, underground conduits, bridges, and overhead structures)
- Working under suspended load
- Access and emergency escape routes for the signalman and other load handlers (e.g., Banksman, Slinger)
- Experience, competence, and training of personnel.
- Number of personnel
- Pre-Use Inspection of equipment by Operator
- Visibility of the load always by Signal man.

Refer to **Annexure – 5** for technical codes and standards reference on lifting equipment.

6. ELEMENT 2: LIFT & RIGGING PLANNING

There are many elements to be considered when developing a lift plan. Whether it is a Routine or Critical Lift, it is essential who will approve the lifting plan, the equipment to be used, and the skill, knowledge, and competence of those conducting and supervising the lift. The process below is always required:

- **Inspection of selected crane:** A competent JSW representative shall inspect the selected crane at the vendor location before mobilization using an inspection checklist (Refer to Sample Pre-use Inspection Checklist in Annexure-1). This checklist should be preserved for records.
- **Crane Certification:** The selected crane shall have valid visual and non-destructive testing (NDT) certificates for hook assemblies, including magnetic particle testing (MPT) or ultrasonic testing (UT). Load testing shall be performed at a minimum of 100% of the rated load at crane configuration, with certificates signed by a competent authority.
- **Rigging Hardware Certification:** All rigging hardware used shall have valid certificates from a competent person.
- **Lift Categorization:** Each lift shall be categorized into Routine or Critical Lift before commencing.
- **Method Statement:** Upon categorization, a method statement needs to be prepared for every lift, and these statements need to be preserved for records.
- **Documented Process:** There shall be a documented process ensuring all critical components are inspected and in place before a crane is commissioned and put into service, especially if the crane configuration changes, such as attachment or removal of a boom section.
- **Pre-Operational Safety Checks:** Operators shall undertake a pre-operational safety check for each shift the crane or lifting equipment is used, and this should be kept with the equipment. The details required in the pre-operational safety check shall be based on a risk assessment for the equipment.
- **Safety Devices:** Lifting equipment shall not be operated with inoperable or defective safety devices or in unsafe workplace conditions. No inbuilt interlock shall be bypassed. Refer to Annexure-3 for the Recommended Safety Features of Crane.
- **Load Capacity Checks:** Ensure that the load being lifted is within the rated capacity of the crane and lifting attachments and within the limits set out in the lift plan.
- **Safety Latch:** All lifting hooks shall be fitted with a safety latch to prevent the load from accidentally detaching unless otherwise specified in a risk assessment.
- **Swing and Safety:** Loads shall not swing over people or occupied buildings. No person shall be under a suspended load or in a position where they could be struck by a falling load. Where there is a risk of a load falling and striking a person, hard barricading or similar controls shall always be in place. The line of fire shall be well-defined and barricaded against trespassers. The line of fire fall envelope shall also consider crane toppling and boom failure.

- **Tag Lines/Guide Ropes:** Tag lines or guide ropes shall be attached to both sides of loads requiring steadying or guidance while suspended. The load shall be well-secured and properly balanced in the sling or lifting device. No person shall touch a suspended load – the load may only be positioned using tag lines. Persons holding taglines or guide ropes should not be in the line of fire or under the load.
- **Ground Bearing Strength:** Check and level the ground bearing strength. Ensure that the ground conditions related to access and load can withstand the pressure during the crane's erection and operation.
- **Weight of Load:** The weight of the load shall be known prior to hoisting or lifting.

6.1 PRECAUTIONS FOR ALL LIFTS

- There shall be a documented and approved method for communication between the crane operator and those assisting with the lift and includes the hand signals to be used by the hoisting team.
- A procedure shall be in place to prevent the use of lifting or rigging equipment in lifting operations if such equipment has been used for towing.
- All underground services are identified prior to applying a weight load and checked to ensure that they can support the load without any subsidence, sinking, or failure in the underground structure, which could cause the outrigger to sink and result in the crane tipping.
- Mobile cranes shall have a Manufacturer safe working load /rating capacity chart and crane operations and maintenance manual available in the crane cabin.
- Operator control stations for vehicle-mounted cranes shall be in an area protected from swinging loads and from the crane jib.
- Slew pins shall be secured in place in mobile cranes while travelling.
- Slewing to test the integrity of outriggers on mobile cranes shall be conducted prior to commencing Lifts.
- Outriggers should rest on impact pads of twice the area of outrigger foot/float. For crawler cranes impact pad preferably provided by OEM should be used to keep the crane level.
- No crane shall be re-rated more than the original load ratings without the crane's manufacturer's written approval of such rating changes. De-rating of cranes procedures or OEM recommendations shall be adhered to.

6.1.1 Outrigger Pad Calculations

Examples:

Timber pads are required under Outriggers.

Sample Example 1 – for a 40 MT crane

A mobile crane is to be set up on its outriggers on asphalt or dry clay/sand.

The crane has a total mass of 32 tonnes and is to lift a 21.65-tonne load—21.65 tonnes is the maximum the crane can lift in the stability range of the load chart at a 6-meter radius. The lift plan requires the load to be slewed above each outrigger foot. Calculate the minimum required area of the timbers to be placed under each outrigger when lifting directly above an outrigger foot.

Lifted load (L) = 21.65 tonnes

Total crane mass (CM) = 32 tonnes

Maximum allowable ground pressure (PMAX) for Asphalt/dry sand/clay = 20 tonnes per m2

area = 0.65 x (CM + L) / PMAX

area = 0.65 x (32 tonnes + 21.65 tonnes) / 20 tonnes per m2

area = 22.75 tonnes / 20 tonnes per m2

area = 1.74 m2

Dimensions of outrigger timbers: v1.74 m2 = 1.32 m

Therefore, length x width of timbers required = 1320 mm x 1320 mm.

Safety and Margin: The 0.65 factor ensures that the calculations accommodate real-world variations and provide a safety margin.

The value for the Maximum Allowable Ground Pressure (PMAX) of 20 tonnes per m² for asphalt, dry sand, or clay is a commonly used reference in engineering and construction for estimating ground bearing capacities. However, this value can vary depending on specific conditions and should be verified with local standards or guidelines.

Sample Example 2 - for a 30 MT crane

A mobile crane is to be set up on its outriggers on asphalt or dry clay/sand. The

crane has a total mass of 29 tonnes and is to lift a 15-tonne load—15 tonnes is

the maximum the crane can lift in the stability range of the load chart at 6 m radius.

The lift plan requires the load to be slewed above each outrigger foot. Calculate the minimum required area of the timbers to be placed under each outrigger when lifting directly above an outrigger foot.

Lifted load (L) = 15 tonnes

Total crane mass (CM) = 29 tonnes

Maximum allowable ground pressure (PMAX) for Asphalt/dry sand/clay = 20 tonnes per m2

area = 0.65 x (CM + L) / PMAX

area = 0.65 x (29 tonnes + 15 tonnes) / 20 tonnes per m2

area = 22.75 tonnes / 20 tonnes per m2

area = 1.43 m2

Dimensions of outrigger timbers: v1.43 m2 = 1.2 m

Therefore, length x width of timbers required = 1200 mm x 1200 mm

6.2 PREVENTING TIPPING

The following points need to be considered to prevent the tipping/toppling of the crane.

- **Crane Leverage:** In Figure 1 When stabilizers are not extended, the tipping point is on the tires. Distance A1 becomes shorter and crane leverage decreases, causing distance B1 to increase, which raises the load leverage on the crane and reduces its capacity.

- **Extension of Outriggers:** When the outriggers/stabilizers are not extended or are partially extended, crane capacity is reduced, and load weight is increased.

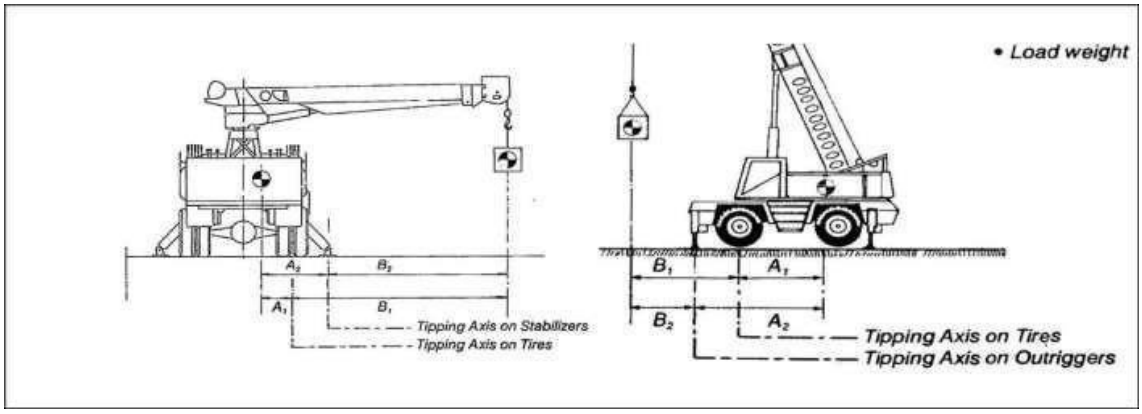


Figure-1: Tipping Prevention

- **Ground Conditions:** All mobile cranes should be placed on properly levelled and compacted ground. Plumb accuracy should be within 1 degree, i.e., +/- 0.5 degrees from the vertical axis.
- **Load Testing:** All mobile cranes shall be load-tested after every assembly at the site and after any change in configuration. Load tests should be conducted on both strength and stability as specified in the crane load chart provided by the OEM.
- **Calibration:** All sensors/load cells of the crane shall have valid calibration.
- **Wind Speed:** No lift should be performed if the wind velocity exceeds 20 km/h (or as specified by the OEM, whichever is lower). The crane should have an anemometer located at the boom top, with the main panel interlocked with the maximum recommended velocity. A dry run should be ensured before lifts in case of blind or steep angle lifts.
- **Tandem Lifts:** When using more than one crane for tandem lifting, each crane's capacity should be derated by 25%, and a critical lift analysis, including a JSA, should be carried out.
- **Load Chart:** Never interpolate between chart listings. Always use the capacities specified by the OEM.
- **Side Pulls:** Side pull lifts are not permitted. Dynamic loading of cranes should be avoided. Dynamic loading results from excessive sway and should be controlled by taglines and proper alignment of lifting tackles.

6.3 RIGGING

Rigging is a very vital link between a crane and the load therefore, every part of the rigging shall be selected, inspected, applied, and maintained with utmost care.
Rigging Plan: While developing a rigging plan following points shall be considered:

- Who is responsible for rigging?
- Has communication been established?
- Is the rigging in acceptable condition?
- Is the rigging appropriate for lifting?
- Does the rigging have proper identification?
- Does all gear have known SWL, check for certificates?
- What is the weight of the load?
- Any chances of slings fouling as the load leaves the ground?
- Will the load lift level and stable?
- Where is the centre of gravity?
- What is the sling angle?
- Will there be any side or angular loading?

- Is adequate padding available to protect the sling against sharp edges?
- Is the hitch appropriate for the load?
- Is a tagline needed to control the load?
- Is the load rigged keeping in mind the Centre of Gravity?
- Any unusual weather approaching? like strong winds, rain, and lighting.

6.4 WEIGHT OF LOAD

- The weight of the load, including packaging materials, rigging hardware, and the centre of gravity, shall be known. In the absence of this information from the supplier, the weight of the load shall be determined either by a weighbridge, load cell, or accurate calculation.
- The weight of the block and of any lifting gear to be used shall be included in the total weight to be lifted.

6.5 DATA FOR LIFTING PLAN- (OPERATOR SHALL KNOW)

- **Lift data:** Equipment weight, rigging weight, total weight, height and radius of the lift, equipment surface area, ground condition, canter of gravity.
- **Equipment data:** Manufacturer, model, size, boom length, jib length, load block, material size; safety devices.
- **Rigging data:** SWL, Sling diameter, length, sling configuration, capacity, hook type, shackle size and capacity.
- **Lift calculations:** Boom length, radius of lift, equipment capacity, size of outrigger footplates, outrigger mats and wind speed.
- **Proximity to power lines and process areas:** Mobile cranes working in proximity to energized power lines shall operate under a proximity permit, which shall define exclusion zones and spotter duties.
- **Proximity to buildings, structures, and process areas:** Cranes operating in proximity to these shall document and plan for exclusion zones; to avoid structures; and to be able to complete the lift successfully.
- **Local hazards and their controls:** Including the route for the crane, ground stability, proximity of people or equipment and agreed communication method and known buried underground services.

6.6 LIFT CATEGORISATION

To ensure that suitable controls are applied, lifting operations shall be categorized according to the level of risk and complexity. JSW Business Unit need to identify and get approval of Routine lifts. All routine lifts shall have SOP, lifting plan and exclusion as per permit to work (PTW).

Non-Routine Lifting activities are further sub divided into Critical & Non-Critical Lifting, the categorization of critical lift shall be done at JSW Business Unit level.

Classification of lift to be done as critical if any of the below points are satisfied.

- Load Exceeds 50% of Crane Load Chart Value. No lifting beyond 75% capacity loading.
- Erection Elevation above 35M from GL
- Irregular shape of Object
- Centre of gravity (CG) is not at Centre.
- Blind Lifts
- Lifts over Live Tracks, Utility Lines, Live Power Lines
- Tandem Lifts
- Erection Load above 20MT
- Erection with Trailing Operation
- Lifts involving personnel/ Man cages.

Crane with a safe working load beyond 3T shall be fitted with rated load indicator, also known as Automatic safe load indicator which conforms to BS 7262 or an equivalent international standard.

- Cranes should be equipped with an anti-two-block device that includes audible and visual alarms.
- Line of fire should be well defined & barricaded against any trespasser.
- The operator shall not leave the crane controls while a load is suspended.
- Overhead travelling cranes shall be fitted with audible travel alarms or an equivalent warning device.

There should be a documented and approved method for communication between the crane driver and those assisting with the lift. Only standard hand signals and walkie talky to be used as means of communication.

No crane shall be moved ("marched") with a load suspended unless it is specifically designed to do so. Any "pick and carry" operations shall undergo an assessment of the dynamics of the load and crane during the planned travel to control any risks.

Outriggers should rest on impact pads of thrice the area of outrigger foot. For crawler cranes impact pad provided by OEM should be used.

All mobile cranes should be placed on ground properly levelled & compacted. Plumb accuracy should be 1degree i.e., +/- 0.5 degree from vertical axis.

No lift should be done if wind velocity is more than 20 km/hr (or as specified by OEM of crane).

Dry run to be ensured and mandatory before lift in case of blind / steep angle lift.

(No lifting to be done beyond 75%).

6.7 ROUTINE LIFT PLANNING

For each lift the following shall be completed:

- Establishing the weight.
- Selection of the crane.
- Consideration of the operation location.
- Ensuring that the crane has been thoroughly examined and inspected.
- Ensuring that a system for reporting defects is in place to stop work if a danger is identified.
- Selecting appropriate lifting gear.
- Ensuring that lifting gear are thoroughly examined, inspected, and checked, before use.
- Designating a person to check the lifting gear.
- Briefing all persons involved in the lifting operation to ensure that the safe system of work described in the method statement is understood.
- Checking, if numerous loads are to be lifted over a long period, to ensure that no changes are required in the safe system of work.
- Weight CG and balancing check before raising
- Ensure that the operation is carried out in accordance with the method statement.
- Lifting gear checklist to be filled after selecting lifting gear.

6.8 CRITICAL LIFTS

Critical lifts include all tandem crane lifts; lifts over operating facilities where this may endanger personnel; lifts over power lines which shall be de-energized and LOTO applied; lifts involving personnel cages; blind lift, lift below power lines, and lifts greater than 75% of the maximum rated load in each specific lifting configuration. (No lifting to be done beyond 80%) Crane drivers and rigging crews involved in critical lifts shall have input into the lifting plan and be consulted prior to finalization of the plan. No interpolation/extrapolation is allowed to arrive at intermediate loads not specified in load chart.

CAD drawings should be used wherever possible for Critical Lifts and are mandatory when planning a tandem lift. The CAD drawings should have following details, if any changes then a proper Management of Change is required:

- Complete configuration of all cranes.
- Crane make and type.
- Rated capacity of all cranes.
- Gross weight of the load.
- Any change in the radius during the lift shall be depicted in the drawings (it shall be tried not to change the radius during the lift).
- Consideration of dynamic factors if lifting from water or bad weather is anticipated.
- Weight/SWL of the rigging hardware shall be mentioned.
- All dimensions of the load to be lifted, including the position of CG of the load.
- The size of mats and ground companion requirements.

The fundamental steps to planning a Critical Lift are:

- Develop a workable lift plan.
- Weight CG and balancing check before raising
- The weight of the load is known through the manufacture of the equipment or weighed on a scale.
- Any lifting points provided on the load are adequate for the loads applied and tested and certified.
- The proportion of the weight taken by each crane throughout the lifting operation is known accurately to be within +/- 2%.
- The cranes are compatible in lifting characteristics.
- The lifting operation is planned so that there is no possibility of contact between the jibs of the cranes or jibs and load.
- The method statement includes access, ground conditions, erection, etc., as well as the sequence of operations when lifting the load.
- A proper Risk assessment
- The suitability of the ground is investigated to withstand the force applied during the lifting.
- During the load lifting phase of the operation, the hoist rope loads and inclinations are monitored, and the information is displayed suitably and clearly to the lifting operations supervisor directing the crane operators.
- Lift Plan shall be prepared and approved by two different competent persons – Maker and Checker.
- Work permit shall be issued for critical lifts.
- Conduct a dry run for complete operation without load, also conduct practice for signalling before conducting the actual lift.
- Designated banksman with a reflective jacket to be provided for signals, which shall be known by all involved in the crane operations.

6.9 TANDEM LIFT PLANNING

Tandem lifting operations, involving the use of more than one crane, require the following:

- Detailed & careful planning.
- Make a workable lift plan.
- Proper JSA Risk Assessment.

- Accurate Assessment of the load on each crane. All rigging hardware that will be used shall have valid certificates from a competent person certified by the state government.
- Similar crane capacities are preferable.
- Use one Banksman to signal both crane operators.
- Use suitable lifting accessories shall have valid certificates from a competent person certified by state Govt.
- Ensure the cranes are de-rated by 25% (Which means if the rated capacity of the crane is 100Tons, consider it to be only 75Tons)
- Weight CG and balancing check before raising
- Conduct a dry run before conducting an actual lift.

Guidelines to be considered before crane positioning.

Access

Access for both the lifting equipment and the load to be lifted is considered at the planning stage. The following matters shall be included:

- The suitability of public roads and site conditions for the movement of large cranes and large loads.
- The widths of entrances to allow the passage of large loads without interrupting the movement of other traffic and emergency egress.
- Adequate space shall be available in which to erect mobile cranes for the work and space to accommodate the maximum length of the jib to be erected, together with sufficient space for the movement of the auxiliary crane.
- Arrangements for closing the area during the erection of the crane, the lifting operation, and the subsequent dismantling of the crane, to completely exclude all personnel, other than those immediately connected with the operations. The road closure permit shall be provided to the on-site fire department.

Ground Conditions

Ensure that the ground conditions both in relation to access and the load, which will be imposed during the erection and operation of the crane, are capable and can withstand the pressure.

Permissible Wind Speed during Crane Operations

Any Crane working on site should have a Wind Speed Indicator (Anemometer) to warn the operator and/or cut off crane operation if the wind exceeds the pre-determined speed of 20 km/h or the crane limitation due to manufacturer specifications.

Overhead Power Lines and Other Obstructions

At all stages during the progress of a lifting operation, from planning through to completion, the lift coordinator shall ensure that precautions are in place to avoid overhead power lines and other overhead obstructions. The overhead protection shall be placed at least 1½-jib lengths on either side of the power line. Power line shall be de-energized and LOTO applied.

Table 2 provides guidance on minimal clearance distance **Overhead Line Voltage and Minimum Clearance** Distance (Ref. OSHA CFR 1926.1408, Power line safety).

Voltage (kV, Alternating current)	Minimal Distance, Feet
Up to 50	10
50 to 200	15
200 to 350	20
350 to 500	25
500 to 750	25

Voltage (kV, Alternating current)	Minimal Distance, Feet
750 to 1000	45
Over 1000	(as established by the utility owner)

Table-1: Overhead Line Voltage and Minimum Clearance

Nighttime Lift

- Any lift at night is to be avoided. In case of unavoidable circumstances, approval is to be taken from the Unit Head/DIC Chairman.
- Lift plan to be reviewed by the Section Head prior to the lift.
- Illumination to be ensured a minimum of 150 Lux.
- Lift to be carried out in the presence of the Area In-charge, Head of the Department, with approval from the Unit Head/DIC Chairman.

7. ELEMENT-3: MOBILE CRANES AND PICK AND CARRY CRANES

7.1 COMPLIANCE WITH SPECIFICATIONS AND AGE LIMITS

Manufacturer's Specifications: Cranes shall adhere to the manufacturer's specifications and limitations. If such specifications are unavailable, a qualified engineer shall determine and document the equipment limitations. Attachments used with cranes should not exceed the manufacturer's recommended capacity, rating, or scope.

Age Limits: Cranes shall not exceed the following age limits from the date of manufacture:

Equipment Type	Lifespan
Crawler Cranes	15 years
Tyre Mounted Cranes	10 years
Tower Cranes	10 years
Gantry Cranes	15 years
2nd Generation Mobile Crane	10 years

Table-2: Age Limits

7.2 FITNESS CONFIRMATION

Cranes shall be confirmed fit for use by a competent third party or according to statutory requirements. Vendors shall provide self-declarations against mandatory requirements before mobilization, and JSW representatives shall verify these points before site entry.

7.3 INSPECTION AND TESTING

Visual and NDT Inspections: The selected crane shall have valid visual and non-destructive testing (NDT) certificates for hook assemblies, including magnetic particle testing (MPT) or ultrasonic testing (UT). Load testing shall be performed at a minimum of 100% of the rated load at crane configuration, with certificates signed by a competent authority.

Load Testing Frequency: Cranes shall undergo load testing every six months if derated and following any major modifications or accidents. New or modified hoisting systems shall be load-tested before normal service.

Documentation: Maintain records of all inspections, testing, and maintenance in a register. The register should document all maintenance history and spare parts, beginning once the crane is mobilized on site.

7.4 OPERATIONAL SAFETY

Pre-Operational Checks: Sites shall implement a documented procedure for pre-operational checks, including safety interlocks, rigging equipment, load limits, and other safety devices.

Safety Devices: Cranes shall be equipped with audible alarms, Safe Load Indicators (SLI) or Load Moment Indicators (LMI), and anti-two block devices. Cranes used at JSW sites shall have valid certificates for all rigging hardware and be fitted with adequate fire extinguishing provisions.

7.5 OPERATIONAL PROCEDURES

Cab and Accessibility: Cranes should have safety glazing, adequate visibility, and safety features such as guardrails, anti-skid surfaces, and accessible fire extinguishers. Ladders or steps shall provide access to cab roofs if necessary.

Safety Measures: Site shall ensure that belts, gears, shafts, and other moving parts are guarded to prevent hazards. Maintain a minimum distance of two meter between the crane's swing radius and stationary objects. Do not operate cranes between sunset and sunrise without adequate lighting.

7.6 REGULATORY COMPLIANCE

Modifications and Additions: Any modifications affecting the crane's capacity or safe operation shall receive written approval from the manufacturer or a qualified engineer. Update capacity, operation, and maintenance instructions as required.

7.7 EMERGENCY AND SAFETY MEASURES

Emergency Procedures: Cranes shall have rescue plans, particularly for cabin-operated EOTs and tower cranes. Provide adequate fire extinguishing provisions for first aid firefighting and ensure crane hooks are equipped with latches.

Parking and Securing: When leaving a crane, lower any suspended load, disengage the clutch, engage all safety locks, and secure the boom against high winds. When parking overnight, also release the load, lower the boom to the ground, and use wheel locks and blocks.

7.8 INSPECTION AND CERTIFICATION

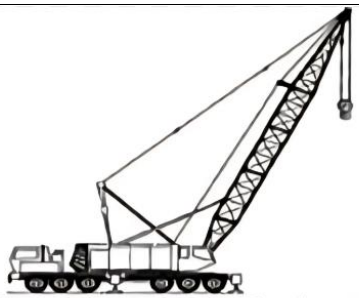
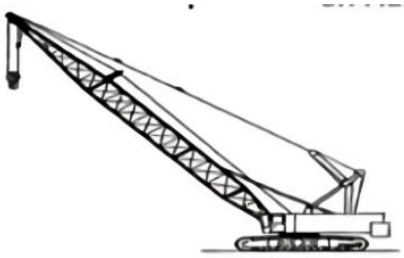
Routine Checks: Perform annual inspections of all lifting machinery and accessories by a competent person. Maintain records as per local statutes. Regularly inspect rigging hardware and update certification as required.

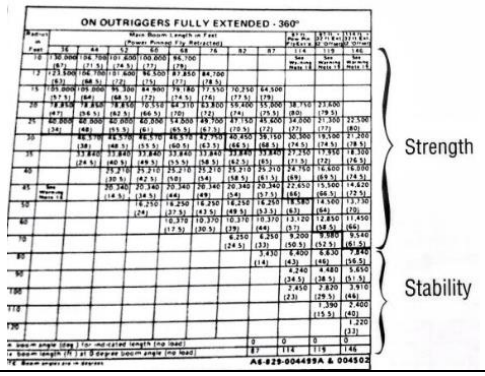
7.9 ASSEMBLY AND DISMANTLING

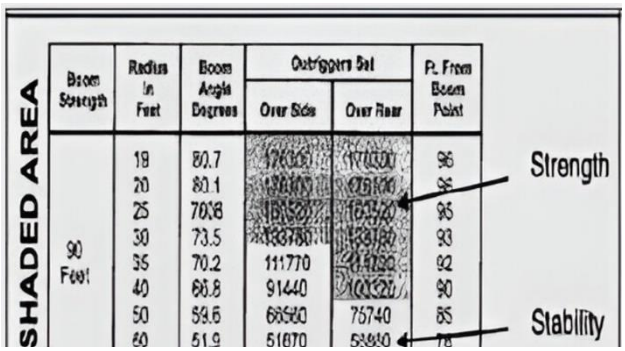
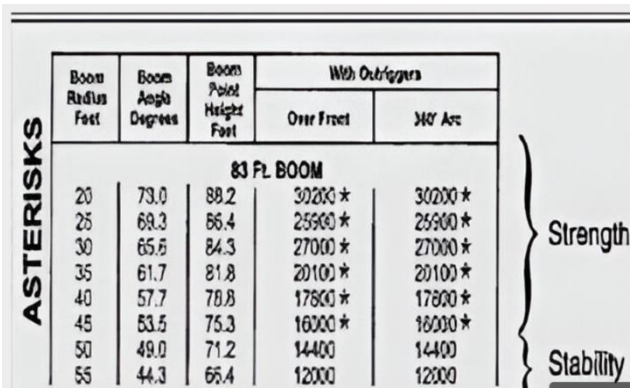
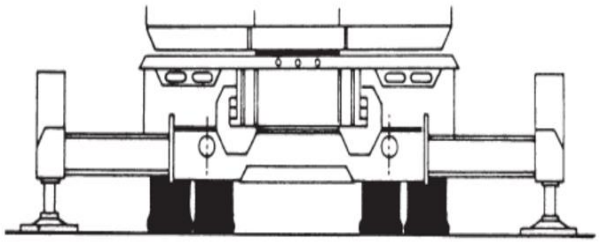
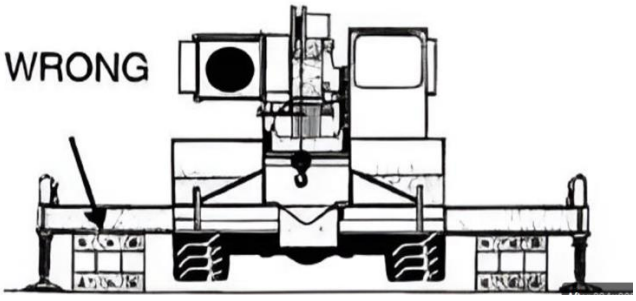
Sites shall follow OEM guidelines and standard operating procedures (SOPs) for the assembly and dismantling of cranes. Conduct risk assessments as necessary.

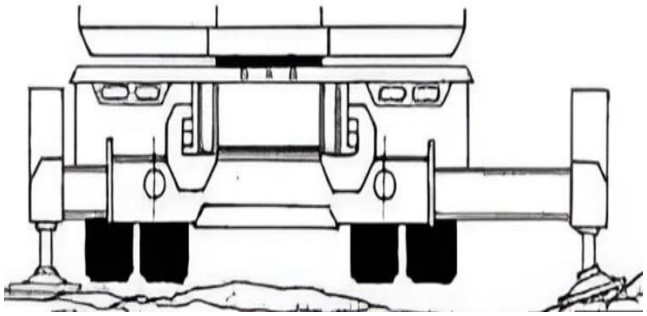
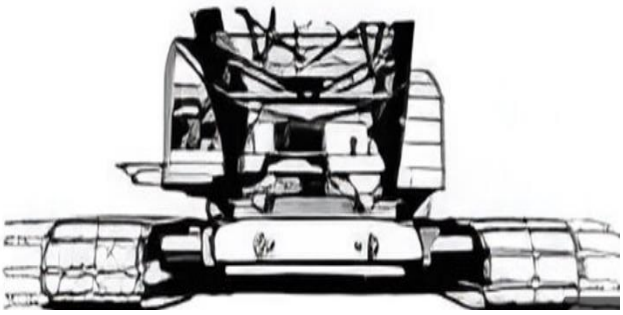
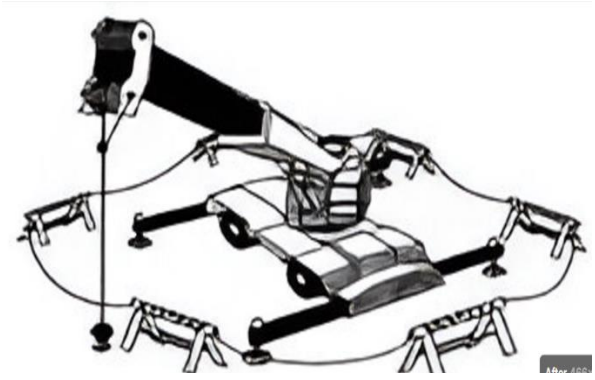
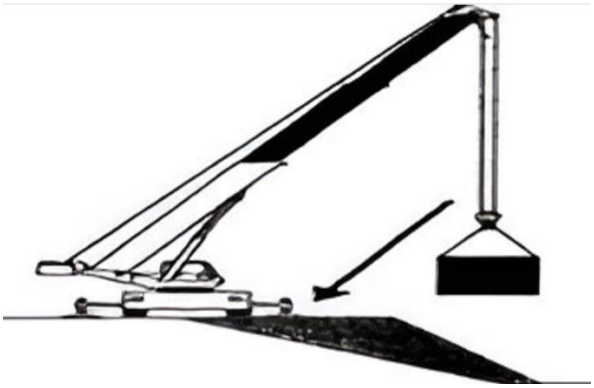
7.10 MOBILE CRANE STABILITY AND LOAD CHARTS

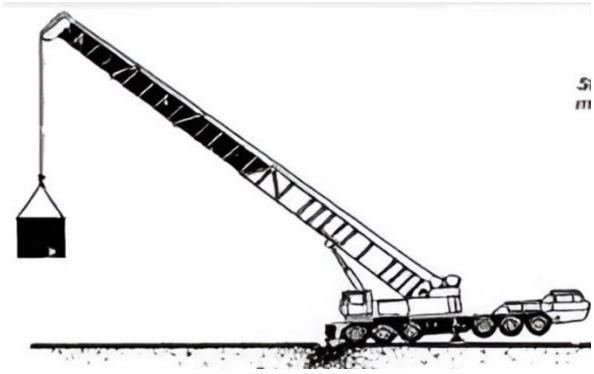
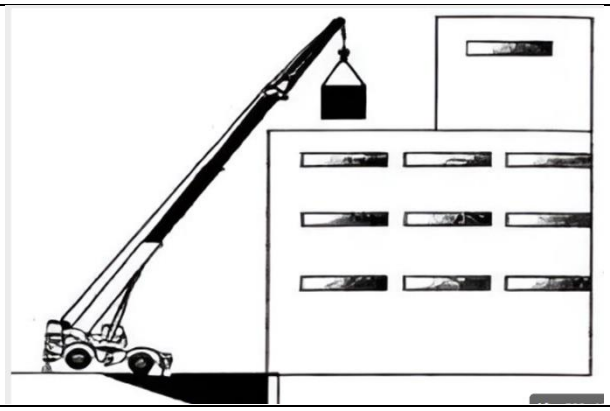
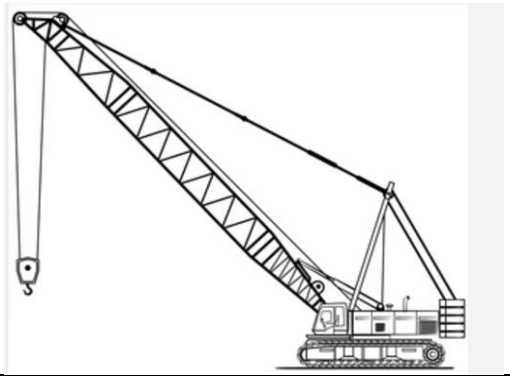
Safe working load recommended operating speeds, and special hazard warnings or instructions shall be conspicuously posted on all equipment. Instructions, warnings, and durable load charts shall be visible while at the control station. Load charts should be affixed to the crane cabin. Load charts shall be those applicable to the specific crane for which they are being used. The crane manual and legally required documents shall be available and in readable condition.

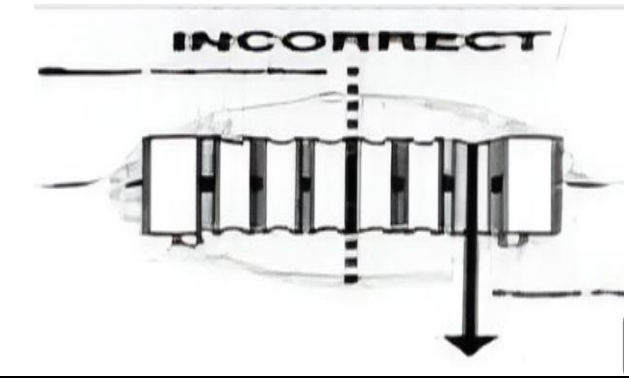
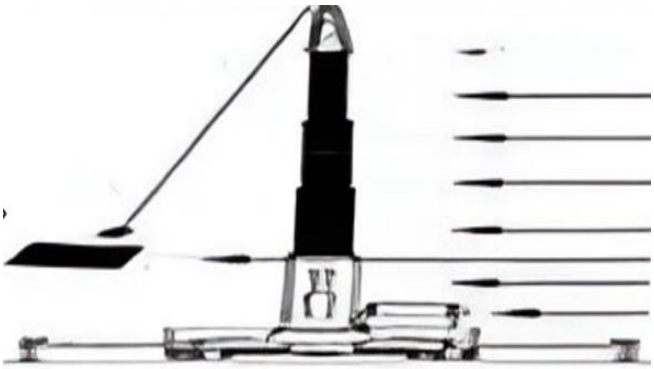
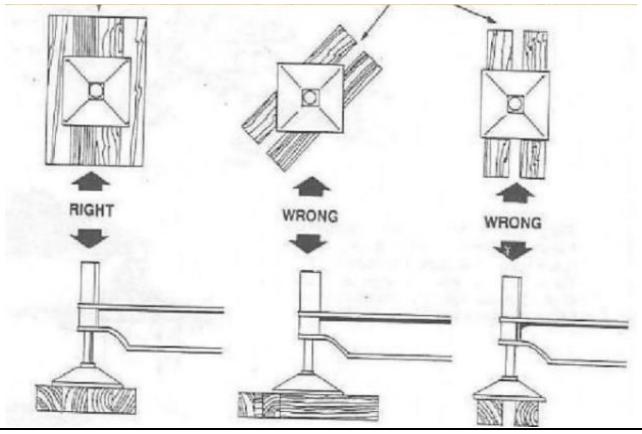
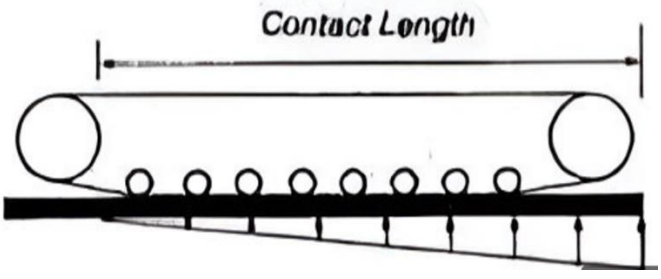
<table>
<tr><td>The Mobile crane load charts are furbished as per these criteria</td><td>
<table>
<tr><th colspan="2">MARGIN OF STABILITY</th></tr>
<tr><td>Crawler Mounted Cranes</td><td>75%</td></tr>
<tr><td>Carrier Mounted Cranes
On Outriggers Extended
On Rubber or Tires</td><td>
85%
75%</td></tr>
<tr><td>Commercial Boom Trucks</td><td>85%</td></tr>
</table>
</td></tr>
<tr><td>Carrier-mounted cranes on Rubber/Tires</td><td>
Carrier Mounted Cranes on Rubber
Rated Capacity = Tipping Load x 75%</td></tr>
<tr><td>Carrier-mounted cranes on outriggers</td><td>
Carrier Mounted Cranes on Outriggers
Rated Capacity = Tipping Load x 85%</td></tr>
<tr><td>Crawler Cranes</td><td>
Crawler Cranes
Rated Capacity = Tipping Load x 75%</td></tr>
<tr><td colspan="2">Every load chart is divided into two portions (strength & stability) by three different means as shown below</td></tr>
<tr><td>Meaning of Black Bold Line

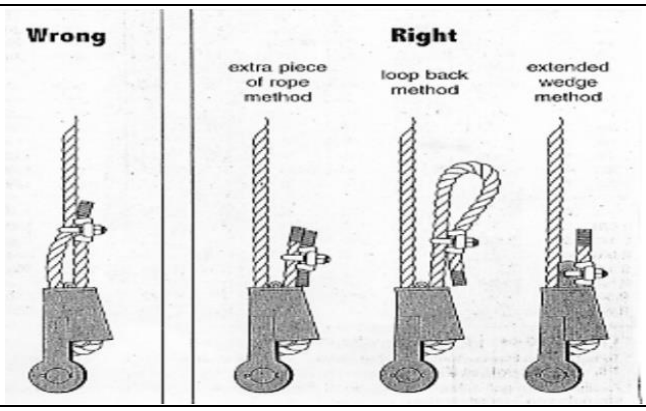
The capacities above the line are based on the strength of the machine, and the capacities below the line are based on the stability factor of the machine</td><td>
</td></tr>
</table>

Meaning of Shaded Areas The capacities in the shaded areas are based on the strength of the machine, and the capacities without shaded areas are based on the stability factor of the machine	
Meaning of Asterisks With asterisks are based on strength capacities, without asterisks are based on the stability factor of the machine	
Always ensure that outriggers are extended completely, and tires are off the ground	
Never block the outrigger rams as the machine leverage decreases	

Never extend outriggers partially	
Ensure crawlers are always extended during the operations	
Barricade the operational area	
While placing the crane on backfill areas always ensure that the outriggers/crawlers are placed after keeping a gap of approx. 1-meter from the edge of backfill area	

Investigate about the compaction where the outrigger/crawlers will be placed	
Always maintain a gap of 2 min meters between the newly constructed building and the outriggers/crawlers	
Ensure the crane operations are smooth and jerk free, and no dynamic loading is created	
While lifting below the ground level, the weight of the total length of wire -rope below ground level shall be added in the load	

Always reeve the pulleys from Centre	
Permissible Wind Speed for Safe Operations - 10 KMPH. Operations Shall Be Ceased at 20mph Wind Speed	
Ensure outriggers are properly placed squarely	
Always block the crawlers with wooden mats or metallic plates to reduce ground pressure	

Wedge socket should be secured as shown in the figure	

7.11 SPECIFIC CRANE CONFIGURATION AND INFORMATION

Crane Make	
Model	
Max. Crane Capacity	Ton
Registration No.	
Max. No. of falls	
No. of falls	
Crane capacity at current falls	Ton
Load and SWL	
Weight of load	Ton
Working radius	m
SWL (at that radius)	Ton
Web Sling	
SWL Capacity	Ton
Length	m
Wire rope sling	
SWL Capacity	Ton
Length	m

Shackle	
Shackle Type (Bow/D')	
SWL Capacity	Ton

7.12 CRANE RADIUS

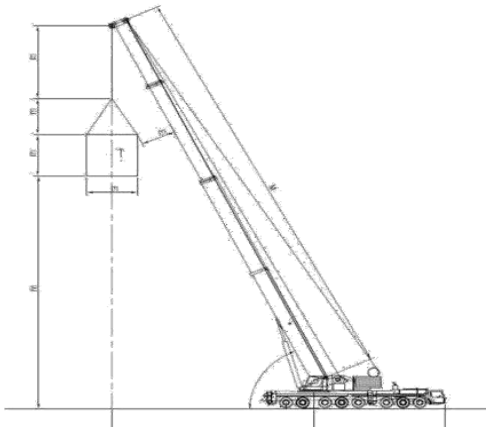


Figure-2 : Side View

To be filled (If change in radius is there) Change of SWL w.r.t Radius			
Location	Radius (m)	SWL (ton)	% of SWL
A			
B			
C			
D			
E			

Note: - Mark the zone in red where the radius is increasing. Alternatively, decreasing.

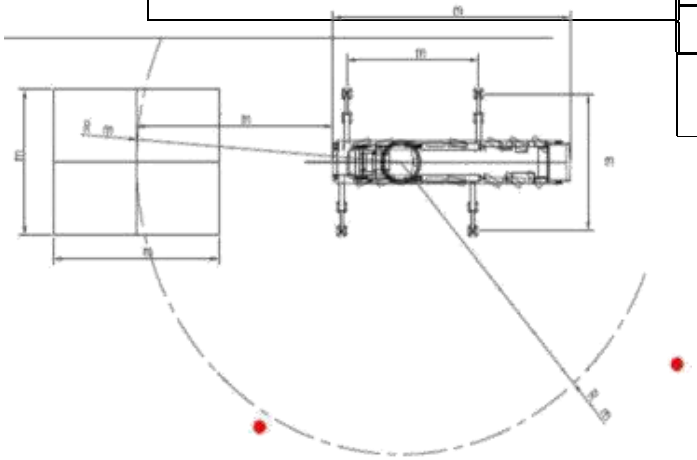


Figure-3: Top View

NOTE:

1. Boom Angle Shall Not Be Changed While Lifting & Swinging
2. Change In Radius Shall Not Be on Top Of Outriggers. (Considering Point Loading)

7.13 EQUIPMENT MAINTENANCE – MOBILE CRANES

Inspection, maintenance, and appropriate testing shall be carried out at determined intervals as per OEM requirements to ensure:

- The parts of the crane subject to deterioration through corrosion, damage, wear, and abrasion are replaced before they become unserviceable.
- The crane is maintained in a safe and serviceable condition.

All equipment used in light lifting operations whether fixed or portable shall be inspected and/or tested to confirm that it is fit for its intended use. Every lifting appliance or piece of lifting gear shall be clearly marked with its safe working load and shall be used within these parameters.

i. Use only if valid examination and test tag available covering safe working load and equipment identification number marking.

ii. Lifting appliances and associated lifting gear shall be examined:
- Before it is used initially.
- Whenever the equipment has been modified or repaired.
- Lifting devices & equipment shall be inspected and tested by a certified third party in established specific periods as per statutory requirements (annually as per Factory Rules and Acts)
- Any appliance or piece of lifting gear that fails the examination or test shall not be used until it is repaired and retested.

Refer **Annexure – 1** for crane inspection checklist for inspecting the crane before deploying it for lifting operations.

7.14 HANDLING AND TRANSPORTING LOADS USING PICK AND CARRY CRANES

7.14.1 Avoid Pick and Carry Loads

JSW Sites should use a truck or lorry designed for transporting loads, materials, or equipment. Avoid using cranes for this purpose.

7.14.2 Risk Assessment

Pre-Operation Assessment: Sites shall conduct a specific risk assessment before performing pick and carry operations, considering:Area of work

- OEM guidelines
- Ground compaction and levelling
- Tyre pressure
- Load dynamics
- Marching path

7.14.3 Transport Limitations

Distance: Pick and carry cranes should not transport materials over distances greater than 50 meters within project or yard areas.

Road Movement: No pick and carry crane are allowed to move with a load on roads.

7.14.4 Operational Restrictions

Tandem Lifting: Two pick and carry cranes shall not be used for lifting in tandem at the site.

Speed: Cranes shall not exceed 8 km/h when moving on roads.

Slopes/Ramps: Pick and carry cranes are prohibited from operating on slopes or ramps.

7.14.5 Safety Measures

Work Permit System: Adhere to the ‘Work Permit Standard JSW/GHS/GS-08’ and ensure the crane has a valid certificate.

Usage Condition: Cabin should be closed while work is ongoing

Personnel Transport: No personnel should be transported with materials, and no co-passengers are allowed in the crane cabin or chassis.

7.14.6 Operator Requirements

Training: Only OEM-trained operators should operate the equipment. Additionally, JSW Operators shall complete training tailored to JSW’s specific operational requirements.

7.14.7 Inspection and Certification

Pre-Entry Inspection: Before entering plant premises, the crane shall be inspected and certified by the Central Maintenance Department, Safety & Fire Services, and the concerned department.

7.14.8 Approved Cranes

Model F-15 (M/s Escorts)

Omega 20T Pick and Carry Crane

Model 15X W-F (M/s ACE)

Chowgule Truck Mounted Crane (up to 2.5T capacity)

Pal finger Hydraulic Lifting and Loading (up to 7.5T)

TIL Industrial Crane (12.5T capacity)

8. ELEMENT 4: ELECTRIC OVERHEAD CRANE

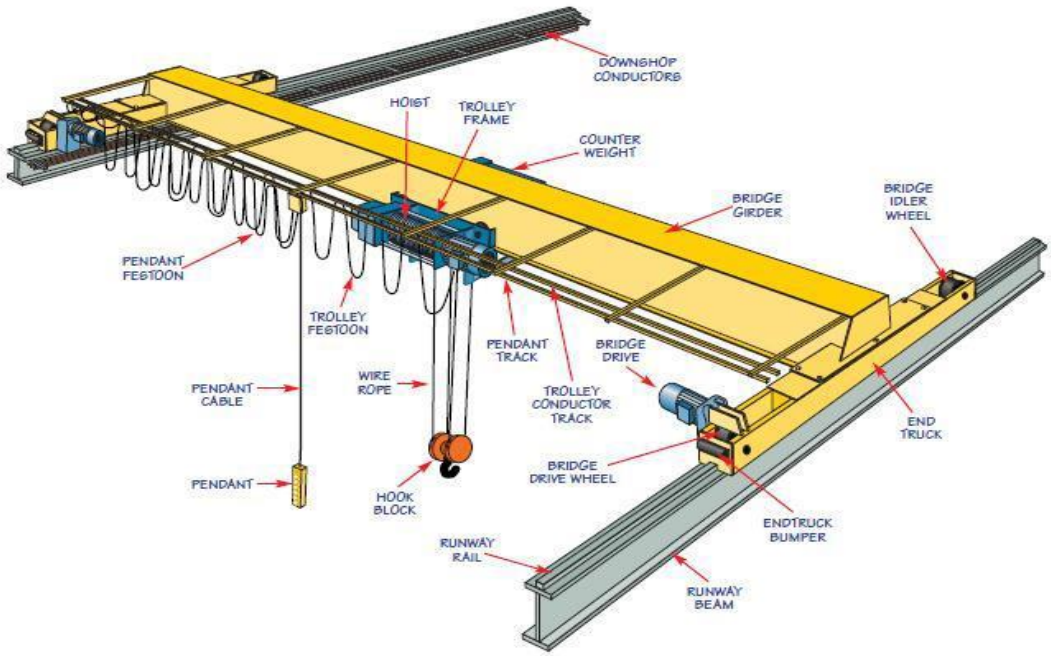


Figure-4: Electric Overhead Crane

This section outlines the comprehensive provisions for the construction, installation, inspection, and maintenance of Electric Overhead Traveling (EOT) cranes. These provisions apply to hand-operated and power-driven overhead and gantry cranes with top-running single-girder or multiple-girder bridges, and underhung cranes used for vertical lifting and lowering of unguided loads.

- Only OEM EOT Cranes shall be installed at sites.
- Design and Procurements shall be vetted with the Safety department in the design stage itself.
- Reputed OEMs only shall be engaged for the procurement and installation of these cranes.

8.1 REQUIREMENTS SPECIFIC TO EOT CRANES

8.1.1 Safety Features

- **Audible Travel Alarms:** EOT cranes shall be equipped with audible travel alarms or equivalent warning devices to alert personnel of crane movements.
- **Load Indicators:** Cranes with all capacities shall have load indicators to display the weight of the load.
- **Overload Protection:** Cranes should have overload protection mechanisms to prevent lifting loads exceeding their capacity.
- **Dead-Man Switches:** Hand-operated dead-man switches should be installed for load travel (LT), crane travel (CT), and hoisting operations.
- **Anti-Collision Devices:** Anti-collision system shall be provided to detect the other crane in the same track which in turn shall slow and stop the crane along with Audio Visual alarm in the operator's cabin.

- **Limit Switches:** Cranes should have interlocks for upper and at least one for lower limits. Interlocks should be routed through separate contactors.
- **Physical Stoppers:** Physical stoppers should be installed at the end of travel limits to prevent mechanical damage.

8.1.2 Markings – Cranes

The SWL of the crane shall be marked on each side of the crane and shall be legible from the ground or floor. Marking shall include.

- SWL
- Year of manufacturing
- Unique identification number
- Test date.
- Due date.

Following display should be provided on EOT Crane:

SL	TYPE OF BOARD	CONTENTS	WHERE TO PLACE
1	Name Plate	Safe Working Load, Manufacturer Name & Year of Manufacturing	Both outer sides of the bridge girders
2	'Inspection Date' Board	Last date of inspection, due date of inspection & done by — Due date: After 1 year (As per Factory Act)	Outer side hand railing of one of the girders
3	'Danger' Board	As per IS 2551 (Relevant for application)	Protective panel cubicle front cover & Main incoming switch
4	'Caution' Board	a) Unauthorized persons are not allowed on the crane gantry b) Use Safety Helmet, Safety shoes, Safety goggles, safety jackets, Safety belt, and other required PPEs while going to the crane gantry	Crane gantry approach staircase hand railing
5	'Instruction' Board	a) Inform the operator through the bell switch before climbing the crane b) Cut off the safety switch before boarding the crane	Near all corner boarding approaches to the crane
6	Do's & Don'ts Board	Do's & Don'ts for Crane operator	Inside the operator cabin
7	Do's & Don'ts Board	Do's & Don'ts for the maintenance crew	Near the panels and on the girder
8	Important Telephone Numbers	Following minimum telephone numbers should be displayed: - Fire Brigade - Ambulance - Security - Shift Safety - Control room of that area	a) In the crane operator's cabin b) Near the control panel/E-room

SL	TYPE OF BOARD	CONTENTS	WHERE TO PLACE
		- Line managers of that area - Head of that area	
9	Hazards on the Crane	1. Gas hazards if any 2. Fire hazards 3. Slip, trip, fall on the same level or from height 4. Clearance between fixed points	a) Near the entrance of the crane b) Both sides of the girder c) Any other suitable location
10	Information about Workplace	Name of the crane Capacity Make Nature of job Specification	At the entrance of the crane or any other suitable location

8.2 GUIDELINES

8.2.1 Operation Activities

- **Prohibition of Distractions:** Use of cell phones and personal stereos is prohibited during crane operation.
- **Crane Access Procedures:** Auto closing gate shall be provided in the crane operator's walkway for the safe entry to the crane. Safety hand railings of square bars shall be provided along and adjacent to every rail track of overhead travelling cranes or crane operator's walkway/passageway. Safety railing to be provided on both outside and inside of each end carriage.
- Safe access ladders with handrails shall be provided at convenient places for the crane operator or any other person going to or coming out from the crane. All the ladders should be provided as far as possible in the centre of the end carriage to avoid risk of falling zero meters. If it is not possible to shift the ladder at the centre, Side protection with hand post for ladder at end side should be provided. The entire ladder should have wider steps to avoid slip from the ladder. Other than this, ladder should be provided in following location also:

  a) Crane walkway to the gantry

  b) Crane walkway to power collector inspection platform

  c) Trolley floor to crane walkway

  d) Besides these, ladders shall be provided wherever found necessary
- **Sound Alerts:** Use a sound alert before moving the crane or crane car.
- **Load Security:** Ensure the load is secure and does not pose risks to personnel.
- **Avoid Limit Switch Use:** Do not use limit switches during normal operation.
- **Safe Distance:** Personnel should avoid standing under overhead loads or within a distance closer than the load height.

8.2.2 Clearances

8.2.2.1 Clearance from Obstruction

Clearance shall be maintained between the crane and the building, as well as parallel running cranes and cranes operating at a different elevation, under all normal operating conditions. In the design of new cranes,

all factors that influence clearance, such as wheel float, truss sag, bridge skewing, or trolley positions and configurations shall be considered. Where passageways or walkways are provided on the structure supporting the crane, obstructions shall not be placed so that personnel will be jeopardized by movements of the crane.

8.2.2.2 Clearance Between Parallel Cranes

If the runways of two cranes are parallel, and there are no intervening walls or structures, there shall be clearance provided and maintained between the two bridges.

Note: If two cranes are on the same runway and there are no intervening walls or structures, anti-collision devices shall be installed to avoid crane collisions.

8.2.3 General Construction

8.2.3.1 Stops and Bumpers

Trolley Stops

- Stops shall be provided at the limits of travel of the trolley.
- Stops shall engage the bumpers or bumper pads mounted on the trolley.
- Stops shall be designed to withstand the forces applied by the bumpers.

8.2.3.2 Bridge Bumpers

- A power-operated bridge shall be provided with bumpers or other automatic means providing equivalent effect.
- Bridge bumpers shall have the following minimum characteristics:
  - Shall be as per OEM recommendation.
  - be designed and installed with a means of retaining the bumper in case of broken or loosened mounting connections.
  - Multiple power-operated bridges operating on the same runway shall have contact bumpers and shall have anti-collision devices.

8.2.3.3 Bridge & Trolley Rail Sweeps

- Bridge truck rail sweeps shall be provided in front of the leading wheels on both ends of the bridge end truck.
- The rail sweep shall clear the rail of objects on the runway which, if they came into contact between the wheel and rail, could cause damage to the wheel or derail the wheel.
  (a) Clearance between the top surface of the rail head and the bottom of the sweep should not exceed 5mm.
  (b) On overhead crane end trucks, the sweep shall extend below the top surface of the rail head, for a distance not less than 50% of the thickness of the rail head, on both sides of the rail head.
  (c) On gantry crane end trucks, when the rail head is located above the pavement or ground level, the sweep shall extend below the top surface of the rail head, for a distance not less than 50% of the thickness of the rail head, on both sides of the rail head.
  (d) Clearance between the vertical inside surfaces of the sweep should be equal to the wheel tread width plus % in. (10 mm), and clearance should be evenly spaced on each side of the wheel tread width.

8.2.3.4 Guards for Moving Parts

- Exposed moving parts, such as gears, set screws, projecting keys, and drive chain and sprockets, which constitute a hazard under normal operating conditions, shall be guarded.
- Each guard shall be capable of supporting, without permanent deformation, the weight of a 200 lb (90 kg) person, unless the guard is located where it is not probable that a person will step on it.

8.2.3.5 Brakes and Braking Means

- Hoist Holding Brakes

(a) Each hoisting unit of crane shall be equipped with at least one holding brake. The holding brake shall be applied to the motor shaft or a gear reducer shaft and shall have a torque rating not less than the percentage of rated load hoisting torque at the point where the brake is applied.
(b) Each hoisting unit of a crane that handles molten material shall be equipped with one of the following arrangements:

- Two holding brakes shall be provided, one of which is applied to a gear reducer shaft, plus control braking means. Each holding brake shall have a torque rating not less than 100% of rated load hoisting torque at the point where the brake is applied.
- One holding brake shall be provided if the hoisting unit has a mechanical load brake or a control braking means that provides controlled lowering of the load upon loss of power. The holding brake shall have a torque rating not less than 150% of rated load hoisting torque at the point where the brake is applied.

(a) Each hoist holding brake shall have thermal capacity for the frequency of operation required by the service.
(b) Hoist holding brakes shall be applied automatically when power to the brake is removed.
(c) Hoist holding brakes shall be provided with means to adjust for lining wear.

8.2.3.6 Hoist Control Braking Means

- Each hoisting unit of the crane shall be equipped with a control braking means that will control the load during lowering to a maximum speed of 120% of rated lowering speed for the load being handled.
- Hoist control braking means can be electrical, such as regenerative, dynamic, counter torque or eddy-current; mechanical; hydraulic; or a worm-geared hoist where the angle of the worm is such as to prevent the load from accelerating in the lowering direction.
- Hoist control braking means shall have thermal capacity for the frequency of operation required by the service.

8.2.3.7 Trolley & Bridge Brakes and Braking Means

- Each power-driven trolley unit of the crane shall be equipped with either a braking means or have trolley drive factional characteristics that will provide stopping and holding functions.
- A power-driven, cab-operated crane with the cab on the trolley shall be equipped with a trolley brake that will provide the stopping and holding functions.
- There should be a provision of operator identification display outside the CAB visible from ground floor. (This should be small A4 size board. the Board to be displayed inside the cab or on the EOT crane by the operator, who operate the crane in the shift)
    - Each trolley brake shall have thermal capacity for the frequency of operation required by the service.

8.2.3.8 Bridge Brakes and Braking Means

A power-driven bridge shall be equipped with either a braking means or have bridge drive frictional characteristics that will provide stopping and holding functions, under conditions where the rails are dry and free of snow and ice, as follows:

(a) have torque capability to stop bridge travel within a distance in feet (meters) equal to 10% of rated load speed in ft/min (m/min) when traveling with rated load.

(b) Each bridge brake shall have thermal capacity for the frequency of operation required by the service.

8.2.4 Electrical Equipment

- All the incoming isolator, circuit breaker, switches etc. shall be provided with positive isolation facility having pad locking arrangement.
- Two-way safety switches shall be provided at four corners of the crane, one at the outside and another at the inside of the crane to put OFF the power of complete crane. In addition, one safety switch shall be

provided near entry and exit of the crane operator's cabin to put off the power of complete crane and one emergency switch shall be provided inside the crane's operator cabin to put off the power of complete crane.

- Foot operated switch shall be provided in the crane operators cabin to stop the long travel motion during emergency conditions.
- Provision of control stop shall be provided along with pad locking arrangements and ON/OFF LED indication for all the motions on a suitable location of the girder for use during trial purpose and other control stop activity. This shall be included in the Site approved control procedure. Suitable enclosure shall be provided to protect these arrangements from adverse environmental conditions.
- Provision shall be made to provide 220V lighting power from the gantry during preventive maintenance or any emergency condition.
- Panel nomenclature to be painted on the outer side of the individual panel doors and all circuit components to be adequately labelled and all control cables properly ferruled to facilitate correct identification.
- Provision shall be made to put OFF complete control and main power from the protective panel or from the outside of the individual control panel. No work should be done inside the panel if there is any power present inside the panel.

8.2.5 Runway Conductors

- Conductors of the open type, mounted on the crane runway beams or overhead, shall be so located or guarded that persons cannot inadvertently meet the energized conductors under normal operating conditions.
- Permanent lifeline shall be installed across the runway platform to facilitate the maintenance of runway conductors or other equivalent work at height measure to be taken.

8.3 EQUALIZERS

If a load is supported by more than one part of rope, the tension in the parts shall be equalized.

8.4 WARNING DEVICES OR MEANS FOR A CRANE WITH A POWER –TRAVELING MECHANISM

- Cab, Floor Operated, Remote-Operated Cranes
  (a) A warning device should be provided for installations where the ability of the operator to warn persons in the path of the load is impaired.
- Types of Devices
  (a) One or more of the following devices shall be provided when required,
  - manually operated gong.
  - power-operated bell, siren, or horn.
  - rotating beacon
  - strobe light.

8.4.1 Inspection Classification

- Initial Inspection. New, reinstalled, altered, repaired, and modified cranes shall be inspected by a competent person prior to initial use.
- Inspection procedure for cranes in regular service is divided into two general classifications based upon the intervals at which inspection should be performed. The two general classifications are designated as frequent and periodic, with respective intervals between inspection defined as follows:
  i. Frequent Inspection. Visual examinations by the operator prior to use or at start of the shift and record of the same is to be maintained in operator log.
  ii. Periodic Inspection. Visual inspection of the equipment in place by a designated person making records of apparent external conditions to provide the basis for a continuing evaluation, as follows:
    a. Normal service — Half yearly
    b. Heavy service — Quarterly

c. Severe service — Monthly

8.4.2 Maintenance, Repairs, and Modifications

- A preventive maintenance program should be established. The program should be based on the recommendations outlined in the crane manufacturer's manual and, when appropriate, additional recommendations outlined by a qualified person based upon review of the crane application and operation. Dated records should be placed on file.
- Replacement parts shall be at least equal to the original manufacturer's specifications.
- Modifications affecting capacity or safe operation shall have the manufacturer’s written approval and the crane shall be inspected by a competent person.
- All maintenance required to be carried out on crane should be done by trained and authorized technician.

8.4.3 Crane Operation & Lift Planning

The Following shall apply to all personnel involved in overhead crane operations. Each operation should be classified into two types of lift.

i. Routine/ Normal Lift

ii. Critical Lift.

All lift using EOT/Overhead crane are normal lift, if lifted weight is less than or equal to SWL of EOT/Overhead crane.

A lift is classified as critical lift if one or more criteria fulfils:

- Tandem Lifting either using 2 hoists of same crane or hoist of two different cranes.
- Lifting load above 15 tons.
- Weight CG and balancing check before raising
- If lifting object is irregular in shape and CG is not known.

In case of routine job related to operation shall be governed by SOP in-line with standard requirement.

In case of maintenance job detailed job safety analysis to be done for lift qualifying critical lift criteria.

8.4.4 Handling the Load

8.4.4.1 Load Weight

- The crane shall not be loaded more than its rated load except for test purposes.
- The combined load applied to more than one hoisting unit shall not exceed the rated load of the crane when the crane has more than one hoisting unit.

8.4.4.2 Attaching the Load

- The hoist rope shall be free from kinks or twists and shall not be wrapped around the load.
- The load shall be attached to the load block hook by means of slings or other devices.
- Care shall be taken to make certain that the slings clear all obstacles.

8.4.4.3 Moving the Load

The appointed person directing the lift shall ascertain that

- The load, sling, or lifting device is seated in the bowl of the hook.

- The load is secured, balanced, and positioned in the hook, sling or lifting device before the load is lifted more than few inches.
- The hoist rope is not kinked.
- Multiple part lines are not twisted around each other.
- The hook is brought over the load in such a manner as to minimize swinging.
- The rope is seated in the drum grooves and in the sheaves if there is or has been a slack rope condition.

During lifting care shall be taken that

- There is no sudden acceleration or deceleration of the moving load
- The load does not contact any obstruction.
- Cranes shall not be used for side pulls.
- The operator shall not cause crane to lift, lower or travel while anyone is on the load or hook.
- The operator shall avoid carrying load over people.
- The operator shall check the hoist brake at least once each shift if the load approaching the rated load is to be handled. This shall be done by lifting the load a short distance and applying the brake.
- The load shall not be lowered below the point where three wraps of rope remain on each anchorage of the hoisting drum unless a lower limit device is provided, in which case, no less than one wrap shall remain.
- When two or more cranes are used to lift load, one qualified person shall oversee the operation. This person shall analyse the operation and instruct other personnel involved in the proper positioning, rigging of the load and the movements to be made.
- The operator shall not leave the position at the controls while the load is suspended over an area accessible to people.

8.4.5 Hoist Limit Devices (Switches)

Prior to the initial use of any hoist during each shift, the operator shall verify operation of the upper limit device under no-load conditions. If more than one upper-limit device is present, only the operation of the primary upper-limit device needs to be verified. Care shall be exercised; the block shall be inched into the limit or run in at a slow speed. If the device does not operate properly, the operator shall immediately notify to his supervisor. The hoist-limit device that controls the upper limit of travel of the load block shall not be used as an operating control in normal operation unless additional means are provided to prevent damage from overtravel.

9. ELEMENT 5: LIFTING & HOISTING EQUIPMENTS ACCESSORIES AND PRECAUTIONS

9.1 SHEAVES

9.1.1 Surface Condition

Groove Quality: Sheave grooves should be smooth and free from defects to prevent damage to the rope. The radius at the groove bottom should closely match the rope's diameter. The groove sides should be tapered outward and rounded to ensure smooth rope entry and reduce wear.

Flange Rims: The flange rims of the sheave should be true to the axis of rotation to ensure proper alignment and prevent rope misalignment.

9.1.2 Materials and Compatibility

Material Choices: Sheaves can be made from various materials including steel, cast iron, aluminium, and various composites. The choice of material affects the sheave's durability, weight, and compatibility with different rope types.

Steel and Cast Iron: These materials are highly durable and suitable for heavy-duty applications. They are compatible with a wide range of rope types, including wire ropes and synthetic ropes.

Aluminium: Lightweight and resistant to corrosion, aluminium sheaves are often used in less demanding applications or where weight is a concern. They are generally compatible with synthetic ropes but may wear more quickly with wire ropes.

Composites: Modern composite materials offer high strength-to-weight ratios and resistance to corrosion and abrasion. They are suitable for both synthetic and wire ropes, offering a balance between weight and durability.

9.1.3 Maintenance and Inspection

Inspection Frequency: Sheaves should be inspected regularly for signs of wear, including groove wear, surface defects, and flange misalignment. The frequency of inspection depends on the operating conditions and the intensity of use, but it is generally recommended to perform visual inspections at least every 500 operating hours or as per the manufacturer’s guidelines.

Maintenance Procedures: Regular maintenance should include checking the groove for any damage or wear, ensuring the flange rims are true, and verifying the sheave’s alignment. Any signs of excessive wear or defects should be addressed immediately to prevent damage to the rope and ensure safe operation.

Guarding: Momentary Unloading: Sheaves that may experience momentary unloading should be equipped with close-fitting guards. These guards help guide the rope back into the groove when the load is reapplied, preventing the rope from slipping out or becoming misaligned.

Bottom Block Guards: Sheaves in bottom blocks should also have guards to prevent fouling when the block is on the ground with loose ropes. This helps to keep the rope in the correct position and avoid tangling or damage.

9.1.4 Lubrication

Lubrication Provisions: All running sheaves should have provisions for lubrication to ensure smooth operation and extend their service life.

Permanently Lubricated Bearings: Bearings that are permanently lubricated and sealed require minimal maintenance and are suitable for many applications.

Sealed or Shielded Bearings: These types of bearings provide good protection against contaminants and require less frequent lubrication.

9.2 DRUMS

Rope drums shall be grooved, except when the crane is provided by the manufacturer for a special application. This requirement does not preclude the use of multiple layer spooling. The grooves shall be free from surface defects that could cause rope damage. The cross-sectional radius at the bottom of the groove should be such as to form a close-fitting saddle for the size of rope used.

9.3 HOOKS

Hooks shall meet the manufacturer's recommendations and shall not be overloaded. If hooks are of the swivelling type, they should rotate freely. Latch-equipped hooks shall be used unless the application makes the use of the latch impractical or unnecessary. When required, a latch or mousing shall be provided to bridge the throat opening of the hook for the purpose of retaining slings, chains, or other similar parts, under slack conditions.

9.3.1 Hook Inspection

Hooks shall be removed from service if damage such as the following is visible and shall only be returned to service when approved by a competent person. Any sort of welding or hot work is prohibited.

- excessive pitting or corrosion
- cracks, nicks, or gouges
- wear — any wear exceeding 10% (or as recommended by the manufacturer) of the original section dimension of the hook or its load pin.
- deformation — any visibly apparent bend or twist from the plane of the unbent hook
- throat opening — any distortion causing an increase in throat opening of 5% not to exceed 1/4 in. (6 mm) (or as recommended by the manufacturer)
- thread wear, damage, or corrosion.
- evidence of excessive heat exposure or unauthorized welding

9.4 ROPES

- The hoisting ropes shall be of a recommended construction for crane service. The total load (rated load plus weight of load block) divided by the number of parts of line shall not exceed 20% of the minimum breaking strength of the rope.
- Socketing shall be done in a manner recommended by the rope or fitting manufacturer or a qualified person.
- Rope shall be secured to the drum as follows:
    a. No less than three wraps of rope shall remain on the drum at each anchorage of the hoisting drum when the hook is in its extreme low position unless a lower- limit device is provided, in which case no less than one wrap shall remain.
    b. The rope end shall be anchored by a clamp attached to the drum, or by a socket arrangement specified by the crane or rope manufacturer. The rope clamps shall be tightened evenly to the manufacturer's recommended torque.
- Eye splices shall be made in recommended manner. Rope thimbles should be used in the eye.
- Wire rope clips shall be drop-forged steel of the single-saddle (U-bolt) or double-saddle type. Malleable cast iron clips shall not be used. For. spacing, number of clips, and torque values, refer to the clip manufacturer's recommendation. Wire rope clips attached with U-bolts shall have the U-bolt over the dead end of the rope and live rope resting in the clip saddle. Clips shall be tightened evenly to the recommended torque. After the initial load is applied to the rope, the clip nuts shall be retightened to the recommended

torque to compensate for any decrease in rope diameter caused by the load. Rope clip nuts should be retightened periodically to compensate for any further decrease in rope diameter during usage.

- Swaged or compressed fittings shall be applied as recommended by die rope, crane, or fitting manufacturer or qualified person.
- Wherever exposed to ambient temperatures at the rope more than 180°F (82°C), rope having an independent wire-rope or wire-strand core, or other temperature damage-resistant core, shall be used.
- Replacement rope shall be the same size, grade, and construction as the original rope furnished by the crane manufacturer.

9.5 ROPE INSPECTION & REPLACEMENT

9.5.1 Frequent Inspection

All ropes should be visually inspected by the operator at the start of each shift. These visual observations should be concerned with discovering gross damage, such as listed below, that may be a hazard.

(a) distortion of the rope, such as kinking, crushing, un-stranding, bird caging, main strand displacement, or core protrusion

(b) general corrosion

(c) broken or cut strands.

When such damage is discovered, the rope shall be removed from service as per detailed inspection, mentioned in periodic inspection.

9.5.2 Periodic Inspection

Periodic inspections shall be performed by a designated person. This inspection shall cover the entire length of rope. The individual outer wires in the strands of the rope shall be visible to this person during the inspection. Any deterioration resulting in appreciable loss of original strength, such as the following, shall be noted and determination shall be made as to whether further use of the rope would constitute a hazard:

- distortion of the rope, such as kinking, crushing, un-stranding, bird caging, main strand displacement, or core protrusion
- reduction of rope diameter below nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires
- severely corroded or broken wires at end connections
- severely corroded, cracked, bent, worn, or improperly applied end connections

Special care should be taken when inspecting sections of rapid deterioration, such as the following:

- sections in contact with saddles, equalizer sheaves, or other sheaves where rope travel is limited.
- sections of the rope at or near terminal ends where corroded or broken wires may protrude.
- sections subject to reverse bends
- sections of rope that are normally hidden during visual inspection, such as parts passing over sheaves.
- Establish data as a basis of judging the proper time for replacement, a continuing inspection record should be maintained. This record should cover points of deterioration listed.

9.5.3 Rope Replacement

(a) No precise rules can be given for determination of the exact time for rope replacement since many variable factors are involved. Once a rope reaches anyone of the specified removal criteria, the rope shall be replaced.

(b) Removal criteria for rope replacement

- In running ropes, twelve randomly distributed broken wires in one lay or four broken wires in one strand in one lay,
- In rotation-resistant ropes, two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in thirty rope diameters.

- One outer wire broken at the contact point with the core of the rope, which has worked its way out of the rope structure and protrudes or loops out from the rope structure.
- Wear of one-third the original diameter of outside individual wires
- Kinking, crushing, bird-caging, or any other damage resulting in distortion of the rope structure.
- Evidence of heat damage from any cause
- Reductions from nominal diameter greater than those listed below:

Rope Diameter	Maximum Allowable Reduction from Nominal Diameter
Up to ~6 in. (8 mm)	1/64 in. (0.4 mm)
Over 5/16 in. to 1/2 in. (13 mm)	1/32 in. (0.8 mm)
Over 1/2 in. to 3/4 in. (19 mm)	3/64 in. (1.2 mm)
Over3/4 into 1 in (29 mm)	1/16 in. (1.6 mm)
Over 1 in. to 1-1/'2 in. (38 mm)	3/32 in. (2.4 mm)

(c) Broken wire removal criteria cited in standard apply to wire rope operating on steel sheaves and drums. The user shall contact the sheave, drum, or crane manufacturer, for broken wire removal criteria for wire ropes operating on sheaves and drums made of material other than steel.

(d) Attention shall be given to end connections. Upon development of two broken wires adjacent to a socketed end connection, the rope should be re-socketed or replaced. Re-socketing shall not be attempted if the resulting rope length will be insufficient for proper operation.

(e) Replacement rope and connections shall have a strength rating at least equal to the rating of the original rope and connections specified by the hoist manufacturer. Any deviation from the original size, grade, or construction of the rope shall be specified by a rope manufacturer, the crane or hoist manufacturer.

(f) Rope Maintenance:

- Rope should be stored to prevent damage or deterioration.
- Rope shall be unreeled or uncoiled in a manner to avoid inducing a twist in or kinking of the rope.
- Before cutting rope, means shall be used to prevent unlaying of the strands.
- During installation, care should be observed to avoid dragging the rope in dirt or around objects that will scrape, nick, crush, or induce sharp bends.
- Rope should be maintained in a well-lubricated condition. Lubricant applied as part of a maintenance program shall be compatible with the original lubricant.

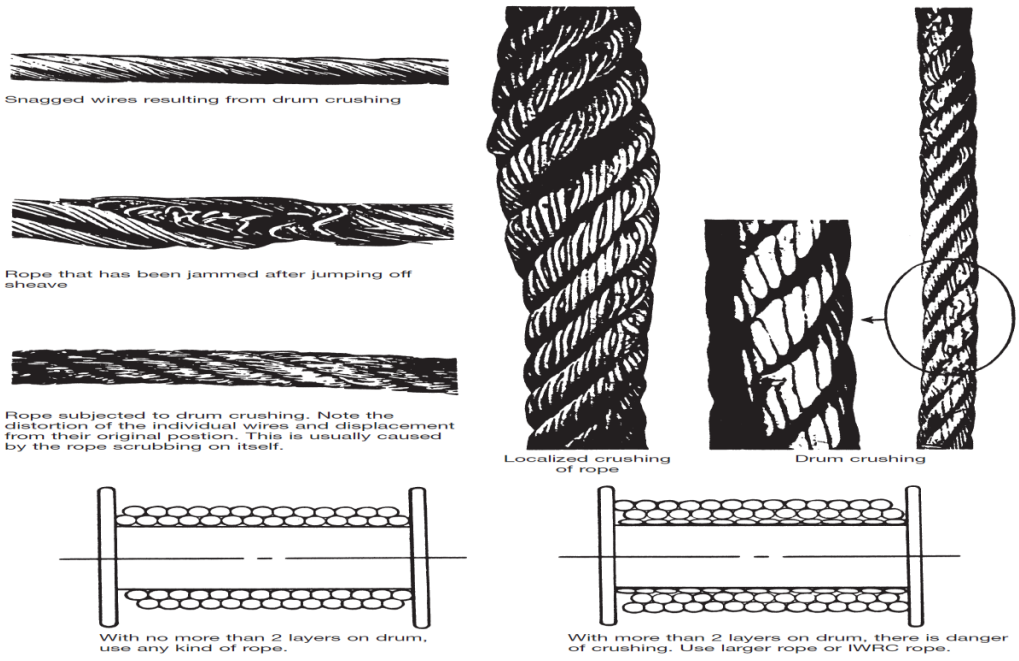


Figure-5: Rope Strands

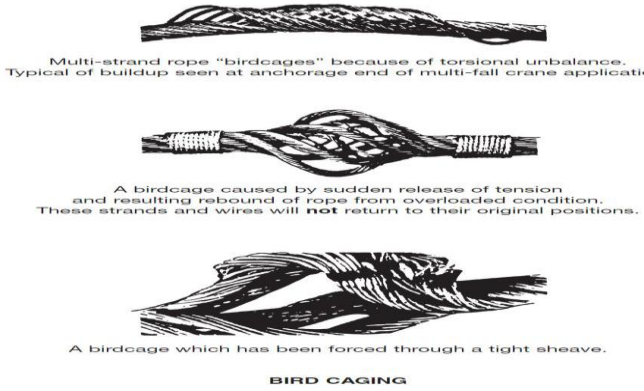


Figure-6: Caging in Ropes

9.5.4 Shackle Types

- Body types covered are anchor, chain, and synthetic sling (see Figure 8).
- Pin types covered are screw pin and bolt-type (see Figure 8).

9.5.4.1 Shackle Identification

Each new shackle shall have forged, cast, or die stamped markings by the manufacturer to show name or trademark of manufacturer, rated load and size.

Shackles shall be removed from service if damage such as the following is visible and shall only be returned to service when approved by a competent person.

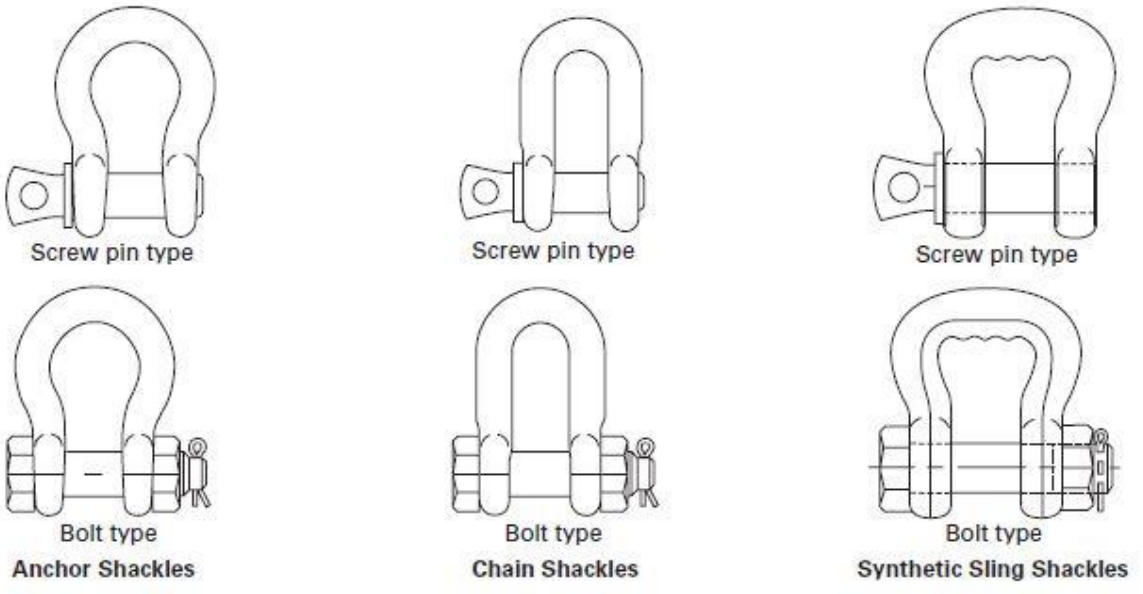


Figure-7: Shackles

9.5.4.2 Rigging Practices with Shackles

- The screw pin shall be fully engaged, with the shoulder in contact with the shackle body (see Figure 10).
- If a shackle is designed for a cotter pin, it shall be used and maintained in good working condition. No alterations or modifications is allowed.
- Contact with sharp edges that could damage the shackle should be avoided.
- Shock loading should be avoided.
- The load applied to the shackle should be centered in the bow of the shackle to prevent side loading of the shackle.
- Multiple sling legs should not be applied to the shackle pin. If the shackle is to be side loaded, the rated load shall be reduced according to the recommendations of the manufacturer (see Fig.11).
- The screw pin shackle shall not be rigged in a manner that would cause the pin to unscrew.
- For long-term installations, bolt type shackles should be used. if screw pin type shackles are used, the pin shall be secured from rotation or loosening.
- Shackles should not be dragged on an abrasive surface.
- Multiple slings in the body of a shackle shall not exceed 120 deg included angle. (Fig 9)
- When a shackle is used in a choker hitch, the pin shall be connected to the choking eye of the sling.

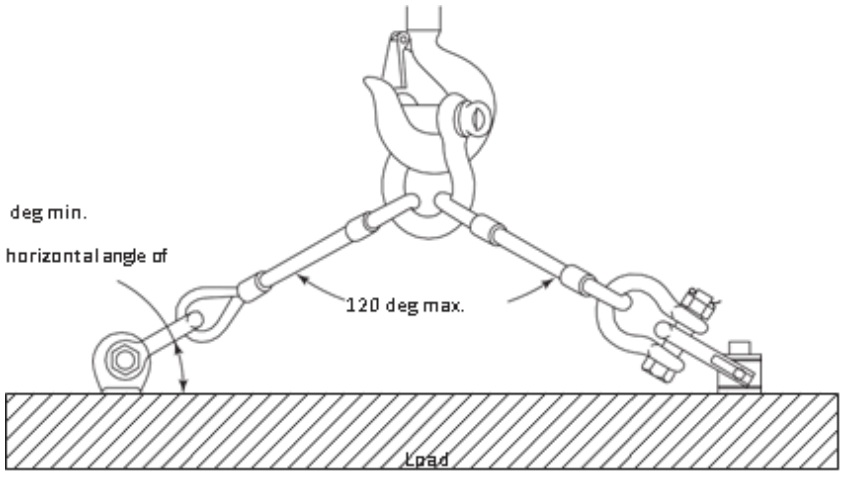


Figure-8: Multiple Slings in The Body of Shackle Shall Not Exceed 120 Degree Included Angle

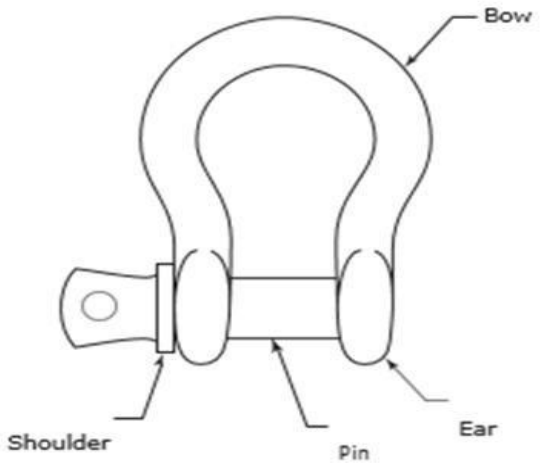
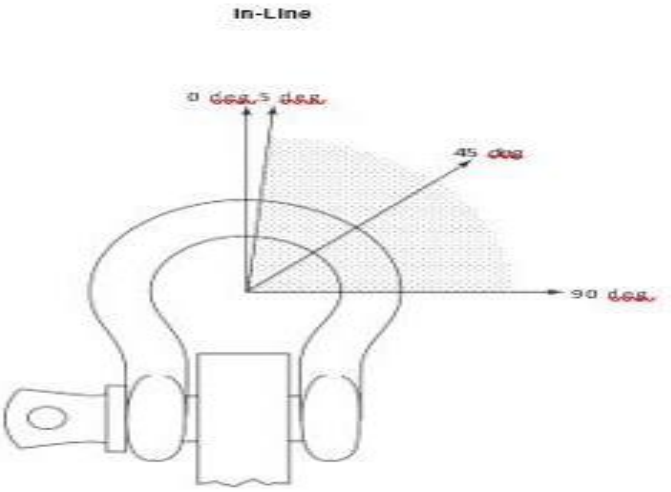


Figure-9: Shackles and Components



Side Loading Angle, deg	% Rate Load Reduction
In-line (0) to 5	None
6 to 45	30%
46 to 90	50%
Over 90	Not recommended to load in this condition. Consult

Figure-10: Side Loading

9.5.5 Turnbuckles, Eye Bolts, Eye Nuts and Swivel Hoist Rings

- Each turnbuckle, eyebolt, and eye nut shall be marked to show name or trademarkof manufacturer, size or rated load and grade for alloy eyebolts.
- Each swivel hoist ring shall be marked to show name or trademark of manufacturer rated load and torque value.

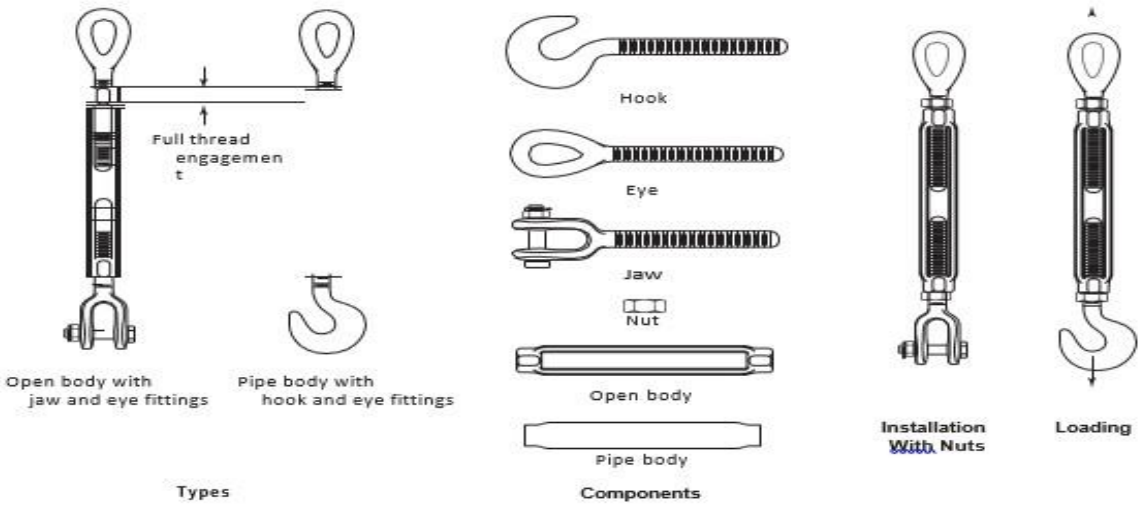


Figure-11: Type of Turnbuckles

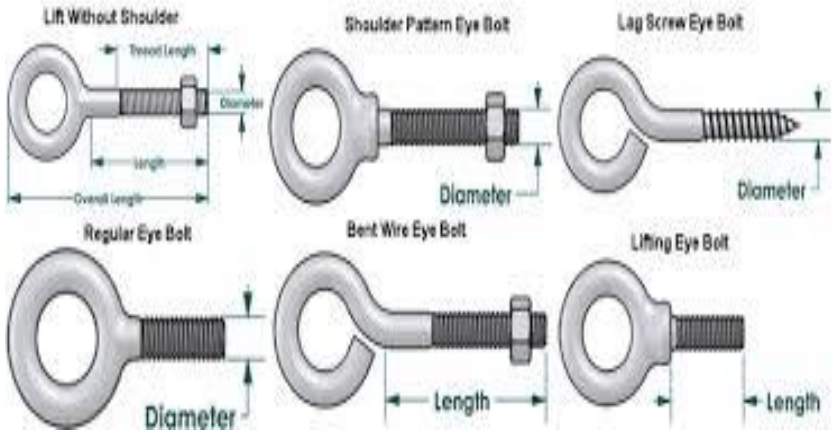


Figure-32: Eye Bolts

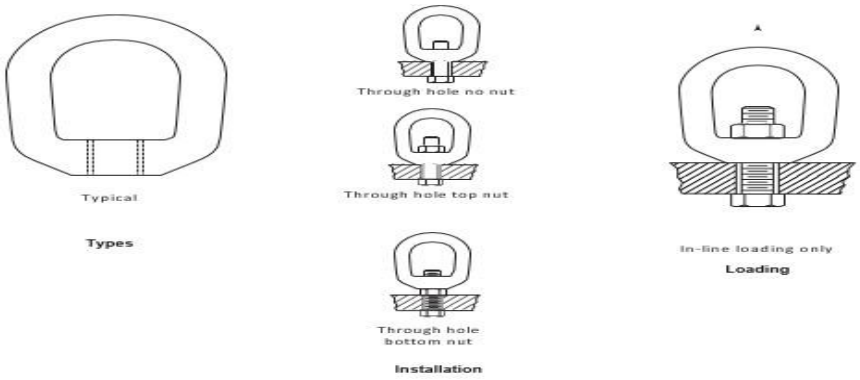


Figure-13: Eye Nuts

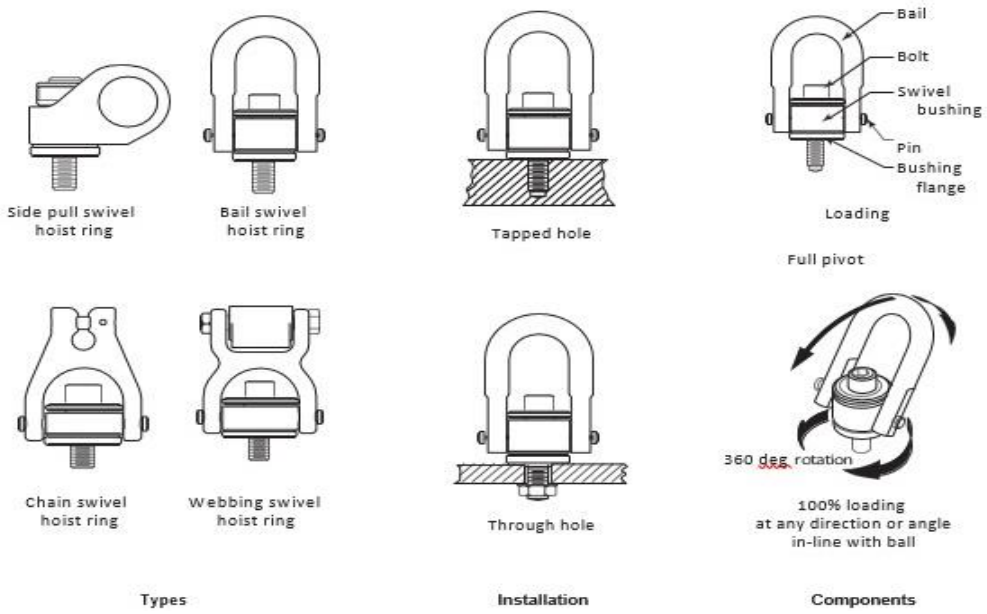


Figure-14: Swivel Hoist Rings

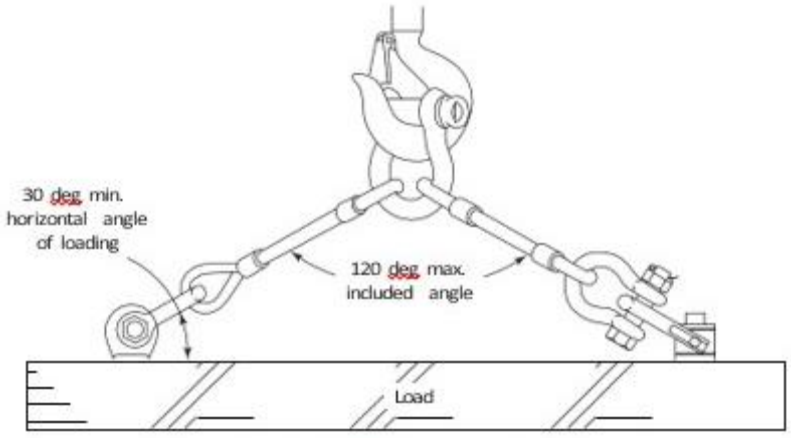
Adjustable hardware shall be removed from service if damage such as:

- missing or illegible identification.
- indications of heat damage including weld spatter or arc strikes.
- excessive pitting or corrosion.
- bent, twisted, distorted, stretched, elongated, cracked, or broken load-bearing components.
- excessive nicks or gouges.
- a 10% reduction of the original or catalogue dimension at any point.
- excessive thread damage or wear.
- evidence of unauthorized welding or modification.
- for swivel hoist rings, lack of the ability to freely rotate or pivot.

9.5.5.1 Rigging with Turnbuckles, Eye Bolts, Eye Nuts, Swivel Hoist Rings

- Turnbuckle end fitting threads shall be fully engaged in the body threads.
- Pipe bodies conceal the length of thread engagement. Verify full engagement before loading (see Fig. 12).
- Components, including pins, bolts, nuts, or cotter pins used with jaw ends, shall be in good working condition prior to use. No alterations or modifications is allowed.
- If locking nuts (see Fig. 12) are used, they shall be compatible with the threads of the turnbuckle end.
- Contact with obstructions that could damage or bend the turnbuckle should be avoided.
- The load applied to the turnbuckle should be in line and in tension.
- Turnbuckles should not be side loaded.
- Turnbuckles should be rigged or secured to pre- vent unscrewing during the lift.
- For long-term installations, turnbuckles shall be secured to prevent unscrewing.
- Turnbuckles should not be dragged on an abrasive surface.
- Turnbuckles should be adjusted with a properly sized wrench, used on the wrench flats of the turnbuckle body.
- Eyebolts should be tightened or otherwise secured against rotation during the lift.
- When used in a tapped blind hole, the effective thread length shall be at least 11/2 times the diameter of the bolt for engagement in steel (see Fig. 13). For other thread engagements or engagements in other materials, contact the eyebolt manufacturer or a qualified person.
- When used in a tapped through-hole of less than one diameter thickness, a nut shall be used under the load and shall be fully engaged and tightened securely against the load (see Fig. 13).
- When used in an untapped through-hole the nut under the load shall be fully engaged. If the eyebolt is not shouldered to the load, a second nut on top of the load should be used where possible (see Fig. 13).
- Eyebolts not shouldered to the load shall only be used for in-line loads (see Fig. 13).

- Only shoulder eyebolts shall be used for angular lifting. The shoulder shall be flush and securely tightened against the load when used for angular lifting. The working load limit (WLL) should be reduced, as shown in Fig. 13.
- When using shoulder eyebolts for angular lifts, the plane of the eye shall be aligned with the direction of loading. Flat washers may be used under the shoulder to position the plane of the eye (see Fig. 13).
- Eyebolts shall be in good working condition prior to use. No Alterations or modifications is allowed.
- Eye nuts should be secured against rotation during the lift.
- The threads of the eye nut shall be fully engaged (see Fig. 14).
- Eye nuts shall only be used for in-line loads (see Fig. 14).
- The plane of the eye may be positioned with a flat washer(s) or lock nut.
- Swivel hoist ring components shall be in good working condition prior to use. No Alterations or modifications is allowed.
- When used in a threaded hole, the effective thread length shall be 11/2 times the diameter of the bolt for steel (see Fig. 15). For other thread engagements or engagements in other materials, contact the swivel hoist ring manufacturer or a qualified person.
- When used in a through-hole application, a nut and washer shall be used. The washer and nut shall be in accordance with the swivel hoist ring manufacturer's recommendations. The nut shall be fully engaged (see Fig. 15).
- The bushing flange (see Fig. 15) shall fully contact the load surface.
- Spacers or washers shall not be used between the bushing flange and the mounting surface of the load being lifted.
- The swivel hoist ring shall be tightened to the torque specifications of the manufacturer.
- The swivel hoist ring shall be free to rotate and pivot without interference during lifting (see Fig. 15).
- The load applied to the swivel hoist ring shall be centered in the bail to prevent side loading.
- Any attached lifting component shall be narrower than the inside width of the bail to avoid spreading (see Fig. 15).
- Components shall be in good working condition prior to use. No Alterations or modifications is allowed.
- Ensure that the swivel hoist ring WLL meets or exceeds the anticipated angular rigging tension (see Fig. 16).
- Shock loading should be avoided.



Horizontal Angle, deg	Stress Multiplier
90	1.000
60	1.155
45	1.414
30	2.000

Figure-15: Angle Of Loading

9.5.6 Wire Rope Clips and Wedge Socket

- Each new wire rope clip saddle shall have forged or die stamped markings by the manufacturer to show, name or trademark of manufacturer, size.

- Each new wedge socket body and wedge shall have forged, cast, or die stamped marking by the manufacturer to show name or trademark of manufacturer, size, model, if required to match wedge to body

9.5.6.1 Wire Rope Clips

- Wire rope clips should not be in contact with the load or any obstruction during the lift.
- Shock loading should be avoided.
- Rigging using wire rope clips should not be dragged on an abrasive surface.
- When wire rope clips are applied to join two lengths of wire rope in an in- line splice, the requirements shall be followed (see Fig. 17).
- The use of wire rope clips to fabricate slings is prohibited. Wedge Sockets
- The wedge sockets should not be side loaded.
- Contact with sharp edges that could damage the wedge socket should be avoided.
- Shock loading should be avoided.
- Impacts can dislodge the wedge from the body and should be avoided.
- Rigging using wedge sockets should not be dragged on an abrasive surface.

9.5.6.2 Assembly – Wire Rope Clips

- Before installing a wire rope clip on plastic-coated or plastic-impregnated wire rope, consult the wire rope clip manufacturer, wire rope manufacturer, or a competent person.
- For U-bolt clips used to create end terminations, the saddle shall be placed on the live end of the wire rope, with the U-bolt on the dead-end side (see Fig. 17).
- At least the minimum number of clips as recommended by the manufacturer, or a qualified person shall be used.
- The spacing and turn-back should be as recommended by the manufacturer or a qualified person.
- The wire rope clip shall be tightened to the torque recommended by the manufacturer or a qualified person.
- After assembly, the connection shall be loaded to at least the expected working load.
- After unloading, wire rope clips shall then be re-tightened to the torque recommended by the manufacturer or a qualified person.

9.5.6.3 Assembly – Wedge Socket

- The wedge socket shall be assembled as recommended by the manufacturer or a qualified person.
- Before installing a wedge socket on plastic coated or plastic impregnated wire rope, consult the wedge socket manufacturer, wire rope manufacturer, or a qualified person.
- The live end of the wire rope in the wedge socket cavity shall be in alignment with the socket's pin (see Fig. 18).
- The assembler shall match the proper wedge with the socket for the wire rope to be installed.

NOTE: Wedges shall not be interchanged between different manufacturers' sockets or models.

- The length of the dead-end tail of the wire rope shall be as required by the manufacturer or a competent person.
- The dead-end tail of the wire rope extending beyond the wedge socket shall be secured in a manner recommended by the wedge socket manufacturer or a competent person (see Fig. 18).
- The dead end of the wire rope shall not be secured to the live end of the wire rope such that it restricts the movement of the live end (see Fig. 19).
- After assembly, the connection shall be loaded to fully seat the wedge before use.

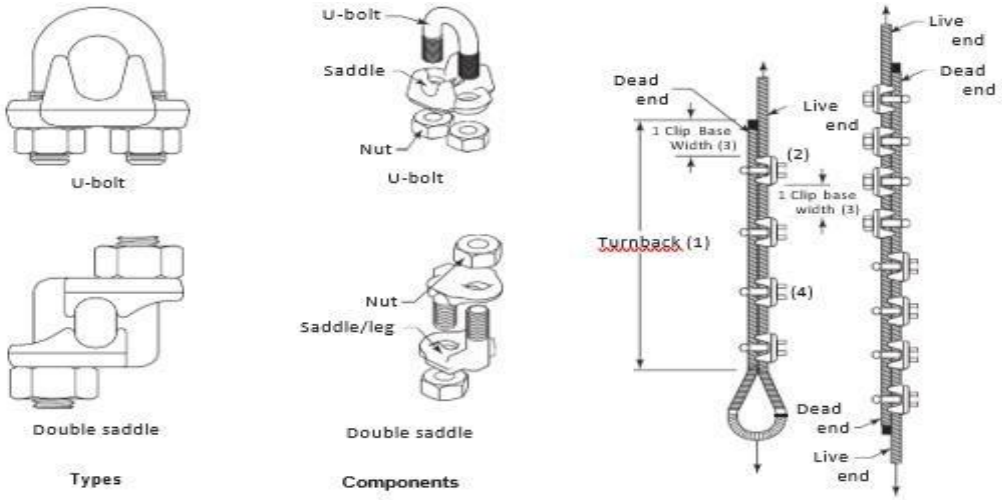


Figure-16: Wire Rope

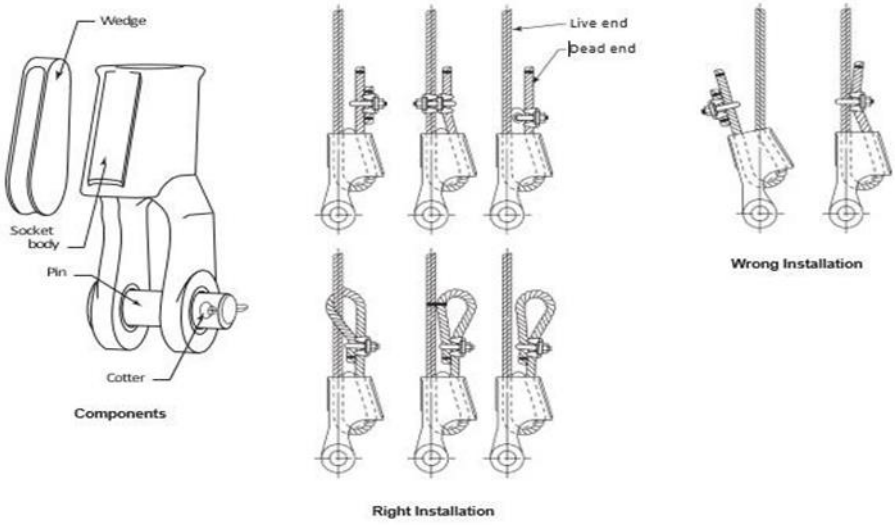


Figure-17: Wedge Socket

9.5.7 Slings

A sling or runner is an item of climbing equipment consisting of a tied or sewn loop of webbing. These can be wrapped around sections of rock, hitched to other pieces of equipment, or tied directly to a tensioned line using is a short piece of cord which is wrapped around the rope to add friction. The slings may be used as anchors, to extend an anchor to reduce rope drag, in anchor equalization, or to climb a rope. Slings are the most used piece of materials handling apparatus. They are used with material LIFTING equipment like cranes, hoists etc. to hold suspended loads.

The Site shall follow some of the general operating practices while working with the slings:

- It shall be ensured that the weight of the load shall be within the rated capacity of the sling.
- Slings shall not be shortened or lengthened by knotting, twisting, with wire rope clips or other methods not approved by the sling manufacturer.
- It shall be ensured that the Slings that are damaged shall not be used.
- Ensure that the sharp corners in contact with the sling shall be padded to prevent damage to the sling.
- Ensure to avoid Shock loading. Sudden starts and stops increase (out of all proportion to the load), stress in the sling and crane hoist rope.
- It shall be ensured that the Slings are stored in an area where they will not be subjected to mechanical damage, corrosive action, moisture, extreme heat, or kinking.
- Ensure that in a choker hitch, wire rope slings shall be long enough so that the choker fitting will choke on the rope body and never on the fitting.

- It shall be ensured that Sling angles less than 45 degrees should be avoided.

9.5.7.1 Wire Rope Slings

Wire rope is often used in slings because of its strength, durability, abrasion resistance and ability to conform to the shape of the loads on which it is used. Wire rope consists of individual wires laid into several strands, which are then wrapped around a central core.

Different number of wires in the strands and various methods of arrangement may affect the characteristics of the wire rope sling. The wire rope shall be equipped with a thimble and with pressed metal sleeve and marked with a Safe Working Load (SWL).

Wire rope used in slings can be made of ropes with either Independent Wire Rope Core (IWRC) or a fibre-core. It shall be noted that a sling manufactured with a fibre-core is usually more flexible but is less resistant to environmental damage. Conversely, a core that is made of a wire rope strand tends to have greater strength and is more resistant to heat damage.

When selecting a wire rope sling the Site shall consider four characteristics: strength, ability to bend without distortion, ability to withstand abrasive wear, and ability to withstand abuse.

The Site shall take the following precautions when using wire rope slings:

- Use only suitable wire rope slings.
- Never use damaged wire rope slings.
- During lifting, the Safe Working Load shall not be exceeded.
- Regular inspections shall be conducted.
- Sudden elevation shall not be allowed.
- If more than one wire rope sling is used in lifting, pay attention to the angle between the slings. (For min/max of sling angles, refer to IS Standard Wire Rope Slings and Sling Legs Specification- IS 2762: 2009).
- Ensure no to bend slings around sharp edges.
- Ensure not to force, hammer or wedge slings or fittings into position. The Slings shall fit freely.
- Ensure not to join wire rope slings made from different lays of rope together as it can seriously affect the lifting capacity.
- Do not use slings with knots.
- Never attempt to shorten or tie wire rope slings.
- Never shock load wire rope slings.
- Ensure not to slide the load along a rope.
- Ensure not to use a single leg hitch on a load that cannot be controlled. rotation of a load can undo the wire rope strands and weaken the rope. and
- Ensure not to make slings from discarded hoist wire rope.

9.5.7.2 Inspection of Wire rope slings

- The Site shall ensure to carry out visual inspection before each use.
- It shall also be ensured that the Slings - Wire rope slings shall be inspected periodically at intervals not more than 12 months for broken wires, kinks, abrasion, and corrosion.

  (Note: Kinking is caused by loops that have been drawn too tightly because of improper handling. Kinks are permanent distortions and will require the rope or the damaged section to be removed from service.)

9.5.8 Synthetic Web Slings or Belt Slings

The Synthetic web slings or belt slings are made of Nylon or Polyester.

Nylon is the most common type used on site. It has an elastic stretch of 6% at noted capacity. Polyester has less stretch, approximately 3 percent.

The stretching of slings allows a cushion against sudden shock. Both types are sensitive to heat and certain chemicals. Neither shall be exposed to temperatures above 180 degrees F and will soften on prolonged sunlight exposure. Therefore, the slings shall be stored inside or under cover.

The size of the sling is determined by the width of the web. Each sling has a tag sewn to it with the type, size and rated capacities (Refer the picture). (Note: the capacity for the vertical, choker and basket hitch are different). The use of synthetic web slings in radiation areas shall be avoided. If it is necessary to use a nylon sling in a radiation area, the responsible person shall ensure radiation exposure to the sling shall not exceed 100,000 rad, during the life of the sling. Polyester fibre shall never be used in a radiation area.

Some of the advantages of Synthetic web slings or belt sling are:

- These are Pliable, flexible, and tend to mold themselves to the shape.
- These slings minimize twisting and spinning.
- These do not rust and are non-sparking.
- These slings won't mar or crush the load, and.
- These slings are elastic and stretch.

The Synthetic web slings or belt slings shall be visually inspected for defects by the person using it before actual use.

10. ELEMENT 5: TOWER CRANE

10.1 GENERAL REQUIREMENTS

- Tower cranes shall be erected, extended and dismantled under the immediate supervision of competent person, designated by site management.
- Tower cranes shall be erected, maintained and used in accordance with the manufacturer's specifications, recommendations and procedures. All modifications shall be approved by the manufacturer and engineered by professional engineer. The safety factors shall not be reduced by any modifications. The crane plates and charts shall be changed to reflect any modifications made.
- A professional engineer shall certify that the crane foundations and underlying soil are adequate support for the tower crane with its maximum overturning moment.
- Tower cranes shall be positioned whereby they can wing 360 degrees without either the counterweight or jib striking any building, structure or other object, except:
    - If the crane can strike an object or another crane, suitable limit switches shall be installed which will prohibit contact with such objects, or
    - Direct voice communications shall be established between any operator of the tower crane (s) involved and a signal person so stationed where the boom and/or counterweight movement and the object with which it may contact crane observed so that operator can be warned of imminent danger.
    - A secondary means of positive communications shall be established as a backup for possible direct voice communication failure.
- Prior to installing a climbing tower crane with an existing building or new construction, a structural engineer shall certify that the building is designed to withstand the torque and floor loading created by the crane to be installed.
- Tower cranes erected on a new foundation shall be tested as per following:
    - The test shall consist of suspending a load of not less than 110% of the rated capacity for 15 minutes. The load shall be suspended from the furthest point of the length of boom to be used. The results of this test shall be within the manufacturer’s recommendations and/or specifications.
    - A record of each test shall be made and signed by the person responsible for conducting the test. Such records shall be maintained on the site for the duration of the work for which it was erected and subsequently made a part of the site permanent equipment records. Records shall be made available to authorized representatives of site, upon request.
- A capacity chart shall be furnished by each crane manufacturer, which shall include a full and complete range of crane load ratings at all started operating radii for each allowable speed and each recommended counterweight load.
- Operating controls shall be properly marked to indicate the function of the controls in each position.
- Limit switches shall be installed and shall be kept properly adjusted. They shall be protected or isolated in a manner which will prevent unauthorized tampering. Limit switches shall provide the following functions:
    - Safely limit the travel of the trolley to prevent it from hitting the outer end of the jib.
    - Limit the upward travel of the load block to prevent two-blocking.
    - Lower over travel limiting device shall be provided for all load hoist where the hook area is not visible to operator.
    - Limit the load being lifted in manner whereby no more than 110% of the maximum rated load can be lifted or moved.

- The crane shall not be used to pull vehicles of any type, remove piling, loosen framework, pull away loads attached to the grounds or walls, or for any operation other than proper handling of freely suspended loads.
- When the operator may be exposed to the hazard of falling objects, the tower crane cab and /or remote-control station shall have adequate overhead protection.
- Each tower crane shall be provided with a slewing brake capable of preventing the jib or boom from rotating in either direction and stopping the rotation of the jib or boom while loaded, when desired. Such brake shall have a holding device which, when set, will hold the jib or boom in a fixed location without additional attention of the operator. When the crane is out of operation, the jib or boom shall be pointed downwind and the slewing brake shall be released to permit the jib or boom to weathervane, providing the jib or boom has a clear 360-degree rotation. Where a 360-degree rotation is not provided, the jib or boom shall be pointed downwind from the prevailing wind and the slewing brake set.
- Each tower crane shall be provided with a braking system on the trolley capable of stopping and holding the trolley in any desired position while carrying maximum load. This brake shall be capable of being locked in a fixed location without additional attention of the operator. An automatic brake or device shall be installed which will immediately stop and lock the trolley in position in the event of a breakage of the trolley rope.
- All electrical equipment shall be properly grounded, and protection shall be provided against lightning.
- All crane brakes shall automatically set in event of power failure. Swing brakes shall also function in this manner or be capable of being set manually.
- Climbing jack systems used for raising a tower crane shall be equipped with overpressure relief valves, direct-reading pressure gauges, and pilot operated hydraulic check valves installed in a manner which will prevent jack from retracting should hydraulically line or fitting rupture or fail.
- Counterweights shall be securely fastened in place and shall not exceed the weights recommended by the manufacturer for the length of jib being used. However, an amount of counterweight as recommended by the manufacturer shall be used.
- Guy wires, wedges, braces or other supports shall be inspected at the beginning and at midpoint of each working shift to ascertain that they are functioning as intended.
- Tower cranes shall not be erected or raised when the wind velocity at the site exceeds 20 kmph or that specified by the manufacturer.

11. ELEMENT 6: ELECTROMAGNETIC CRANE

Electrically operated magnetic lifting devices, in the form of either single or a group of magnets, suspended from chains or wires or otherwise attached to lifting equipment, can be used for lifting and transporting steel and most ferrous metal stock or manufactured components. They are widely used in many industrial sectors including metal/component manufacture and storage, shipbuilding, as well as the breaking and scrap handling industries.

Magnets can be round or rectangular or specially constructed for a particular purpose. Several different types of magnets are available, for example:

- flat pole plate magnets for handling sheet metals and bulk goods, such as scrap iron.
- specially shaped pole plate magnets for lifting pipes, round steel bars, or sectional steel.
- magnets with adjustable pole fingers for lifting items of irregular shape.
- magnets with safety devices, e.g., grab claws, as additional equipment.

Magnets can be provided with no power supply, i.e., permanent magnets, or where power is supplied by cable from an external source or through an in-built battery.

The magnet and any associated electrical equipment should be designed for its intended purpose and constructed to withstand the environment in which it is required to operate.

11.1 THE HAZARD

The hazards associated with their use are the following,

Falling Material - Persons, plant and equipment, and services in operation could be at risk from being struck by the material being moved or which has become detached from the magnet, as well as from the potential consequences of failure of the lifting device, e.g., following loss of power.

Electromagnetic Field (EMF)- It is thought that the magnetic field around the magnet may interfere with implanted active body implants such as heart pacemakers, insulin pumps, or with communication equipment or plant controls in the area. If currents used are exceptionally large, the power frequency fields around the conductors may need to be assessed.

11.2 SAFETY REQUIREMENTS

Magnetic lifting devices that are an integral part of machinery are classed as ‘lifting equipment;’ those that can be fitted to and removed from lifting equipment are ‘accessories for lifting.’ ‘Lifting equipment and ‘accessories for lifting’ are both ‘work equipment.’ Refer **Annexure – 3** for lifting equipment accessories safety requirements and precautions.

The key requisites are,

- **Suitability** – Any lifting device should be suitable for the purpose for which it is to be used or provided.
- **Safe use** – Every lifting device should be clearly marked with its safe working load (SWL) and should not be operated above its SWL.
- **Maintenance** – Lifting equipment should be maintained in an efficient state, in efficient working order, and in good repair.
- **Thorough examination and inspection** – Lifting equipment should be thoroughly examined and, where appropriate, inspected by a competent person at least every 12 months, 6 months for ‘accessories for lifting’, or in accordance with a scheme of examination and records of thorough examination kept available.

  Note: where the safety of lifting equipment depends on its installation, e.g., a crane, it should be thoroughly examined before being put into service at a new site or location.

- **Information and training -** Employers are required to ensure that employees are adequately informed, instructed, and trained in the safe use of equipment.

11.3 Safety Devices and Precautions

- **Warning devices -** Equipment for lifting should be fitted with suitable warning devices and indicators, e.g., to show when it is magnetized or operating at a reduced power level.
- **Protection against failure of mains electrical supply** - Except for the permanent magnet type, any interruption to the electrical supply could result in a release of the load. An auxiliary supply, by means of batteries which come into operation automatically on failure of the mains supply, will normally support the load for up to 20 minutes and enable it to be manually lowered to the ground or restoration of the mains electrical supply to be affected. The condition of such batteries should be checked regularly.
- Suitable power failure warning devices should be fitted for both main supply and stand-by equipment. Also, the system should not be capable of being energized if the stand-by equipment is below the required power level.
- **Rating of Cranes -** When attached to a crane, the weight of the magnet and its accessories should be considered when assessing the load-carrying capacity and safe operation of the crane. Mobile cranes not only have to contend with the weight of the magnet but also the inertia effects during slewing and travel.
- **Protection against lifting excess material –** While lifting from a stack, to avoid easy displacement of more material than required, a reduced-power or similar facility may be used.
- **Lifting of bundles - protection against falling material -** Where magnetic lifting devices are used to handle bundled materials, it is essential that appropriate risk control measures are in place to protect people, plants, and equipment from the risk of falling material.
- **Personal Protective Equipment -** The selection and use of suitable workwear and other personal protective equipment (PPE), e.g., head protection, gloves, protective footwear, etc., is important to help protect against any residual risks, e.g., from falling loads.
- **Training -** Magnetic lifting devices should be operated only by fully trained persons who have been adequately informed, instructed, and trained in the safe use of the equipment and the findings of any risk assessment. Training courses should cover the:
  a. potential dangers from the use of magnetic lifting equipment.
  b. factors, including load configuration, which may cause equipment or lifting operation failure and how to avoid them.
  c. precautions to reduce the risk of accident and injury to themselves and others.
  d. principles for selecting the right equipment.
  e. limitations on the use of the equipment.
  f. arrangements for planning and carrying out safe lifting operations, including safe systems of work.
  g. specific instructions on safe use issued by the manufacturer/supplier.
  h. location and operation of the equipment controls.
  i. scheme for examination, maintenance requirements, and system for reporting defects.
  j. emergency arrangements

11.4 Carrying out a Risk Assessment

- Before using magnetic lifting equipment, Business/Site/Location should obtain sufficient information to ensure the following:
  i. Preparation of a requisition specification and provision of equipment that will be safe for the intended use.
  ii. Provision of adequate information about the use for which the equipment was designed and tested; and

- Magnetic lifting devices should not be treated as 'general purpose' pieces of lifting gear as they shall be designed to suit types of loads and environments. In all new applications, advice on the suitability of an existing device for the lift should be sought from the equipment manufacturer.
- Business unit/Site/Location should carry out a suitable and sufficient assessment of the risks, before new or existing magnetic lifting devices are specified for handling loads. This should consider whether such devices are the safest option, and if so, if the equipment is appropriate considering all the circumstances of the proposed operation. The assessment should be carried out by someone with knowledge of the stock storage and handling processes, as well as the capabilities and limitations of this type of lifting equipment.
- Some of the factors that have a bearing on the selection of lifting magnets and operating conditions, particularly the SWL, include:

i. **Properties of load materials** - Magnet lifting is not appropriate for all steels. When handling mixed steel types, it should be recognized that non/partially magnetic items are likely to fall away if magnetized pieces supporting their move.

ii. **Load weight, thickness, shape, and area in contact with the magnet** - The surface area of the load and the proportion of the magnet face in contact with it will dictate the number and size of magnets required for safe handling as much as the weight and thickness of the load. For example, a billet may only require a single two-pole magnet, whereas a thin plate section of equal weight may require a multiple arrangement of magnets.

Where the surface of materials is non-uniform, e.g., corrugated, or perforated sheet, flat lifting magnets can be used but should be rated according to the percentage of the load that contacts the magnet face, as well as the kind of "path" that the material offers to the magnetic flux from pole to pole.

It should also be borne in mind that where magnets are used to lift many pieces at the same time, for example, when handling scrap, penetration of the load by the magnetic flux may be poor at the periphery of the load, and part of it may fall off, even though the nominal SWL has not been exceeded.

iii. **Stiffness or flexibility of the load** - Overhang at the ends of a flexible load, e.g., long bar, flat or thin sheet, may cause it to peel off the magnet under its own weight during handling operations. Several magnets may be selected to give greater coverage over the load area rather than reliance being placed on weight-lifting ability alone. Proper configuration/positioning of the magnets should minimize the sag or drop of the overhanging portions of a load.

iv. **Range of sizes to be lifted and frequency of operations -** Where assemblies of magnet are likely to be required to handle a range of load shapes and sizes, it is essential that the equipment supplier and/or the person carrying out the risk assessment are provided with sufficient information as to the likely demands on equipment.

v. **Surface conditions of magnet and load** - The effectiveness of a magnet falls rapidly as the distance between its face and the load, i.e., the airgap, is increased. Good contact between the surfaces of the magnet and the load is essential for the magnet to achieve optimum and safe performance. To maximize contact, both the magnet face and the load surface should be as smooth and clean as possible, and the air gap kept to a minimum.

vi. **Temperature of magnet and load** - The temperature of the magnet and load should be considered as, for example, ferrous materials lose their magnetic properties with increasing temperature and cease to be magnetic at 768ºC. Magnets should not be used for hot work unless designed for this duty and only within the specified operating temperature limits.

11.5 EQUIPMENT MAINTENANCE

The manufacturer's instructions for the regular inspection and maintenance of the magnetic equipment should be followed. Where appropriate, inspection and maintenance schedules should include the following,

- **Power cables to the magnet** – Check for damage and ensure that they are properly supported.
- **Magnet assembly** – Check for damage and that retaining bolts are kept tight.
- **Magnet** – Check for deterioration of insulation resistance; check the value of coil resistance to ensure that "inter-turn" faults have not developed whilst in use.

- **Electrical plug and socket connectors** – Check that mechanical strength, insulation, and electrical conductivity are being maintained lifting tackle e.g., chains, rings etc associated with the magnet – thoroughly examine at appropriate intervals.
- **Electrical back-up batteries** - Check their condition and that the battery back-up alarm works when the power is off.

12. ISOLATION REQUIREMENTS FOR CRANES

Ensuring effective isolation of cranes: whether they are Electric Overhead Travelling (EOT) cranes, mobile cranes, or tower cranes—is crucial for the safety of personnel and the protection of equipment. Isolation measures prevent accidental or unauthorized operation during maintenance and emergencies and are vital for compliance with safety standards.

12.1 GENERAL ISOLATION REQUIREMENTS

12.1.1 Electrical Isolation

- **Isolation Switches:** Cranes shall be equipped with clearly marked and easily accessible electrical isolation switches to disconnect power sources completely during maintenance or emergencies.
- **Lockout/Tagout (LOTO) Procedures:** Implement lockout/tagout procedures to ensure that power cannot be restored until maintenance is completed and safety checks are performed. This involves using locks or tags on isolation switches to prevent accidental energization.

12.1.2 Mechanical Isolation

- **Mechanical Locks:** Mechanisms should include mechanical locks or pins to secure moving parts in place during maintenance. This prevents accidental movement that could cause injury or equipment damage.
- **Documentation:** Clearly document and label isolation procedures to prevent accidental or unauthorized operation.

12.1.3 Emergency Stop Systems

Emergency Stops: Cranes should have emergency stop systems that can immediately halt operations if a dangerous situation arises. These systems should be evaluated regularly to ensure proper functionality.

12.1.4 Training and Information

Training: Personnel should be trained in LOTO procedures, including how to safely isolate equipment and follow lockout/tagout protocols.
Documentation: Maintain detailed records of isolation procedures, including isolation points, procedures for reactivation, and emergency instructions.

12.2 SPECIFIC ISOLATION REQUIREMENTS BY CRANE TYPE

12.2.1 Electric Overhead Travelling (EOT) Cranes

12.2.1.1 Electrical Isolation:

Main Disconnect: EOT cranes should have a main disconnect switch located in an accessible area, away from the crane's operational zone. This switch should completely isolate the crane's electrical systems.
Control Panel Isolation: The crane's control panel should have its own isolation switches, allowing for the disconnection of control circuits separately from the main power.

12.2.1.2 Mechanical Isolation:

Travel Mechanisms: Ensure that the hoist and travel mechanisms can be mechanically locked to prevent unintended movement.
Safety Precautions: Lockout/tagout procedures should be followed when servicing the hoist or travel mechanisms.

12.2.1.3 Safety Devices:

Warning Devices: Install visible indicators to show when the crane is isolated. This includes lights or alarms that signal when the power is disconnected or when maintenance is in progress.

12.2.2 Mobile Cranes

12.2.2.1 Electrical Isolation:

Main Power Isolation: Mobile cranes should have isolation switches that disconnect the main power supply and all electrical circuits, including those for boom and winch operations.
Battery Isolation: Mobile cranes with battery-powered systems should have battery isolators to disconnect the battery when not in use or during maintenance.

12.2.2.2 Mechanical Isolation:

Boom and Winch Locks: Implement mechanical locks or pins to secure the boom and winch in a stationary position during maintenance.
Stabilizers: Ensure that stabilizers are properly extended and locked before performing maintenance.
Safety Devices:
Operational Warnings: Mobile cranes should be equipped with operational warning systems to alert operators when maintenance is required or when isolation procedures are active.

12.2.3 Tower Cranes

12.2.3.1 Electrical Isolation:

Electrical Disconnect: Tower cranes should have electrical disconnects that isolate the main power and control circuits. These should be accessible and clearly marked.
Control Panel Isolation: Control panels on tower cranes should also have isolation switches for disconnecting the control systems.

12.2.3.2 Mechanical Isolation:

Load and Slewing Mechanisms: Ensure that load and slewing mechanisms can be locked out to prevent movement during maintenance.
Mast and Jib Locks: Implement locking mechanisms for the mast and jib to prevent accidental movement.

12.2.3.3 Safety Devices:

Isolation Indicators: Use visual indicators on tower cranes to show when isolation is active, such as indicator lights or warning signs.

12.3 EQUIPMENT MAINTENANCE AND SAFETY CHECKS

12.3.1 Regular Inspections

Electrical Systems: Inspect isolation switches, electrical cables, and connectors regularly to ensure they are in good condition and functioning correctly.
Mechanical Components: Check mechanical locks, pins, and other isolation features for wear and proper operation.

12.3.2 Battery Maintenance

Condition Checks: For cranes with battery systems, regularly check battery condition and ensure that battery isolation switches are functioning.

12.3.3 Safety Checks

Test Isolation Devices: Regularly test isolation devices and emergency stop systems to ensure they function correctly under load.

12.3.4 Documentation and Records

Maintenance Records: Keep detailed records of all maintenance and inspections, including the status of isolation features and any issues identified.

13. ELEMENT 7: PEOPLE

Personnel	Training and Certification	Key Responsibilities	Competency Requirements
All Personnel	- Annual training required. - Competence and authorization necessary for: a) Operating cranes. b) Setting up or rigging loads. c) Providing signals. d) Inspecting, maintaining, or testing equipment.	- Should be trained and certified. - Competence documented and approved by site management. - Knowledge of dynamic loading and crane impact essential.	- Competency for each crane class based on operating time, conditions, and testing. - Familiarity with equipment manuals and safety practices.
Lifting Coordinator	- Authorized to direct and supervise lifting operations. - Competency through certified training.	- Prepare and provide method statements including risk assessment, equipment details, rigging hardware, and safety precautions. - Ensure crane and equipment inspections. - Be present during lifts.	- Should have authority and experience. - Clear communication skills. - Knowledge of all duties and hazard assessments.
Crane Operator	- Routine maintenance and checks required. - Vision certified by an ophthalmologist. - Annual practical and theoretical assessments.	- Operate crane per manufacturer's instructions. - Respond to signals from one slinger/signaller. - Ensure crane is on level ground and properly configured.	- Trained on specific crane model. - Knowledge of rated capacity limiters, environmental effects, and safety practices. - Ability to refuse unsafe work.
Riggers	- Certified by Site Material Handling Safety Leader (SMHSL). - Minimum age 21 years.	- Attach/detach loads correctly. - Supervise rigging operations and hand signalling. - Inspect and select appropriate rigging hardware.	- Skilled in rigging hardware and inspections. - Capable of performing and supervising rigging tasks. - Knowledge of load calculations and safety procedures.

Personnel	Training and Certification	Key Responsibilities	Competency Requirements
Banksman	- Minimum age 21 years. - Trained in slinging and signalling. - Good eyesight and hearing required.	- Direct crane and load movements. - Use of hand signals or radios. - Ensure clear communication and safety on site.	- Knowledge of site hazards and emergency procedures. - Ability to implement control measures and signalling systems. - Competent in communication and safety protocols.

13.1 MEDICAL FITNESS

Operators shall have their eyesight certified by an ophthalmologist, with examinations occurring every 12 months for those up to 45 years of age and every 6 months for those over 45 years, as per state regulations. Site or unit management may mandate more frequent medical examinations. Physical defects or emotional instability that could pose safety hazards may lead to disqualification. Riggers and signalmen shall be certified by the Site Material Handling Safety Leader (SMHSL) or equivalent, be at least 21 years old, and demonstrate physical fitness concerning eyesight, hearing, reflexes, and handling of equipment. All certifications and qualifications, including eyesight certifications, should be documented in contracts to ensure compliance and safety.

14. EMERGENCY PREPAREDNESS AND RESPONSE

Business Unit/Site/Location shall review the credible emergency scenarios and develop a written emergency preparedness and response plan. The emergency plan should identify the emergency equipment's and resources and actions for any foreseeable emergency.
Lifting team shall, as a minimum, consider the following scenarios when planning a lifting emergency plan:

a. Collapse of lifting equipment and recovery of personnel from a collapsed crane or tower crane
b. Contact with overhead power lines and electrocution of personnel.
c. Collision between such as crane-crane, crane-truck, and crane-building
d. Rescue from a tower crane.
e. Load being snagged during lifting operations or Security of the load being compromised during lifting operations.
f. Any other foreseeable emergency that may occur.

The documented procedures should be tested by conducting mock drills involving all lifting operation personnel. The mock drills shall be documented and recorded as part of the safe system for work.

15. TRAINING

A comprehensive training, certification, and competency assurance procedure shall be established for all personnel involved in material lifting and handling operations, including equipment operators (e.g., crane, forklift), riggers, foremen, signalmen, banksmen, helpers, and maintenance and planning personnel. Training programs should encompass both theoretical and practical components, tailored to each job role and position, with clearly defined competency levels required for full responsibility. Personnel should complete the necessary training and certification programs and achieve the required competency level before assuming full operational duties.

15.1 GENERAL AWARENESS TRAINING

Regular awareness training shall be provided to all involved personnel, including contractors, to cover key safety issues such as safe operation, vision limitations (blind spots), emergency procedures, operating conditions (adverse weather, night operations, load conditions), and critical lifting.

15.2 TASK-SPECIFIC TRAINING

Detailed training and certification should be obtained from OEMs, qualified agencies, or certified individuals. This training should address the specific requirements of material lifting and handling operations.

15.3 REFRESHER TRAINING

Refresher training should be conducted at least once every three years or sooner if there are changes to procedures or identified knowledge gaps. This ensures that personnel remain updated on any changes in the program and maintain their competency.

15.4 TRAINING RECORDS

All training records should be retained for a minimum of three years or until retraining occurs, in accordance with local requirements. This ensures ongoing compliance and verifies the proficiency of personnel involved in material handling operations.

16. RACI MATRIX

The roles and responsibilities to implement this standard are outlined below: Activity Description	Employee/ Concerned Supervisor	Line Organization	Site EHS	CORPORATE EHS	Contractor
Identification and assessment of site conditions	R	A	C	-	R
Planning, Preparation, Risk Assessment	R	A	C	-	R
Assign responsibility for implementing control measures	R	A	C	-	R
Protective and Rescue equipment plan	R	A	C	C	I
Ensure Job execution	R	A	C	-	R
Training and Certification	-	A	C	I	R
Audit/Inspection and monitoring for compliance	-	A	R	C	-
Identify Rescue Team	R	A	I	C	R

17. MANAGEMENT OF RECORDS

R = Responsible	expected to participate in the activity and contribute the best of his/her abilities
A = Accountable	responsible for the results
C = Consulted	contributes towards decision making
I = Informed	kept informed but need not participate in the effort

To ensure compliance, safety, and operational effectiveness, records related to crane lifting activities shall be systematically maintained and managed as outlined below:

- **General Record Retention**
  Retention Period: All records related to crane lifting activities, including inspection reports, certifications, and lifting plans, should be retained for a minimum of three years or as required by regulatory standards, whichever is longer.
- **Equipment Inspection Records**
  Cranes: Retain periodic inspection and maintenance records for cranes, including the results of load tests and any corrective actions taken.
  Lifting Accessories: Maintain inspection records for slings, shackles, chains, and hooks for six months or longer based on site policy.
  Lifting Cables and Hoists: Ensure inspection records for cables and hoists are updated after each periodic inspection and retained for six months.
- **Certification Records**
  Crane Certification: Maintain certifications for crane operators, lifting supervisors, and riggers, ensuring they are valid and updated.
  Load Test Certificates: Retain certificates from load tests performed on cranes and lifting equipment for a minimum of three years.
- **Incident and Near-Miss Reports**
  Retain records of any incidents or near-misses during crane lifting activities, including investigation reports, root cause analyses, and corrective actions, for a minimum of three years.
- **Training Records**
  Crane Operator Training: Maintain records of training completed by crane operators, including names, training levels, dates, and instructors.
  Rigger and Signal Person Training: Retain records for rigger and signal person certifications for at least three years or until their validity expires.
- **Work Permit Records**
  Lifting Work Permits: Retain completed lifting work permits for three years from the date of closure to ensure traceability.
- **Inspection Types and Frequencies**
  Maintain records for all inspections conducted on cranes and lifting equipment, as per the following:
  Prior to First Use:
    - **Inspector:** Qualified Person
    - **Frequency:** Upon arrival and prior to acceptance

  Functional Inspection:
    - **Inspector:** Operator/User
    - **Frequency:** Before beginning work at each shift/work

  Periodic Inspection:
    - **Inspector:** Competent Person
    - **Frequency:** Annually or semi-annually, based on statutory requirements of the respective state

18. LEGAL AND OTHER REQUIREMENTS

JSW site shall access, identify, evaluate, and keep up to date the Crane Lifting requirement as per prevailing law in operation.

19. KEY PERFORMANCE INDICATORS

To ensure conformance to the requirements of this Standard, the following key performance indicators (KPI's) shall be identified, communicated, recorded, and monitored:
Indicative list of KPI'

- At least once in three months, a competent person shall inspect all material lifting equipment in accordance with the manufacturer's recommendations and country and/or Business/Site requirements, the frequency of inspection shall be documented and maintained.
- Undertake internal inspection of Tools and Tackles by site competent person at least once in three months.
- Material lifting equipment including tools & tackles shall receive periodic inspection by an approved TPI agency at least once in six months or one year as applicable.

20. ASSURANCE

Each site shall conduct a self-assurance program to ensure compliance with this STANDARD as part of its Safety assurance program. Third-party system audit shall be conducted by Group Safety or external consultants to ensure compliance with the standard.

21. DEFINITIONS

Term	Definition
Anti-Two Blocking Device	A device which prevents main block/auxiliary block from touching the boom tip sheaves.
Appointed	Assigned specific responsibilities by representative.
Auxiliary Hoist	A supplemental hoisting unit of lighter capacity and usually higher speed than provided for the main hoist.
Banksman	A crane driver's helper, who signals instructions to the driver for the movement of the crane and its jib.
Below the hook Lifting Devices	Devices that are not normally reeved onto the hoist rope or chain, such as hook-on buckets, magnets, grabs, and other supplemental devices used for ease of handling certain types of loads. The weight of these devices is to be considered part of the load to be lifted.
Boom	A horizontal or angled structural component on a jib crane that extends from the main support structure and supports the load-carrying mechanisms.
Capacity	The maximum weight in tons the crane will be required to lift safely without tipping, falling or loss of load.
Chain Guide	A means to guide the hoist load chain at the load sprocket.
Clearance	The distance from any part of the crane to a point of nearest obstruction, including swing load of counterweight.
Competent	“Competent person” means a person who, is qualified because of knowledge, training, and experience to conduct the work and its performance safely. is familiar with this legal safety requirements and the JSW Safety Standards that apply to the work and has knowledge of any potential or actual danger to health or safety of workers and known what controls are required to prevent an injury / illness.
Counter Torque	A method of control by which the power to the motor is reversed to develop torque in the opposite direction.
Counterweight	A counterweight is a weight that, by exerting an opposite force, provides balance and stability of a mechanical system. Its purpose is to make lifting the load more efficient, which saves energy and is less taxing on the lifting machine.
Crane	A machine for lifting and lowering a load and moving it horizontally and vertically with the hoisting integral part of the machine. Cranes whether fixed or mobile are driven manually or by power.
Deflection	The difference in elevation at the tip of the boom between an unloaded jib crane and a fully loaded jib crane; usually measured in inches. Our Jib Crane designs tend to have stricter deflection criteria than others in the industry.

Term	Definition
Designated Person	A person selected or assigned by the employer or the employer's representative as being competent to perform specific duties.
Drum	The cylindrical member around whom the ropes are wound for raising or lowering the load.
Dual or Tandem Lift	Tandem lift involving the simultaneous use of two or more cranes or hoists to lift a large load. A lift in which the Centre of gravity of the load can changes during the lift.
Dynamic	A method of controlling crane motor speeds when in the overhauling condition to provide a retarding force.
Emergency Stop Switch	A manually or automatically operated electric switch to cut off electric power independently of the regular operating controls.
Enclosures	The enclosures house all the electrical components on the crane.
Equalizer Beam	Equalizer beams are used to equalize the load.
Fail safe	A provision designed to automatically stop or safely control any motion in which a malfunction occurs.
Fleet Angle	The fleet angle is defined as the largest angle of the rope between the first sheave and the drum flange, relative to the Centre line of the drum. With all types of drum, the rope is subject to a fleet angle, which directly influences its behaviour and impacts on its service life.
Hand Signals	A crane operator should always move loads according to the established code of signals and use a signaller. Hand signals are preferred and commonly used. A signaller may be required by law if the operator’s view of the intended path of travel is obstructed.
Height Under Boom (HUB)	The distance from the floor to the underside of a jib crane’s boom. The minimum height under boom equals the height of the load, plus the maximum distance the load is to be lifted, plus the headroom required for the hoist, trolley, and attachments.
Hoist	A mechanical unit that is used for lifting and lowering a load via a hook or lifting attachment.
Hoist Chain	The load bearing chain in a hoist.
Hoist Motion	The motion of a crane which raises and lowers a load.
Holding Brake	A brake that automatically prevents movement when there is no power.
Hook Height	The vertical distance from the hook or lifting attachment point of a crane to the ground or a specified reference level. It is a critical measurement that determines the maximum height at which a load can be lifted or lowered and is essential for planning and executing safe lifting operations.

Term	Definition
Lift Height	The maximum safe vertical distance that the hook can travel from the floor
Crane Jib	Crane jib –an extension at the top of a crane tower that gives the crane additional lifting or moving capabilities. There are different types of jibs. A saddle jib is a horizontal extension, at a right angle to the tower, with a hook attached to a trolley.
Lifting Devices	Lifting Devices are tools or equipment designed to lift, lower, or support loads during various operations. They are commonly used in industrial, construction, and maintenance settings to handle materials safely and efficiently. Lifting devices encompass a range of equipment with different mechanisms and capabilities. E.g.: Crane, Hoists, Jibs etc.
Crane Hook	A crane hook is a crucial component of a crane's lifting mechanism, designed to securely attach and support loads during lifting and moving operations. It is typically made of high-strength steel and is shaped to provide a reliable connection between the crane and the load.
Limit Switch	A device designed to disconnect the power automatically at or near the limit of travel for the crane motion.
Load	The total superimposed weight on the hoist load block or hook.
Load Block	The assembly of hook or shackle, swivel, bearing, sheaves, sprockets, pins, becket, and frame suspended by the hoisting rope or load chain. This shall include any appurtenances reeved in the hoisting rope or load chain.
Load Chain	The load-bearing chain in a hoist.
Load Moment Indicator / Safe Load Indicator	A device in a mobile or portable cranes that indicates boom length, radius, and load weight. And alerts the operator when lift exceeds the safe operating range of machinery.
Load Sprocket	A hoist component that transmits motion to the load chain. This hoist component is sometimes called load wheel, load sheave, pocket wheel, or chain wheel.
Main Hoist	The hoist mechanism provided for lifting the maximum rated load.
Main Boom	Is the main boom of the mobile crane which takes the complete load
Mast	The vertical steel component of a jib crane which supports the crane. Free Standing jib cranes (including Workstation Jibs) have a circular pipe for a mast, Wall Cantilever cranes have standard I-beams, and Mast Type cranes have wide flange beams. Wall Bracket cranes do not have a mast.
Non running Sheave	A hoist sheave used to equalize tension in opposite parts of the rope or chain. Because of its slight movement, it is not termed a running sheave.
Out Riggers	The foot of the crane which take complete weight of the machine and the load.

<table>
<tr><th>Term</th><th>Definition</th></tr>
<tr><td>Out Rigger Pads</td><td>Is a mat that is fabricated to distribute the load of the outriggers. These mats are strong enough to support the crane and the hoisting material’s weight. As a general guideline, outrigger pad size should be at least three times the size of the outrigger foot itself for proper weight distribution.</td></tr>
<tr><td>Overhead Power lines lifting clearances</td><td>Cranes lifting near overhead line wire or electrical lines should maintain a minimum standard clearance distances of:
<table>
<tr><th>Voltage (KV)</th><th>Minimum Approach Distance</th></tr>
<tr><td>Up to 33 KV</td><td>3 meters (10 feet)</td></tr>
<tr><td>33 KV to 66KV</td><td>4 meters (13 feet)</td></tr>
<tr><td>66 KV to 132 KV</td><td>5 meters (16 feet)</td></tr>
<tr><td>132 KV to 220 KV</td><td>6 meters (20 feet)</td></tr>
<tr><td>220 KV to 400 KV</td><td>7 meters (23 feet)</td></tr>
<tr><td>Above 400 KV</td><td>8 meters (26 feet)</td></tr>
</table>
A person shall be designated to observe clearance of the equipment & give timely warning for all operations, where it is difficult for the operator to maintain the desired clearance by visual means.

Any overhead wire shall be an energized line unless & until the person owning such line or the electrical utility authorities indicate that it is not an energized line, and it has been visibly grounded. The crane operator should also apply his isolation lock and sign on to the work permit.</td></tr>
<tr><td>Overload</td><td>Any hoist load greater than the rated load.</td></tr>
<tr><td>Parts (Lines)</td><td>Number of lines of rope or chain supporting the load block or hook.</td></tr>
<tr><td>Pendant</td><td>The pendant gives the operator precise control over the motions of the crane.</td></tr>
<tr><td>Power Supply</td><td>The electrical service available in the building for which the crane is being designed.</td></tr>
<tr><td>Power Transmission Parts</td><td>Hoist machinery components including the gears, shafts, clutches, couplings, bearings, motors, and brakes.</td></tr>
<tr><td>Qualified Person</td><td>A person who, by possession of a recognized degree in an applicable field or a certificate of professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.</td></tr>
<tr><td>Radio Remote Control</td><td>The radio control performs exactly like the pendant but operates using a radio frequency.</td></tr>
<tr><td>Rated load</td><td>The maximum load a crane is designed to handle.</td></tr>
<tr><td>Reeving</td><td>A system in which a rope or chain travels around drums, sheaves, or sprockets.</td></tr>
</table>

Term	Definition
Rigger	A rigger works with the carne and affixes the rigging to the load and the hook on the crane. They give instructions to the crane to safely lift a load. Riggers should be aware of elements that can affect hoisting safety, factors that reduce capacity, and safe practices in rigging, lifting, and landing loads. Riggers should also be familiar with the proper inspection and use of slings and other rigging hardware.
Roller Chain	A series of alternately assembled roller links and pin links in which the pins articulate inside the bushings and the rollers are free to turn on the bushings. Pins and bushings are press fit in their respective link plates.
Rope	A wire rope, unless otherwise specified.
Running Sheave	A hoist sheave that rotates as the load block is lifted or lowered.
Safety Latch / Hook Latch	A latch provided to bridge the throat opening on hook to prevent the release of load.
Side Pull	The component of the hoist pulls acting horizontally when the hoist lines are not operated vertically.
Spreader Beam	Any beam where the load being lifted mainly puts a compressive stress in the beam.
Standby Crane	A crane which is not in regular service but is used occasionally or intermittently as required.
Stop	A device to limit travel of a trolley or crane bridge. This device is normally attached to a fixed structure and does not have energy absorbing ability.
SWL (Safe working load)	The manufacturer's recommended maximum weight load for a line, rope, crane or any other lifting device or component of a lifting device.
Tagline	Is a piece of rope that is attached to the load to help directed while it being hoisted? They should be non-conductive.
“Walkie Talkie”	A walkie-talkie is a small portable radio, which you can talk into and hear messages through so that you can communicate with someone far away.

22. ANNEXURES

22.1 ANNEXURE - 1: SAMPLE PRE-USE INSPECTION CHECKLIST

Owner: **Machine Model:** **Inspected By:**
Machine Make: **Rated Capacity:** **Date Of Inspection:**

	SL	NAME OF PARTS	OK	NOT OK	REMARKS
LEVEL FLUID	1	Crankcase Oil			
	2	Coolant level			
	3	Hydrolytic oil			
CAB	4	Electrical system			
	5	House lock			
	6	Service /Parking Brakes			
	7	Swing Break			
	8	Gauges/ meters			
	9	Housekeeping			
	10	Fire Extinguisher			
	11	Load Chart			
	12	Windows/ Mirrors			
	13	Travel/Marching			
	14	Seat Belts			
	15	Spill Kits			
	16	Check all mirrors, including the one for the hoisting drum			
	17	Check all windows			
	18	Leveling device			
FUNCTION	19	Steering			
	20	Outriggers			
	21	Boom Up/Boom Down			
	22	Hoists Up/Down			
	23	Swing			
	24	Anti-Two-Blocking Device			

ASSECESRIES	**25**	LMI/Load Moment Indicator			
	26	Boom Length Indicator			
	27	Boom Angle Indicator			
	28	Buzzers/Alarms			
	29	Horn/Backup Alarm			
	30	Load Block/Ball/Hooks			
	31	Load Block/Ball/Hooks			
	32	Safety Latches			
	33	Wedge Socket			
	34	Sheaves			
	35	Wire Rope Retainers			
	36	Main Boom			
LOWER WORKS	**37**	Jib/ Extension			
	38	Tires/Inflation or tracks			
	39	Machine Guards			
	40	Hoist Brakes			
UPPER WORKS	**41**	Hoses Condition			
	42	Spooling on drums			
	43	Parts of Line (Reeving)			
	44	Main Hoist Rope			
	45	Outrigger Mats			
	46	Slew pin			
	47	Load cell / sensor			
	48	Automatic safe load limiter			
	49	Wind speed indicator			

22.2 ANNEXURE - 2: BASIC LIFT PLAN

1. General	
Department / Project site name	
Location of lifting operation	
Name of the department and/or Business Partner supervisor carrying out the lifting operation	
Date and Time of lifting operations	
Permit to work No.	

2. Details of the Load/s			
Description of load/s			
Overall dimensions			
Total weight of load	Kg/ Tons	☐ Known weight	☐ Estimated weight
Centre of gravity	☐ Obvious	☐ Estimated	☐ Determined by drawing
Critical Load	☐ One lifting equipment used (not a critical load) ☐ Meets the criteria of Critical Load ☐ more than one lifting equipment used. ☐ Load exceeds 75% of lifting equipment SWL. ☐ Special rigging and hoisting will be utilized. ☐ Any others, please specify (Overload power lines, hazardous material service lines and-so-on)		

3.Details of the lifting Equipment, Lifting Gears and Lifting Relationship	
Lifting Equipment #1	
Name, type, make and model	
Max. operating radius	
Planned operating radius	
Allowable load (SWL from load chart)	
Ratio of lift to allowable load	
Clearance between boom and lift	
Clearance between boom and surrounding facilities/utilities	
Lifting Equipment #2	
Name, type, make and model	
Max. operating radius	
Planned operating radius	

Allowable load (SWL from load chart)	
Ratio of lift to allowable load	
Clearance between boom and lift	
Clearance between boom and surrounding facilities/utilities	
Type of lifting /rigging equipment and gears. Clearly specify such as Slings, webbing, chains, shackles, spreader beam and-so-on.	1. 2. 3. 4.
Lifting and rigging assessment	☐ Permit to work ☐ Safety Protocol ☐ Rigging study ☐ Rigging sketch
Lifting plan – step by step written plan covering lift sequence, load path, team role and emergency rescue	☐ Yes, available and briefed all stake holders
Date of last certification of lifting equipment and rigging equipment/gears	Certificate no. Certificate Date: Expiry Date:

What are the means of communication between the lifting crew?

☐ Standard hand signals ☐ Others, please specify……

Qualified Resources:

Position	Name	Qualification /Experience
Competent Person		
Department Supervisor		
Lifting Supervisor		
Crane Operator		
Rigger		
Signalman		
Others (Please state)		

4. Step by step of the Lifting Operation

	Person Responsible
1) Identify the location for lifting and Ensure area is clear from any obstruction	Lifting Supervisor
2) Alert other group about the lifting activity.	Lifting Supervisor

3) Position the crane for lifting with in detailed working radius	Crane Operator
4) Deploy the competent riggers and identify the banksman	Department Supervisor
5) Ensure proper communication established between crane operator and signalmen	Lifting Supervisor
6) Ensure certified lifting tools & tackles for lifting operation	Rigger
7) Secure the load properly, ensure the correct angle achieved for the lift	Department Supervisor
8) Use tag lines to the load to prevent the sudden swing	Rigger
9) Lift the load slowly, check the load is secure properly	Signalman
10) Ensure no movement in loading area, no one working under load	Lifting supervisor
11) Place the load in designated area. Signalman to guide crane operator	Signalman
12) Unsecure the load from pad eye	Rigger
13) Hard barricading of operational area	Rigger
14) Obtain and affix tagline	Rigger
15) Check wind velocity	Crane Operator
Reviewed by: Name ---------- Date ---------- Signature ----------	

Note: Rigging or zone operation sketch is recommended to include the initial location of the load, the final location and path of the load. It is also important to indicate any obstructions or equipment that may obstruct the lifting operation.

22.3 ANNEXURE - 3: RECOMMENDED SAFETY FEATURES OF CRANES

The minimum recommended safety features are as listed below for the site to ensure during hiring crane from third party:

A. Safe Load Indicator

All cranes shall be provided with automatic safe load indicator with a visual warning to the crane driver and an audible warning to those in the vicinity.

B. Load Radius Indicator

A load radius indicator is required on certain jib cranes. It shall be clearly visible to the operator and indicate the appropriate safe working load and radius for all configuration of the jib cranes used.

C. Motion Limit Devices

Where motion limit devices are fitted to limit hoisting, travelling, slewing, traversing, climbing or any other crane motion, they shall be regularly inspected and maintained in good working order.

D. Overload Cut Out Devices

Switches, or other devices, may be fitted to cut out any selected crane motion when the crane is in an overload situation. The devices shall be maintained in good working order.

E. Level Indicator

Where fitted, level indicators shall be used in accordance with the instruction manual and maintained in good working order.

F. Anemometer

Anemometers, or other wind speed measuring devices, shall have their indicators mounted in clear view of the crane driver or where appropriate, the person controlling the lift being undertaken. The correct operation of these devices shall be regularly verified, and they shall be maintained in satisfactory condition.

G. Fire Extinguisher

Fire extinguisher shall be provided in the operator's cabin.

H. Cabins for Drivers

The driver of every power-driven lifting appliance shall be provided with a suitable cabin and the cabin shall:

- Provide an unrestricted view for proper operation
- Provide protection from weather; and
- Allow access to the machinery for maintenance work.

I. Brakes and Controls

All cranes, crabs and winches shall be fitted with brakes capable of holding and controlling their maximum loads. The mobile crane shall be fitted with suitable horn, head lights, side lamps, rear and stop lights and flashing direction indicator.

22.4 ANNEXURE - 4: COMMON TYPE OF LIFTING EQUIPMENT

A. **Mobile Cranes:** These cranes consist of a jib mounted on' a purpose designed chassis either road wheel mounted, or crawler tracked. They may be permitted, when specified, to move on their wheels or tracks when carrying loads or may require the use of stabilizers or outriggers to permit the lifting of their design loads. Larger mobile cranes may consist -of separate units which when assembled for crane duties operate on a fixed base. Enhanced duties may be obtained in special cases by the attachment of additional structural members and counterweight or by mounting the mobile crane on a special base or track, or by a combination of both. The common types of mobile cranes include Tire-Mounted Mobile Cranes (telescopic boom/ lattice boom), Crawler-Mounted Cranes, Rough Terrain Crane, and Aerial Man Lift.

B. **Lorry Loaders (Jib Type):** This type of lorry loader consists of a jib crane mounted on a load carrying vehicle primarily intended for handling loads on or off the vehicle to which it is attached.

C. **Jib Cranes:** These cranes consist of a jib or jib arm is the horizontal or near-horizontal beam used in many types of cranes to support the load clear of the main support. Jib mounted at an elevated level on a vertical tower, the jib being capable of slewing through 360 deg. Tower cranes may be mounted on a fixed base, crawler tracks, rails or wheels or may be mounted onto another structure.

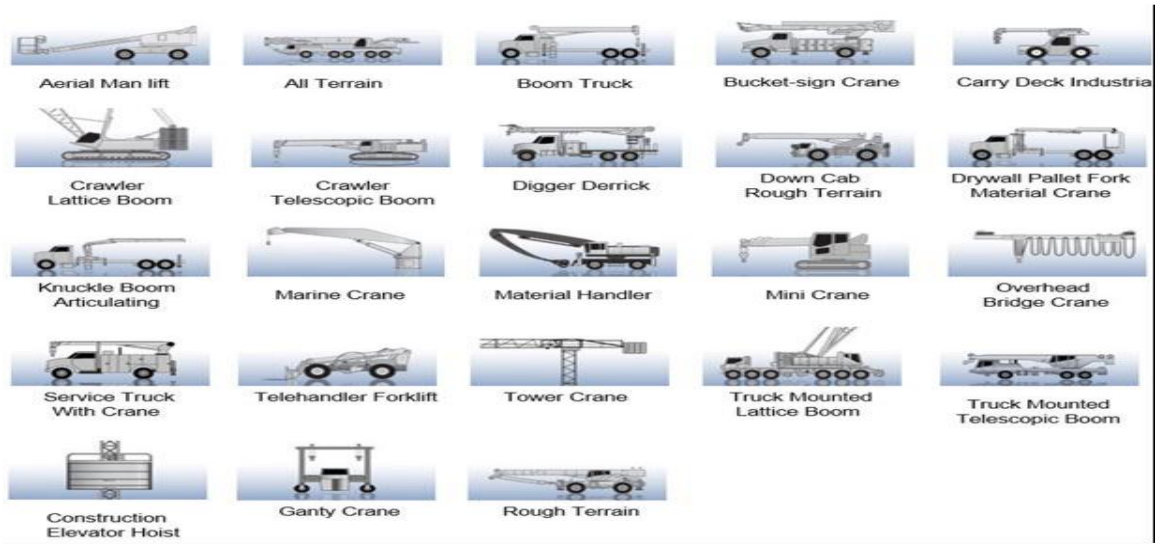
D. **Derrick Cranes:** These cranes consist of a jib which is supported by ropes from a mast which in turn is supported either by guy ropes, stays or other means.

E. **Overhead Travelling Cranes:** These cranes consist of a bridge girder, or girders mounted on end carriages housing the long travel wheels which travel along a gantry track. The girders support a crab fitted with hoisting machinery having a hook, magnet or grab and traversing machinery. The crab may support a fixed or slewing under hung jib or mast. The crane is normally operated from a cabin either suspended from the main girders or attached to the crab.

F. **Container Handling Cranes:** These cranes are specifically designed for the purpose of handling containers and incorporate a purpose-built spreader in their construction.

G. **Hoist:** is a device used for lifting or lowering a load by means of a drum or lift-wheel around which rope or chain wraps. The more commonly used hoist in today's worldwide market is an electrically powered hoist. These are either the chain type or the wire rope type.

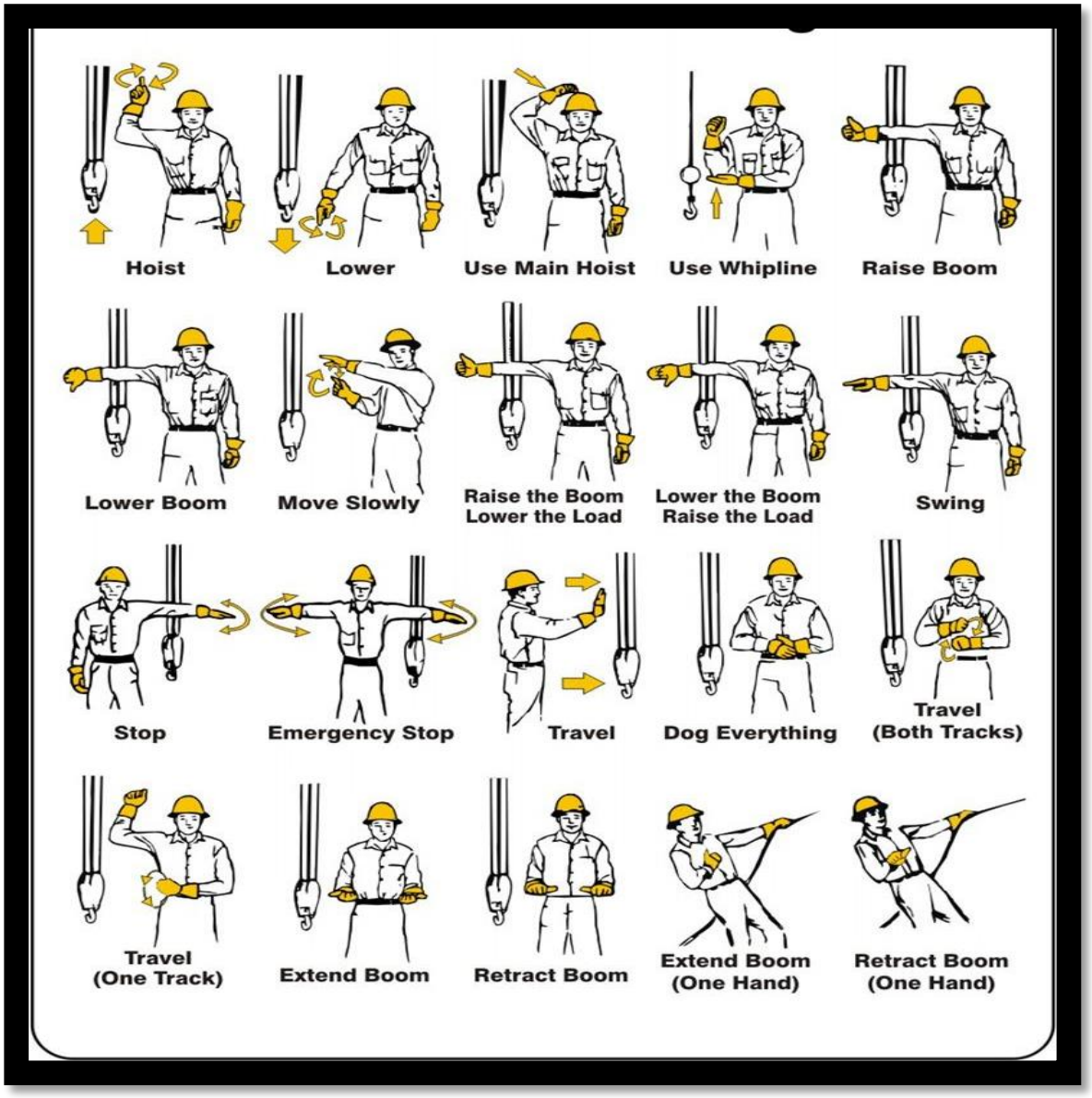
H. **Winch:** Used to pull in (wind up) or let out (wind out) or otherwise adjust the tension of a rope or wire rope. In its simplest form, it consists of a spool (or drum) and electric / pneumatically operated.



22.5 ANNEXURE - 5: TECHNICAL CODES AND STANDARDS REFERENCE ON LIFTING EQUIPMENT'S

Sr. No.	Standard		Title
			ASME/ANSI Standards (USA)
1.	ASME B30.3 and B30.4		Tower Cranes & Portal and Pedestal Cranes
2.	ASME B30.2; B30.17 & B30.18		Overhead and Gantry Cranes; Cranes and Monorail (with underhung Trolley or Bridge); Stacker Cranes
3.	ASME B30.16		Overhead Underhung and Stationary Hoists (chain blocks, air hoists)
4.	ASME B30.23; ANSI A92.2/3/5/6		Personnel Lifting Systems; Elevating and Vehicle Lift devices
			Indian Standards
1.	IS 13367 (Part 1): 1992		Safe Use of Cranes- Code of Practice
2.	IS 3177: 1999		Code of Practice for Electric Overhead Travelling Cranes and Gantry Cranes other than Steel Work Cranes
3.	IS 3443: 1980		Specification for cranes rail sections
4.	Doc No. CMD-III/1855/1 Manual / 17 MARCH 2008		Manual for wire ropes
5.	IS 14469: 1997		Determining the stability of mobile cranes
6.	IS 6521-1 (1972		Code of practice for design of tower cranes
7.	IS 1367: 1994 (Part 6): 1994		Mechanical properties and test methods for nuts with specified proof loads
8.	IS 1856: 2005		Specification for steel wire ropes for haulage purpose
9.	IS 2266: 2002		Specification for steel wire ropes for general engineering purpose
10.	IS 13870: 1993		Cranes and lifting appliances – selection of wire ropes Part 1 general
11.	IS 807:2006		Design, Erection and Testing (structural Portion) Of Cranes and Hoists – Code of Practice

22.6 ANNEXURE - 6: STANDARD CODE OF HAND SIGNALS FOR LIFTING EQUIPMENT'



22.7 ANNEXURE - 7: SELF-ASSESSMENT AUDIT CHECKLIST

Confirm each control/ safeguard below beforestarting work		Guidance for confirming each control/safeguard	Executor/ Performing Work	Verification authority
Prior to Lifting activity following have been complied:				
	The lift has been planned	• The lift method, equipment, and number of people required has been assessed and determined. • When required, an approved lift plan or procedure is in place and has been evaluated by a competent person? • The lift has been assessed for: o load weight. o load size. o centre of gravity (e.g., lifting points) • The lifting equipment's current capacity and condition has been assessed. • Equipment operator and lifting crew have discussed the written lift plan prior to lifting		
	The hazards are identified and controlled	• Complete a task risk assessment specific to the scope of work. • Discuss hazards with the work team prior to the start of work. • Identify overhead hazards and/or other obstructions (e.g., overhead power lines), making sure to check: o load path. o swing radius. o overhead hazards o pickup/lay-down zones. • Check for simultaneous operations that may introduce any additional hazards. • Discuss stop work considerations if work situation changes including change of weather Note: Consider how to apply "hands-free lifting" (e.g., use of push poles and/or taglines)		
	Workers involved with the lift are qualified to perform their task	• Lifting equipment operator and lifting crew are qualified to perform their task. Note: To be "qualified" may require certification and/or assessment to meet company or applicable legal requirements		
	The lifting equipment is stable and potential for unplanned movement has been assessed	• Lifting appliance is level and/or placed on stable ground. • Matting has been assessed for stability and is level for the lifting equipment. • Outriggers are deployed. • Loads have been assessed for stability, considering:		

Confirm each control/ safeguard below beforestarting work		Guidance for confirming each control/safeguard	Executor/ Performing Work	Verification authority
		○ load securing. ○ workplace conditions ○ travel path. ○ equipment capacity • Equipment is operated per OEM requirements (e.g., weather, sea state and temperature)		
	The lifting and rigging equipment are: • certified • inspected • rated for the lift	• Pre-use crane inspection has been completed. • Safety and monitoring devices are in place and functioning. • Manufacturer's load chart is available. • The rigging equipment has been inspected prior to lift. • The rigging equipment is rated for the lift. Note: If load chart does not exist, assume equipment is not rated for the lift; stop work and identify alternative lifting equipment that is rated for the load		
	A communication plan and responsibilities are agreed to by the lift crew	• Communication method(s) (e.g., hand signals, radio) have been agreed to and tested. • Equipment operator and lifting crew have discussed the emergency response, including what emergency stop signals be used. • The person in charge of the lift has been identified as per the lift plan or procedure. • The members of the lift crew have agreed to their individual roles and responsibilities for the lift. • The signaller for the lift has been identified (banksman/flagman/dogman/spotter)		
	The load has been inspected prior to lift	• Every load has been inspected for integrity and stability (e.g., centre of gravity) ○ The load and its packaging can withstand the forces/motion caused by the lift • Loose objects have been secured or removed prior to lift. • Loose and small objects are well packaged or placed in lifting basket		

Confirm each control/ safeguard below beforestarting work		Guidance for confirming each control/safeguard	Executor/ Performing Work	Verification authority
	Barriers and exclusion zones are in place	• **Exclusion zones have been identified and controls are in place to protect people from line of fire hazards, including:** ○ working under suspended loads ○ moving objects ○ dropped objects. • **Access to exclusion zones is controlled (e.g., attendant, or physical barriers)** • **Escape routes are unobstructed and known by the work crew**		

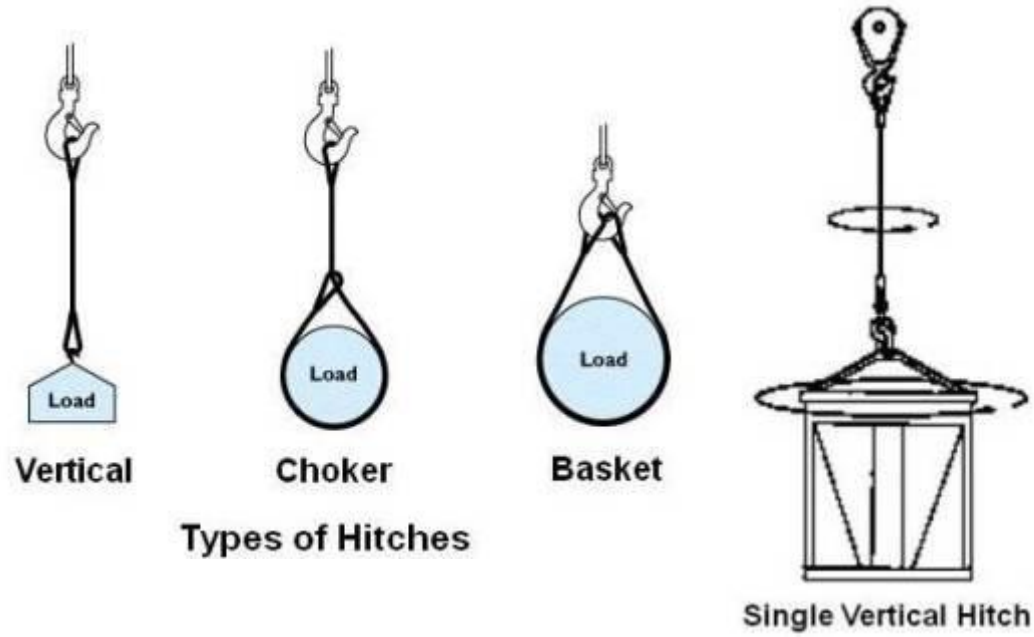
22.8 ANNEXURE - 8: HITCHES AND SAFE WORKING LOAD LIMIT

In rigging various types of hitches are used to hold loads. Safe working load limit of a sling depends on type of hitch, sling angle and D/d ratio. Information on types of hitches and effect of type of hitch, sling angle and D/d ratio on safe working load is given in this article.

22.8.1 Types of Hitches

Every lift uses 1 of 3 Basic Hitches shown above – Vertical, Choker and Basket. Detail about various sling configurations using them is as under.

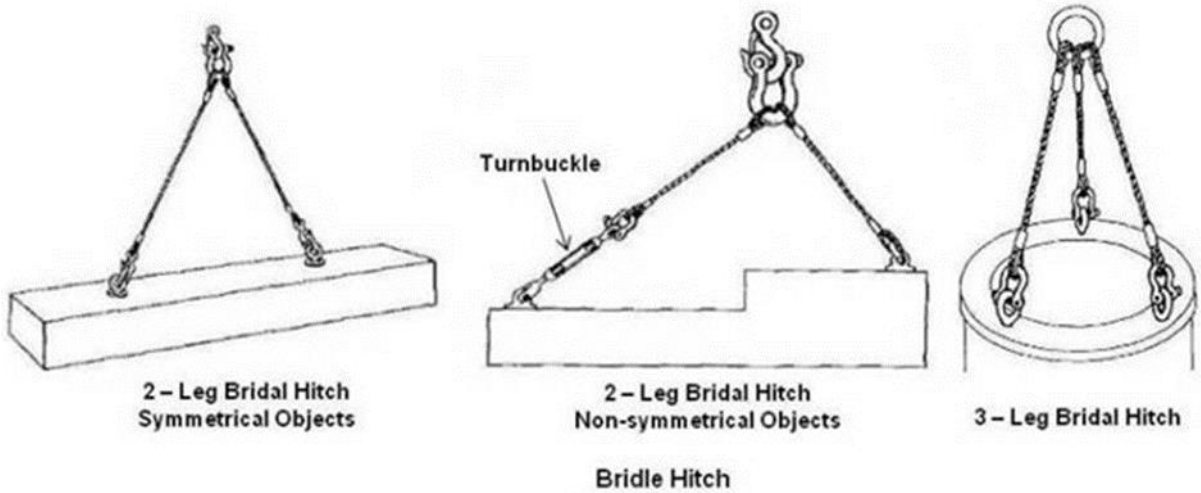
Single Vertical Hitch



In single vertical hitch a sling is used to connect a lifting hook or other device to a load. In this configuration the total weight of the load is carried by a single leg, the sling horizontal angle is 90º (angle between horizontal line and sling), and the weight of the load can equal the maximum working load limit of the sling. This hitch provides absolutely no control over the load because it permits rotation. A tagline should be attached to prevent rotation which may damage the sling.

22.8.2 Bridle Hitch

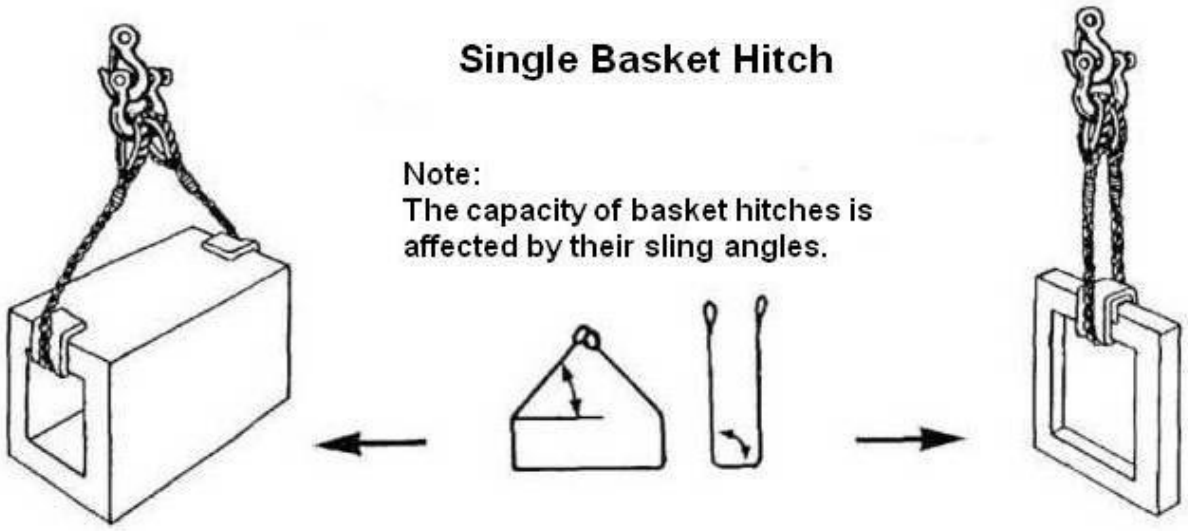
Two or more sling hitches can be used together to form a bridle hitch. This configuration provides good load stability when the load is distributed equally among the legs (symmetrical objects), the hook is directly over



the load's centre of gravity and the load is raised level. In case of non-symmetrical objects (off-centre loads), a sling leg may be fitted with a turnbuckle to adjust the length to level it. Instead of a turnbuckle, come along of adequate capacity may be also used. Proper use of a bridle hitch requires that sling angles are carefully measured to ensure that individual legs are not overloaded. Because the load may not be distributed evenly, when more than two slings (3 or 4 leg slings) are used, load may be carried by only two legs while other legs are only balancing it. Unequal length sling legs may be one reason for this. In view of this, it is recommended to assume that the load is carried by two legs only and the sling may be rated as two leg slings. If a qualified rigger or rigging specialist ensures that the load is evenly distributed, the full use of all the legs is allowed.

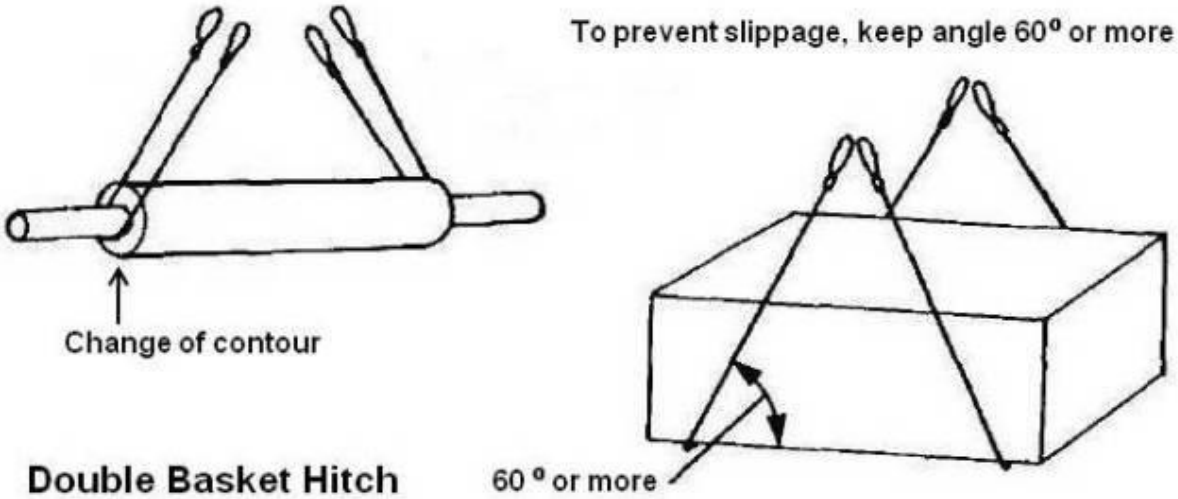
Note:
All wire rope sling capacity tables (e.g. in ASTM B30.9 and Wire Rope User's Manual) consider all legs sharing equal loads.

22.8.3 Single Basket Hitch



The single basket hitch is used to support a load by attaching one end of the sling to the hook, then passing the other end under the load and attaching it to the hook. One shall ensure that the load does not slide along the sling during lifting.

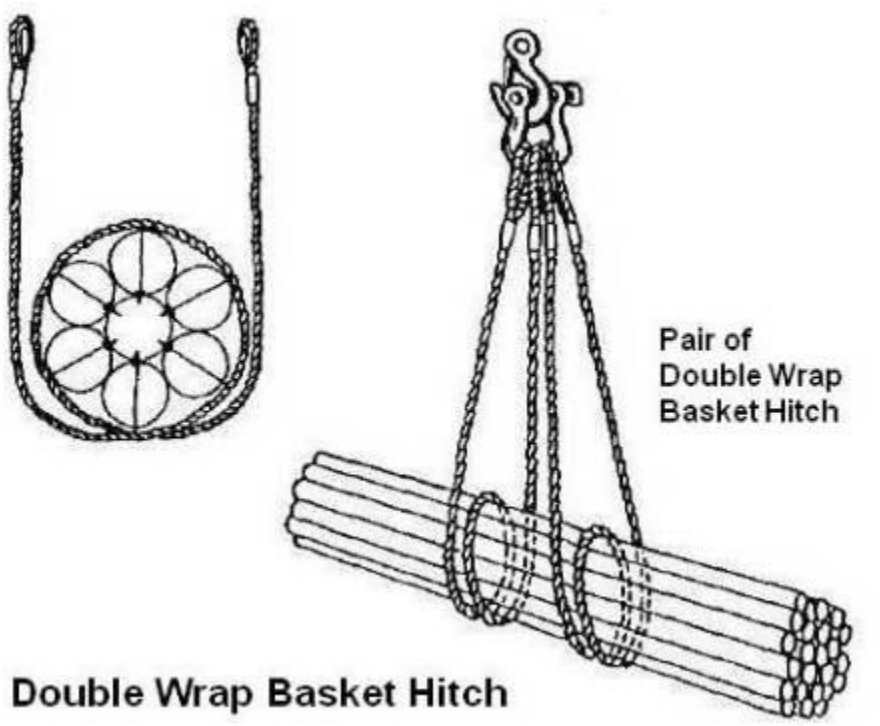
22.8.4 Double Basket Hitch



The double basket hitch consists of two basket hitches passed under the load. They should be placed under the load so that it is balanced. The lags of the hitches should be kept far enough apart to provide balance but

not so far apart that low angles are created, and the legs pull in towards the centre. The angle between the load and the sling should be approximately 60º or greater to avoid slippage. On smooth surfaces, both sides of the hitch should be snubbed against a change of contour to prevent the sling from slipping as load is applied. Otherwise use a double wrap basket hitch.

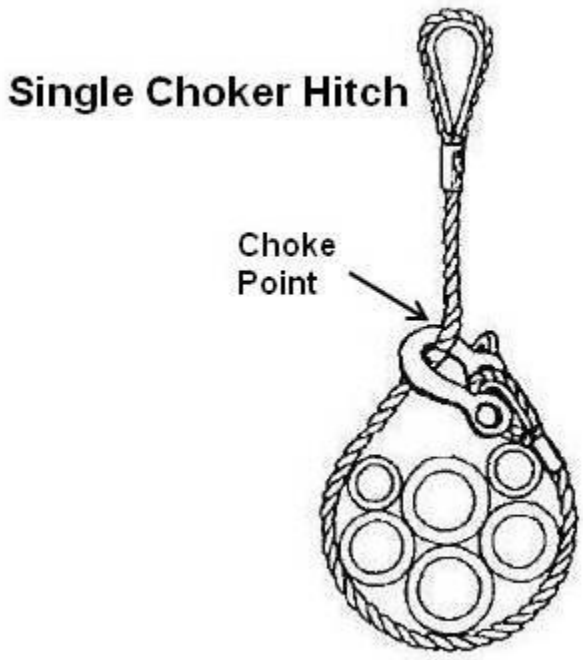
22.8.5 Double Wrap Basket Hitch



Double Wrap Basket Hitch

The double wrap basket hitch is a basket hitch wrapped completely around the load and compressing it rather than merely supporting it, as done by the ordinary basket hitch. The double wrap basket hitch can be used in pairs like the double basket hitch. This arrangement is used for handling loose material, pipes, rods, or a smooth cylindrical load because the sling is in full 360º contact with the load and tends to draw it together.

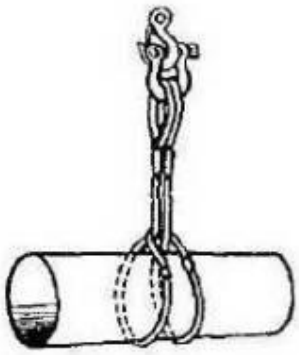
22.8.6 Single Choker Hitch



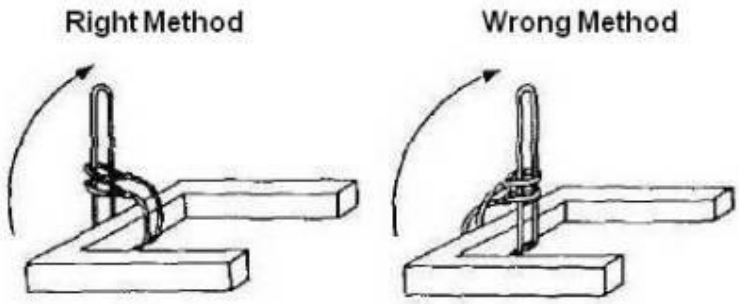
The single choker hitch forms a noose in the rope. It does not provide full 360º contact with the load. It should not be used to lift loads difficult to balance or loosely bundled. The hitch reduces lifting capacity of a sling as this method of rigging affects the ability of the wire rope components to adjust during the lift, places angular loading on the body of the sling and creates a small diameter bend in the sling at the choke point.

22.8.7 Doubled Choker

The single choker hitch can be doubled up to provide twice the capacity or to turn a load as shown below (Doubling a single choker hitch is not the same as using a double choker hitch.).

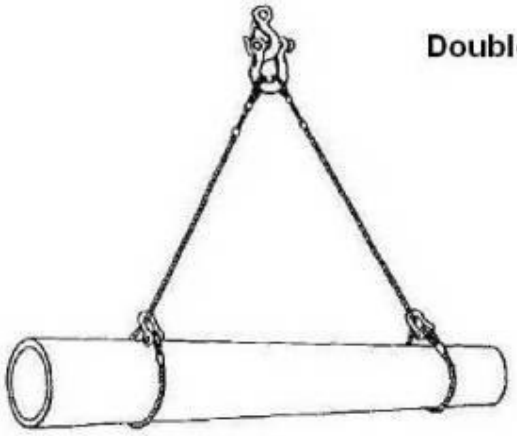


Doubled Choker

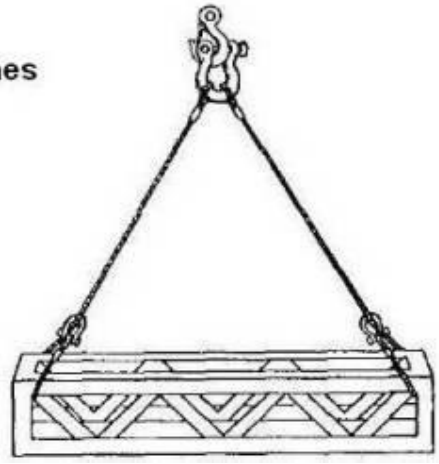


Turning of Load by Doubled Choker

22.8.8 Double Choker Hitch

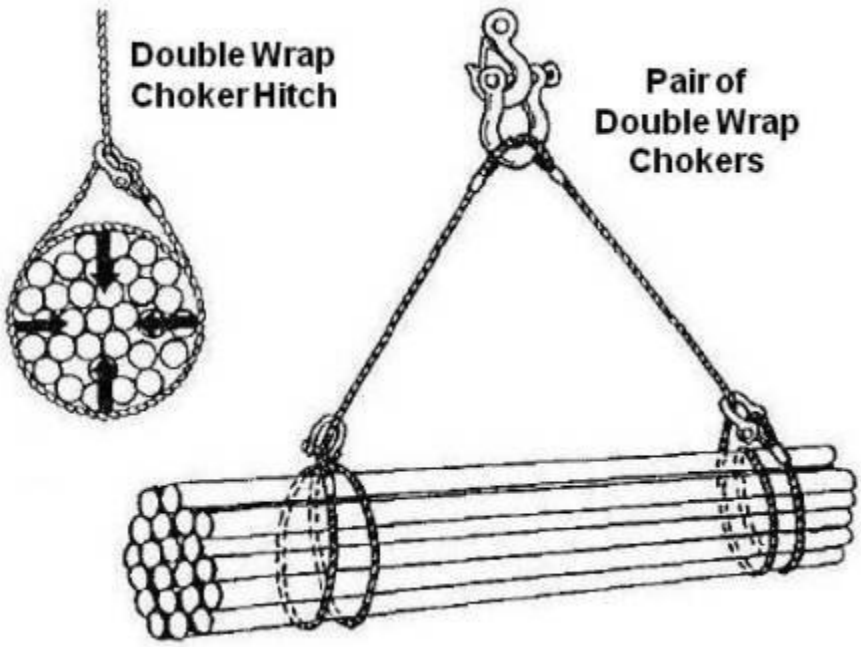


Double Choker Hitches



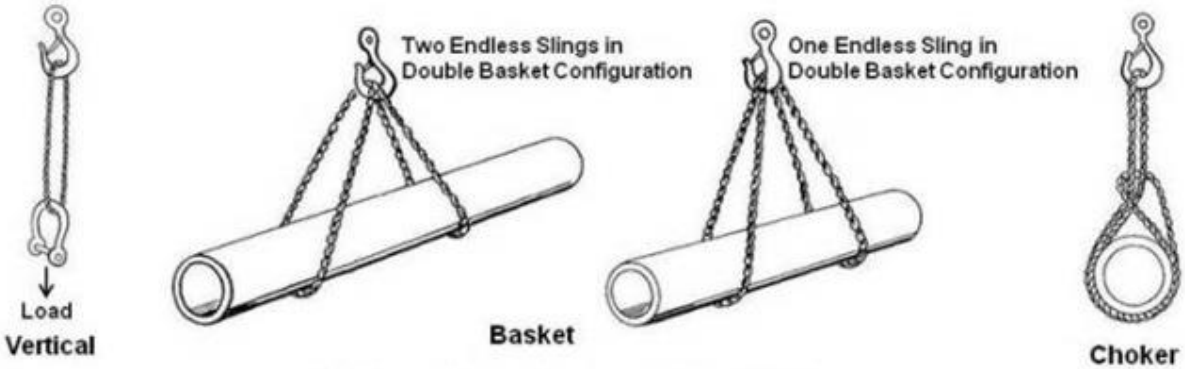
The double choker hitch consists of two sling chokers attached to the load and spread to provide load stability.

22.8.9 Double Wrap Choker Hitch



Double wrap choker hitch is formed by wrapping the sling completely around the load and hooking it into the vertical part of the sling. This hitch is in full 360º contact with the load and tends to draw it tightly together. It can be used either single on short, easily balanced loads or in pairs on longer loads.

22.8.10 Endless Slings or Grommet Slings

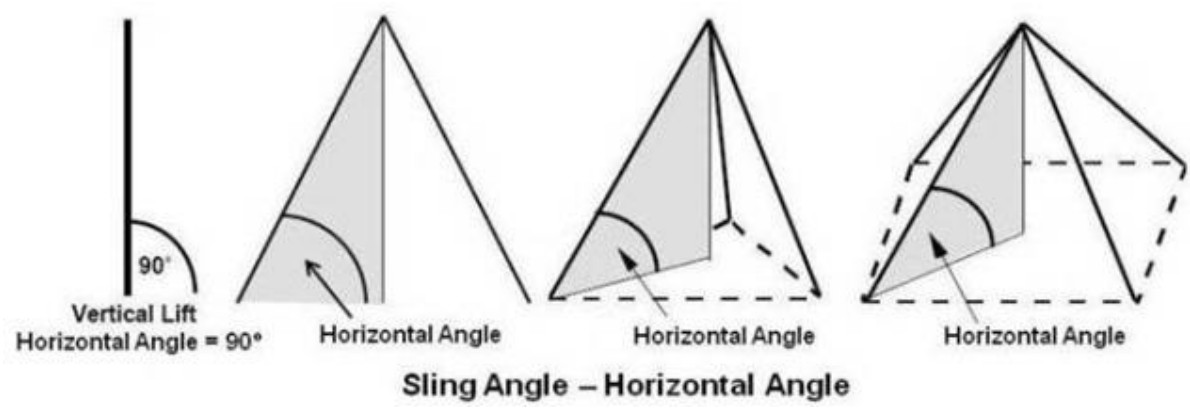


Endless Sling or Grommet Sling Hitches

Endless slings are used for all three types of basic hitches as shown above. They are made from wire ropes, chains and synthetic materials. They are flexible but tend to wear faster than other slings because normally they are not fitted with fittings and deforms when bent over hooks.

22.8.11 Sling Angle

The loading in any type of sling is affected by the angle of the sling leg. Any angle other than vertical (sling angle = 90º) at which the sling is rigged, increases the loading (tension) on the sling. Due to this, sling's working load limit reduces. As the angle decreases the stress imposed on the leg of a sling increases. This angle, which is measured between a horizontal line and the sling leg or body, is called sling angle or horizontal angle as shown below.



Sling Angle – Horizontal Angle

Sling's working load limit (WLL) can be calculated by applying trigonometrical function (for stress calculation) as under.

Sling's working load limit = Sling's vertical capacity x sine of horizontal angle.

For easy of understanding and 'day-to-day' practical calculation above equation can be written as under.

Sling's Working Capacity = Factor x Sling's Rated Capacity

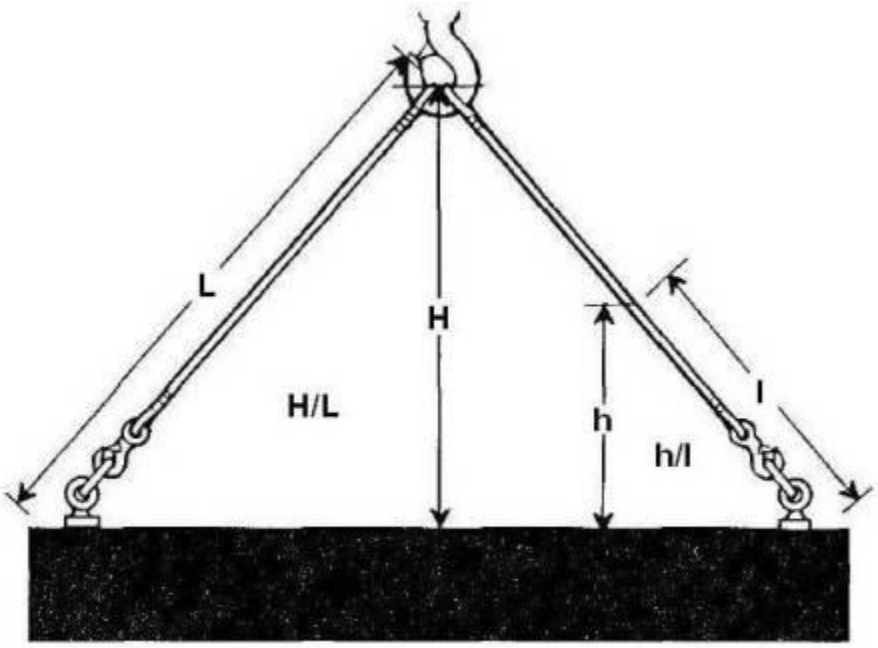
Where Factor shall be taken based on sling angle from following table.

Sling Angle in Degrees	Factor	Sling Angle in Degrees	Factor
15	0.259	55	0.819
20	0.342	60	0.866
25	0.423	65	0.906
30	0.500	70	0.940
35	0.574	75	0.966
40	0.643	80	0.985
45	0.707	85	0.996
50	0.766	90	1.000

As sling stresses increase tremendously with angles smaller than 45°, it is recommended not to use sling angle less than 30º. Low sling angles also create large horizontal compressive forces in the load which may be sufficient to cause buckling, especially in long flexible loads. If two or more slings are used, the minimum horizontal angle shall be used for calculating working capacity.

As measuring of sling angle can be difficult on a construction site, use the following methods to estimate safe working loads for common sling configurations.

Each rule is based on the safe working load of a sling in vertical hitch of a given size and material and the ratio H/L, where H is the vertical distance of the hook to the top of the load and L is the distance, measured along the sling, from the saddle of the hook to the top of the load as shown below.

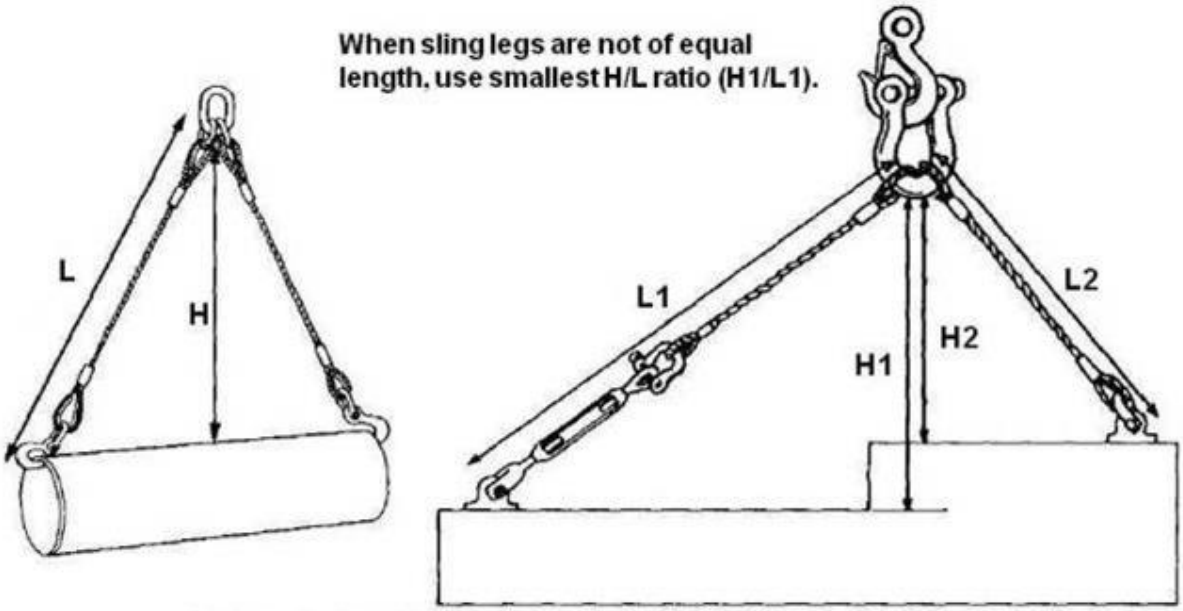


Measuring H and L

If it is not possible to measure the entire length of the sling, measure along the sling from the top of the load to a convenient point and call it distance “l”. From this point measure vertically down to the load and call it distance “h”. The ratio h/l will be the same as the ratio H/L as shown in above sketch. Either H/L or h/l will apply equally to the following methods.

Note:
When sling legs are not of equal length, use smallest H/L ratio.

Capacity of Bridle Hitches (2-Leg)



Determining Capacity of 2-Leg Bridle Hitches

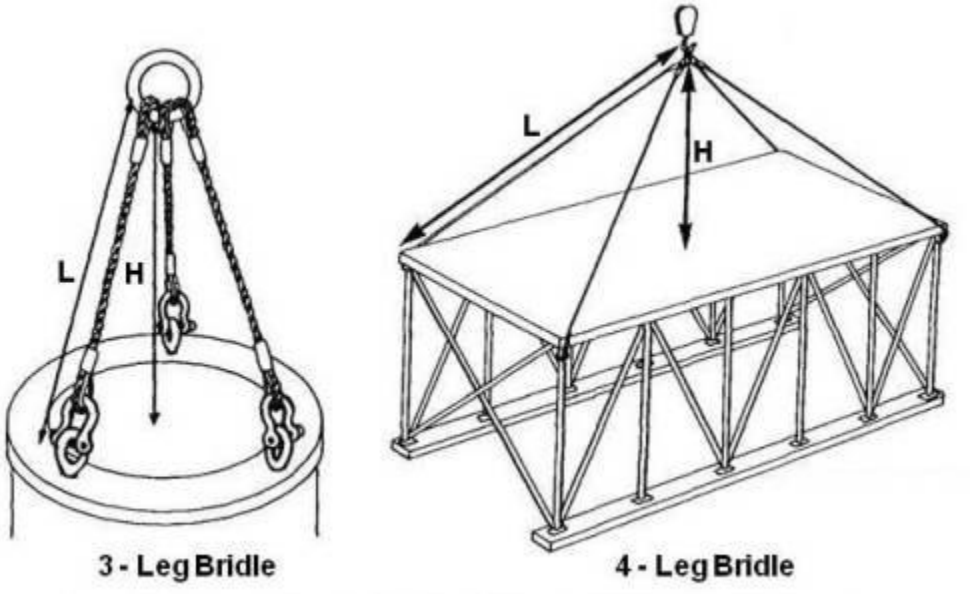
WLL = WLL (of Single Vertical Hitch) x (H/L) x 2

22.8.11.1 Capacity of Bridle Hitches (more than 2 Legs)

Three and four leg bridle hitches are rated equally to account for the possibility of unequal load distribution in a four-leg hitch.

WLL = WLL (of Single Vertical Hitch) x (H/L) x 3

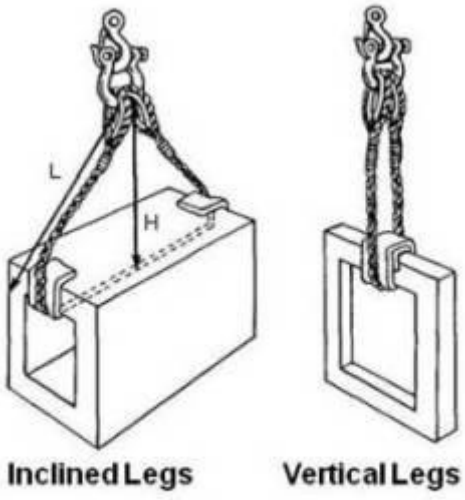
The three leg hitches are less susceptible to unequal distribution since the load can tilt and equalize the loads in each leg. However, lifting an irregularly shaped, rigid load with a three-leg hitch may develop unequal loads in the sling legs. To be safe, use the formula for a two-leg bridle hitch under such circumstances.



Determining Capacity of 3 and 4 Leg Bridle Hitches

Note:
The rated capacity of a multi-leg sling assumes that all legs are used. If this is not the case, de-rate the sling assembly accordingly and hook all unused legs to the crane hook so they will not become snagged during the lift.

22.8.11.2 Capacity of Single Basket Hitch

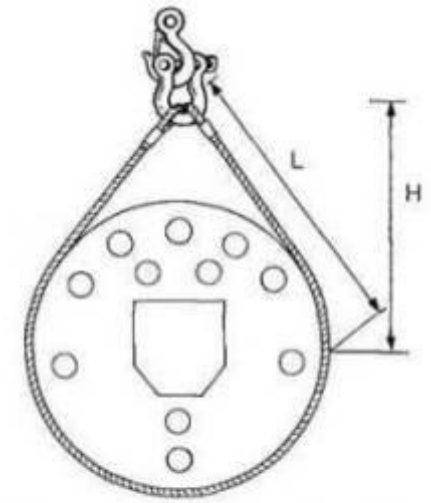


Determining Capacity of Single Basket Hitch

For single basket hitch, sling capacity is as under based on sling configuration.

For inclined legs, WLL = WLL (of Single Vertical Hitch) x (H/L) x 2
For vertical legs, WLL = WLL (of Single Vertical Hitch) x 2

22.8.11.3 Capacity of Double Basket Hitch



Determining Capacity of Double Basket Hitch With Inclined Legs

For double basket hitch, sling capacity is as under based on sling configuration.

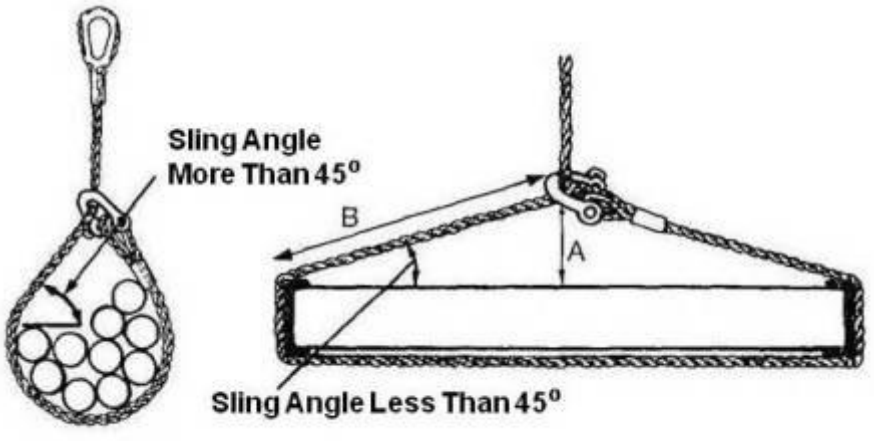
For inclined legs, WLL = WLL (of Single Vertical Hitch) x (H/L) x 4
For vertical legs, WLL = WLL (of Single Vertical Hitch) x 4

22.8.11.4 Capacity of Double Wrap Basket Hitch

Depending on configuration, safe working loads are the same as for the single basket hitch or the double basket hitch.

22.8.11.5 Capacity of Single Choker Hitch

When the load is hanging free, and the choke was not forced down towards the load, the normal sling angle is about 45 degrees.



Determining Capacity of Single Choker Hitch

Based on sling angle (formed by the choker), capacity of single choker hitch is as under.

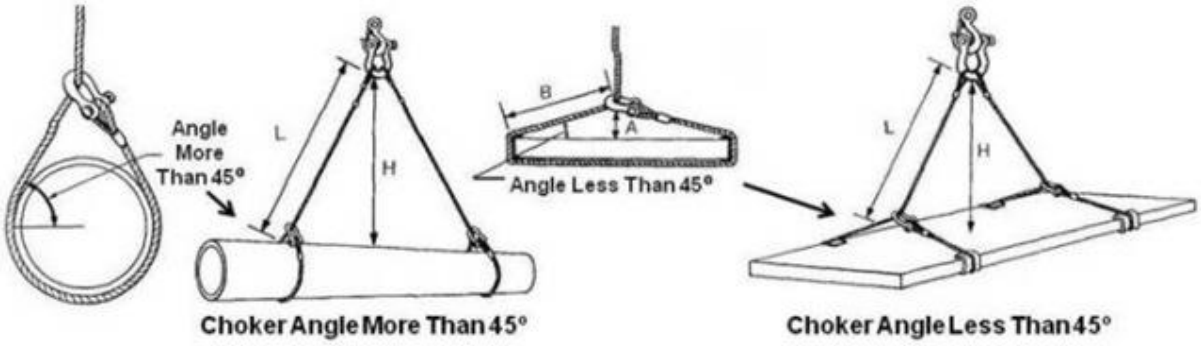
For sling angle of 45º or more, WLL = WLL (of Single Vertical Hitch) x ¾

Sling angles of less than 45º are not recommended. If they should be used,

WLL = WLL (of Single Vertical Hitch) x (A/B)

In a choker hitch, sling shall be long enough so that the choker fitting chokes on the wire rope body and never on the fitting (sleeve/ferrule).

22.8.11.6 Capacity of Double Choker Hitch



Determining Capacity of Double Choker Hitch

Based on sling angle (formed by the choker), capacity of double choker hitch is as under.

For sling angle of 45º or more, WLL = WLL (of Single Vertical Hitch) x ¾ x (H/L) x 2

Sling angles of less than 45º are not recommended. If they should be used,

WLL = WLL (of Single Vertical Hitch) x (A/B) x (H/L) x2

22.8.11.7 Capacity of Double Wrap Choker Hitch

Depending on configuration, WLLs are the same for the single choker hitch or the double choker hitch.

22.8.11.8 Capacity of Endless/Grommet Slings

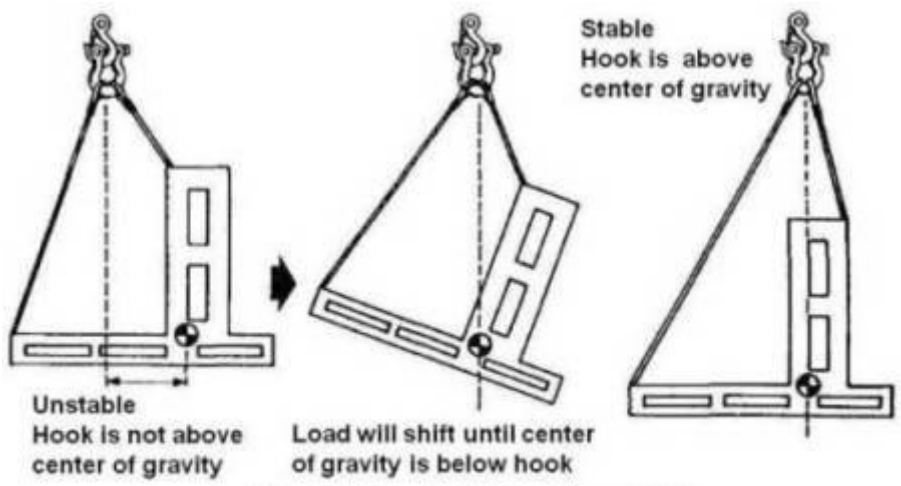
Although grommet slings support a load with two legs, their WLL is usually taken as 1.5 times the WLL of a single vertical hitch. This reduction allows for capacity lost because of sharp bends at the hook or shackle.

22.8.12 Centre of Gravity

Centre of gravity is the point around which an object's weight is evenly balanced. The entire weight may be concentrated at this point.

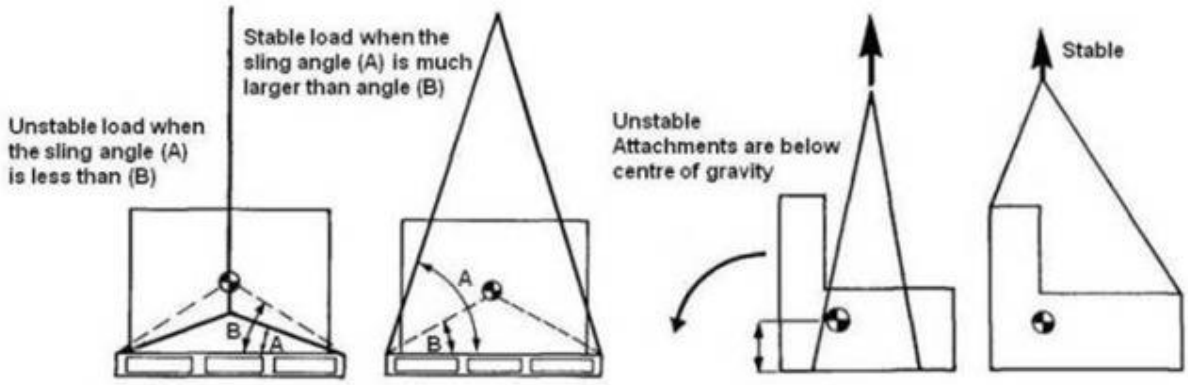
It is always important to rig the load so that it is stable. For this the load's centre of gravity should be directly under the main hook and below the lowest sling attachment point before the load is lifted.

A suspended object will always move until its centre of gravity is directly below its suspension point. To make a level or stable lift, the crane hook block should be directly above this point before the load is lifted as shown below.



Effect of Center of Gravity on Lift

For load stability it is equally important to ensure that the support points of a load (i.e. where the slings are attached to the load) lie above its centre of gravity. Under suspension, an object's centre of gravity will always seek the lowest level below the point of support. This knowledge is especially important for lifting pallets, skids, or the bas of any object since they all tend to topple. This type of load will be stable if the attachments are above the centre of gravity as shown below.



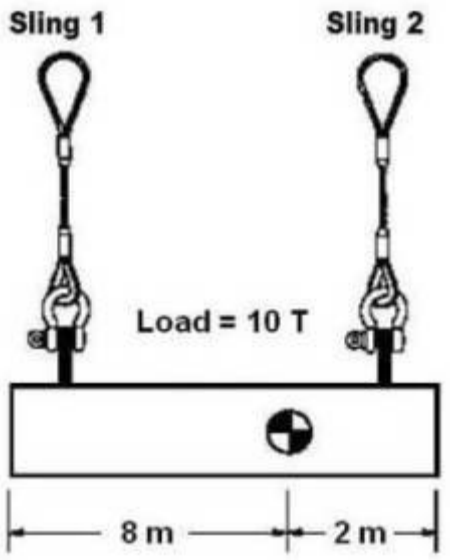
Centre of Gravity and Load Stability

An object symmetrical in shape and uniform in composition will have its centre of gravity at its geometric centre. With odd, shaped objects, the centre of gravity can be difficult to locate. In such cases the rigger should guess where it lies, rig accordingly and signal for a trial lift. The centre of gravity will lie somewhere along a line drawn vertically from the hook down through the load. The rigger than adjust the slings accordingly to balance the load. If any load tilts more than 5º after it is lifted clear of the ground, it should be landed and rigged over again.

It may be noted that when the centre of gravity is closer to one attachment point than the other, the sling legs should be unequal in length. In this case their angles and loads will also be unequal.

22.8.12.1 Loading at Pick Points for Off-Centre Centre of Gravity Objects

When the centre of gravity is not equally spaced between the pick points, the sling and fittings will not carry an equal share of the load. The sling connected to the pick point closest to the centre of gravity will carry the greatest share of the load. The load carried by each pick point can be calculated as shown below.

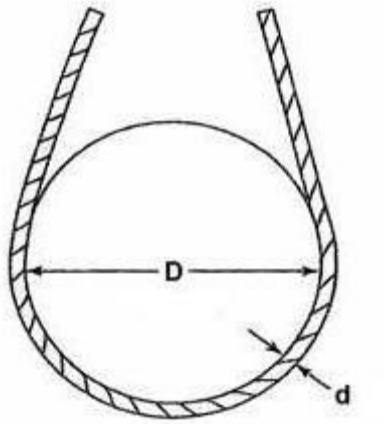


For above case, load carried by slings 1 and Sling 2 will be,

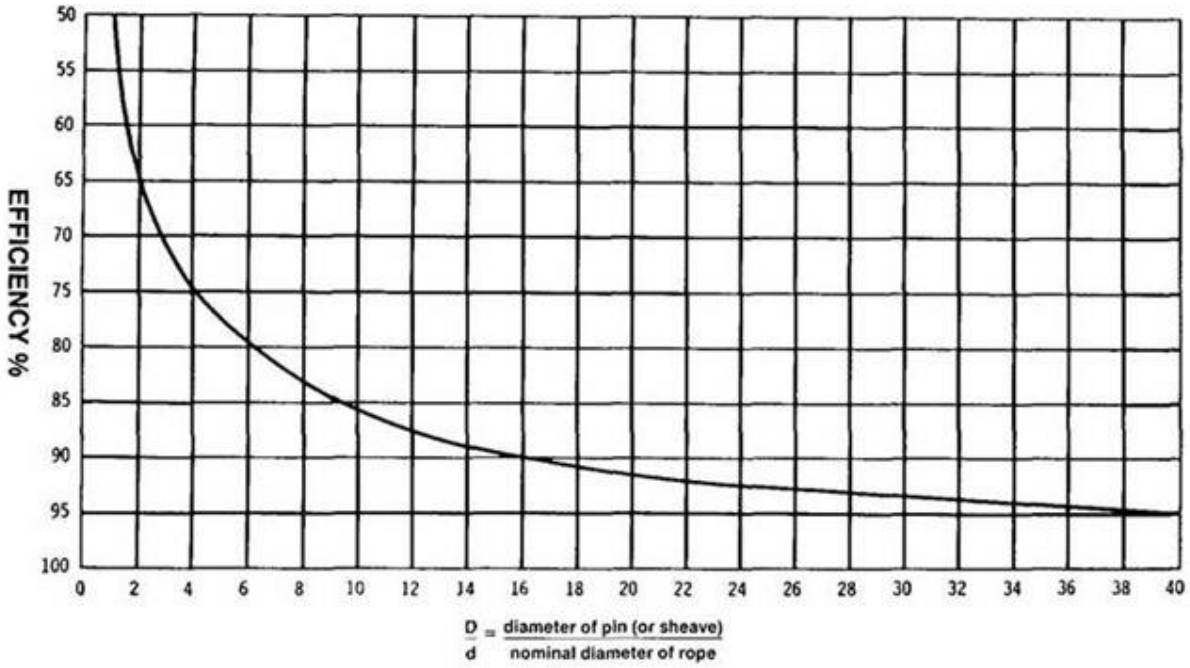
Sling 1 = (10 T x 2 m) / (8 m + 2 m) = 2 T
Sling 2 = (10 T x 8 m) / (8 m + 2 m) = 8 T

The above calculation is since for balancing, torque (load x length of lever arm) generated by both the pick points shall be equal and opposite.

22.8.12.2 D/d Ratio

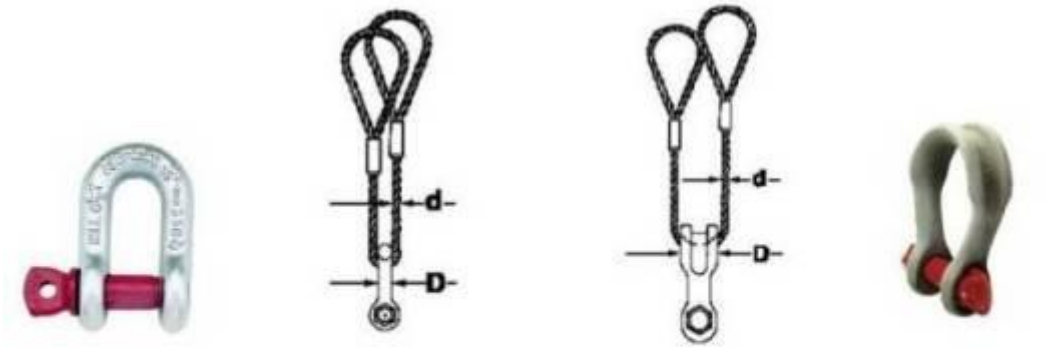


The capacity of a wire rope sling can be greatly affected by being bent sharply around pins, hooks, or parts of a load. The wire rope industry uses the term “D/d ratio” to express the severity of bend. “D” is diameter of curvature that the rope or sling is subjected to, and “d” is the diameter of the rope. The minimum D/d ratio is usually taken as 20 which correspond to 92 % efficiency. As wire ropes are usually at least 8 % stronger than the catalogue strength, the bent sling at D/d = 20 is therefore considered 100 % efficient. In case wire rope slings are used for smaller D/d ratio, sling capacity shall be decreased based on wire rope efficiency as per following graph. This curve is based on static loads and applies to 6-strand class 6×19 and 6×37 wire ropes.



STRENGTH EFFICIENCY OF WIRE ROPE
WHEN BENT OVER PINS OR SHEAVES OF VARIOUS SIZES

Based on above graph, if the shackle or object has 2 times the diameter of a wire rope sling (D/d = 2) the basket sling capacity should be reduced by 35 % as shown below.



Normal Shackle | Normal Shackle D/d = 2 | Wide Body Shackle, D/d = 5 | Wide Body Shackle

Examples – Small D/d Ratios

To increase d/d ratio and sling capacity, use wide body shackle. If D/d ratio is 5 after using wide body shackle, sling capacity shall be reduced by about 20 %.

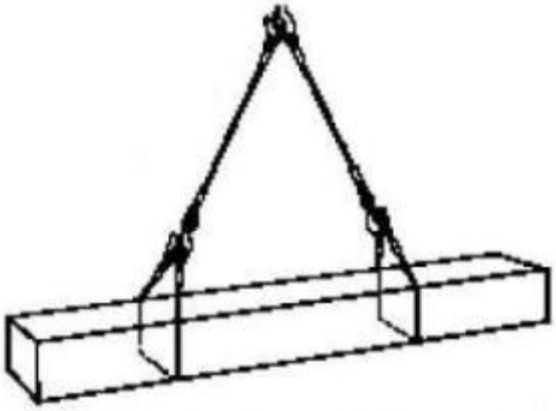
Load hooks should have sufficient thickness to ensure proper sling D/d ratio, particularly when using slings in an inverted basket hitch. that is the sling body is placed into the hook and the sling eyes are facing downward.

22.8.12.3 Preventing Sling Damage

Make sure loads are not bolted to the floor. In winter, make sure that the load is not frozen to the ground.

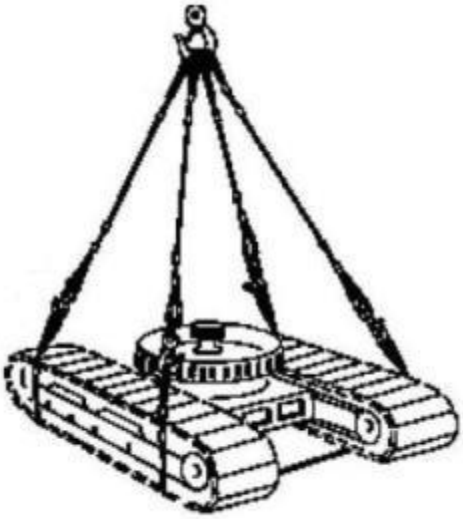
If slings are used above spreader, select their size based on weight of load to be lifted plus weight of spreader.

Use additional single leg slings to wrap around the load as shown below. If they get damaged, they are less costly to replace.



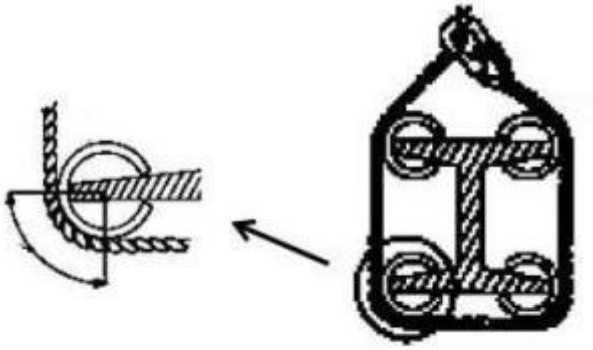
Use of Additional Slings to Wrap The Load

For large loads a 4-leg bridle sling can be made into a double basket sling by adding 2 single leg slings. These single leg slings can be made of larger diameter rope to better withstand load conditions as shown below. They are less expensive to replace than the entire 4-leg sling if they get damaged.



Lifting of Large Loads

Use proper corner protection. A sharp steel edge may cut through wire rope sling. at least it will permanently damage the sling. As shown below, sliced steel pipes have proven to an effective corner protector. For square and round objects proper wooden padding will be sufficient. Before making the final lift, do a trial lift. Check that the padding is strong enough and does not crack under the load weight.



Corner Protection

Do not place the splice sleeves, rope thimbles, or sling hooks around corners as shown below. A sleeve failure will result in the failure of the sling.



Damage to Sleeve

23. REFERENCE

References Document	Full Title, Brief Description and Web Links
IS 13367-1	This standard gives guidance for the safe use of all types of crane subjects covered, including a safe system of work, management planning, the recommendation for selection, installation, testing, operation, and maintenance of cranes and for selection of drivers, signallers, and riggers.
ISO Standard -11228 guidelines	The ISO 11228 series establishes ergonomic recommendations for different dynamic manual handling tasks. It provides information for designers, employers, employees, and others involved in work
ANSI B30.5 SAFETY CODE FOR CRAWLER, LOCOMOTIVE, AND TRUCK CRANES	ASME B30.5 is one of ASME's most requested safety standards—widely respected and applied throughout the building and construction industry. It addresses crawler cranes, locomotive cranes, wheel-mounted cranes, and any variations thereof that retain the same fundamental characteristics and are powered by internal combustion engines or electric motors.
IPSS GUIDELINES INTER PLANT STANDARD IN STEEL INDUSTRY	IPSS has done Inter Plant standardization in the steel industry (Various Steel Industries coordinated together e.g.: Tata Steel, JSW Steel, Arcelor Mittal Nippon Steel, Steel Authority of India Limited)

JSW Group

MANAGEMENT STANDARD

MANAGEMENT OF CHANGE

JSW/GHS/GS-16

MANAGEMENT STANDARD MANAGEMENT OF CHANGE

Management Standard Title:	**MANAGEMENT OF CHANGE**	**Date of Revision**	**10..12.2024**
Document	JSW/GHS/GS-16	**Revision**	00

Document Issue and Revision History		
Date	Revision Number	Change Summary

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Authorised by	G S Rathore
Signature	
Position	COO & WTD

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1. PURPOSE

The purpose of this standard is to establish a comprehensive process for managing changes or modifications in the design and/or operations of industrial facilities (both Brownfield and Greenfield) to ensure the highest standards of asset integrity and process safety performance. This standard aims to:

- **Ensure Safe and Reliable Modifications:** Implement changes to products, equipment, processes, operations, or services safely and reliably, with a focus on maintaining or improving operational performance.
- **Evaluate Safety and Health Impacts:** Assess all modifications for potential safety and health impacts before implementation, including detailed hazard identification and risk assessments.
- **Apply a Risk-Based Approach to Interlocks:** Utilize a hierarchy-based risk assessment matrix for interlocks to evaluate and prioritize risks based on their potential impact and likelihood, ensuring appropriate mitigation measures are in place.
- **Consider Compliance and Business Implications:** Evaluate all management system requirements and business considerations before implementing changes that affect asset integrity, ensuring compliance with statutory and company policies.
- **Address Human Factors and Skills:** Evaluate and address skill requirements for personnel involved in implementing changes. Ensure that training programs are developed and effective, considering human factors to facilitate safe and efficient operations.
- **Protect Against Unauthorized Changes:** Safeguard assets and systems from unauthorized modifications to prevent adverse impacts on technical integrity, safety, and operational performance.
- **Facilitate Effective Implementation:** Conduct all necessary activities for processing and safely implementing changes, including training and addressing any human factors. Adjust interlock management and review practices as needed based on the nature of the changes.
- **Implement Comprehensive Change Management:** Capture, track, and document all changes, including updates to engineering documents, and prevent unauthorized modifications.
- **Ensure Proper Review and Authorization:** Ensure that the level of detail in each review is appropriate for the potential hazard posed and that changes are authorized by the appropriate level of management.
- **Maintain Up-to-Date Knowledge and Documentation:** Continuously update process safety knowledge, information, and technology, ensuring that all modifications are accurately reflected in as-built drawings and technical documentation.

This standard supports a robust health and safety program and aligns with JSW Safety Policy, encompassing modifications to plant and equipment, procedures, practices, raw materials, processing conditions, and interlocks. It aims to identify and mitigate potential hazards before they impact workers, ensuring a well-rounded approach to change management.

2. SCOPE

This Management of Change (MOC) Standard is applicable to all JSW companies, subsidiaries, managed business sites/locations, corporate/regional offices, research and development facilities, new projects, and entities resulting from mergers and acquisitions. The standard is relevant to all employees and contractors within the JSW Group.

Lifecycle Coverage: The MOC Standard applies throughout the entire lifecycle of projects, including planning, assessment, exploration, evaluation, design, development, operation, and closure.

Business-Specific Requirements: Each business unit shall develop and publish supplementary requirements specific to their operations in alignment with this standard.

Compliance with Legislation: Adhere to national and local legislation where requirements are more stringent than those outlined in this standard.

Exceptions:

Capital Project Changes shall comply with the project management process in the management system of business.

Note: This exception does not mean that the changes that may occur during the different stages of the project itself are not subject to the MOC process as a part of the project management process or through a separate procedure/process, but rather that major projects must subject to HIRA studies that consider all process safety risks, including those related to Brownfield and Tie-In activities. In case of the project management system does not include specific requirements for MOC, any changes in design philosophies, specifications, and/or approved for construction scope at different project phases shall be subjected to the MOC process as mentioned in this standard.

Implementation Requirements:

Comprehensive Application: Business and Sites shall ensure that all requirements are understood, implemented, and monitored across all facilities, existing projects, and future developments.

MOC Procedures: Business and Site shall develop procedures that include changes affecting:

- **Design Specifications and Functionality:** Modifications in equipment, hardware, and design specifications, including additions, deletions, or replacements.
- **Process Flow Diagrams (PFDs) and Piping and Instrumentation Diagrams (P&IDs):**
- Modifications to PFDs and P&IDs, including additions, deletions, and relocations.
- Changes to safety device set points or configurations outside established operating ranges.
- **Workplace Layouts:** Alterations in equipment locations or layout drawings.

Note: Soon, MOC will be digitalized. The process should adhere to the standard, ensuring all digitalized procedures and records comply with the established requirements.

This standard provides guided requirements for JSW entities, operational subsidiaries, companies, affiliates, and joint ventures, ensuring that changes are systematically managed and aligned with safety, compliance, and operational integrity standards.

In the Standard, the following verbal forms are used to indicate requirements, recommendations, permissions, or capabilities:

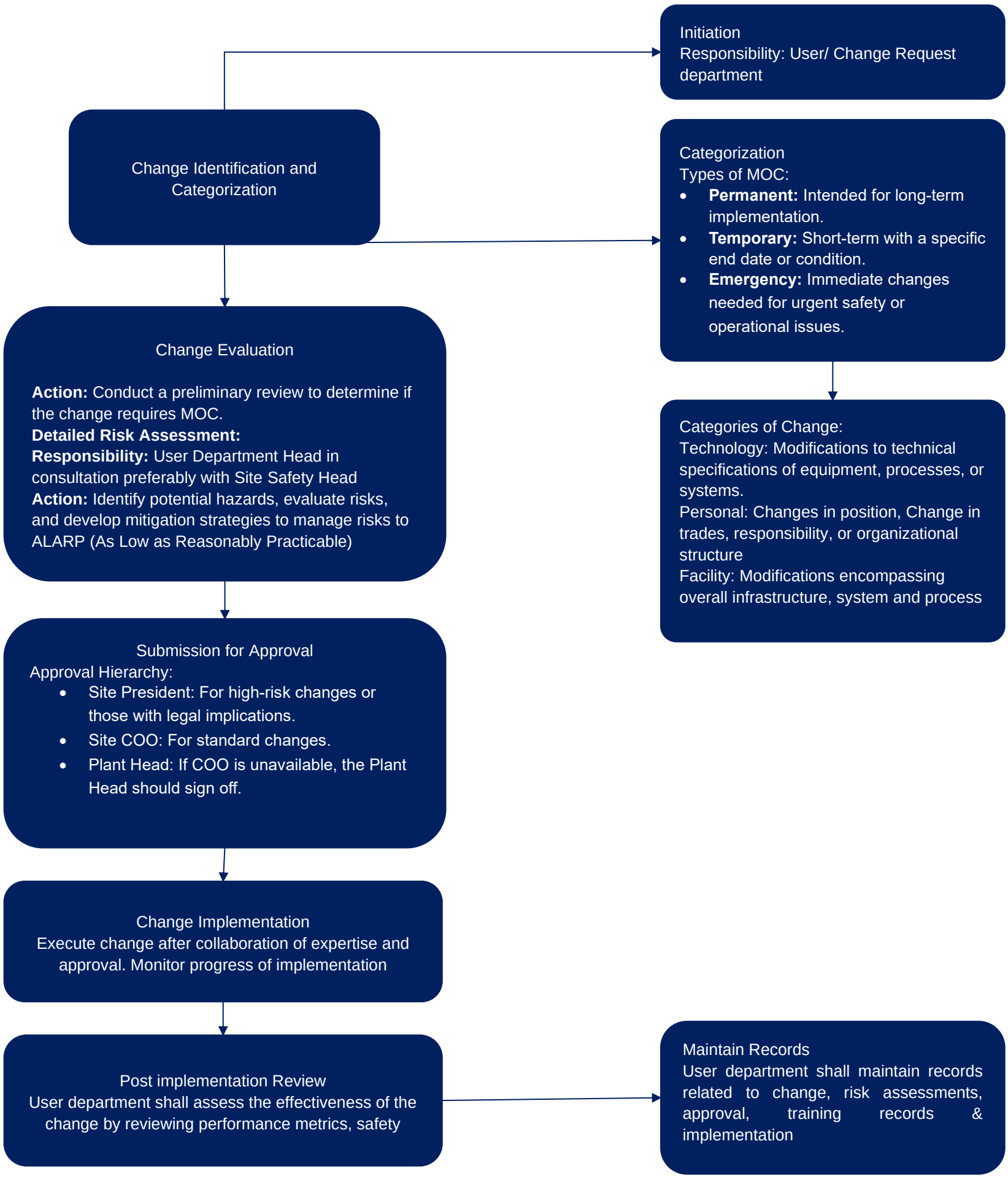
- “shall” indicates a requirement.
- “should” indicates a recommendation.
- “may” indicates a permission.
- “can” indicates a possibility or capability.

3. REVIEW

This standard shall be reviewed at least every 5 years or Management of Change occur. The review shall include the evaluation of the following:

- Management of Change procedure and policy.
- Change communication and Training records of employees.
- Learning from the incidents.
- Implementation and Monitoring
- Changes to industry standards, laws, and regulations.

4. PROCESS FLOW



5. ELEMENT-1: MANAGEMENT OF CHANGE

Management of Change (MOC) involves recognizing potential hazards that a change may introduce, evaluating the risks linked to these hazards, and addressing them in an organized manner. Any modifications to plant, processes, or personnel can bring about risk and may lead to unintended outcomes. A review of incidents across industry indicates that ineffective Management of Change processes can result in:

- Change management that focuses on the expected benefits without properly considering the possible risks.
- A tendency to focus on technical change rather than all types of change e.g., organizational, materials and legal and regulatory requirements.
- Failure to communicate changes to the people affected by the change.
- Failure to update or revise key documents such as operating procedures; and

Therefore, a structured process for managing changes from the planning stage to implementation is crucial for identifying potential hazards and managing associated risks. The Management of Change process is not meant for exploring ideas; before beginning a Management of Change in the system, the following steps shall be taken:

- Discuss the proposed change with relevant stakeholders, such as with line manager.
- Confirm the feasibility of the change and the availability of necessary resources, including funding and personnel.
- Obtain agreement that the change shall proceed through the Management of Change process.

5.1 CATEGORIZATION OF MOC

5.1.1 Categorization of MOC – Types of Changes

The timing and duration of the change, where the classification is broken into permanent, temporary and emergency, these terms are explained as follows:

5.1.1.1 Permanent Change

A permanent change refers to an alteration that results in a new, enduring state, with no expectation of reverting to the original condition. Examples include:

- **Physical Modifications:** Changes to plants, infrastructure, and equipment.
- **Operational Adjustments:** Alterations to feed rates, compositions, catalysts, chemicals, or extended operation durations.
- **Safety System Updates:** Modifications to safety alarm set points and software.
- **Protective Measures:** Adjustments to trip and protection functions.
- **Maintenance Schedules:** Revisions to testing, maintenance, or engineering inspection schedules.

A permanent change is expected to progress through all stages of the Management of Change (MOC) process and remain in effect indefinitely. Most Technical MOCs are of a permanent nature. MOCs that remain open for more than two years should be reviewed biennially. If conditions related to processes, equipment, or risks have changed, the MOC should be closed and a new MOC initiated. If conditions remain unchanged, this should be documented in the MOC as a comment.

5.1.1.2 Temporary Management of change

A Temporary Management of Change (MOC) is used for alterations expected to be in effect for a short, predetermined period. Temporary MOCs follow the same work process as permanent changes but should be applied cautiously due to associated risks.

Duration and Categories:

Short-Term (30 Days or Less): For Temporary MOCs expected to last 30 days or less, the risk assessment should include considerations for reverting to the original state.

Extended Terms (90, 180, or 360 Days): For Temporary MOCs anticipated to last up to 90, 180, or 360 days, the specific maximum duration should be selected based on the anticipated complexity and risk. The criteria for choosing these durations should be clearly defined based on operational and risk factors.

Evaluation and Approval:

Extension: If an extension beyond the initial period is necessary, it can only be granted once for a maximum of 60 additional days. The extension requires:

- Revalidation of the original risk assessment.
- A detailed explanation for why the extension is needed.
- Approval from management to ensure the extension is justified and not arbitrary.

Conversion to Permanent MOC:

Transition Process: When converting a Temporary MOC to a Permanent MOC:

- A new risk assessment shall be conducted.
- A new Permanent MOC shall be created.

The Temporary MOC should remain active until the Permanent MOC is authorized and ready for implementation. The Temporary MOC should be closed only after the Permanent MOC has been approved and initiated.

Duration Specification and Assurance Options:

Defined Durations: Maximum durations (90, 180, or 360 days) should be clearly defined based on the nature and impact of the change. Each category should have specific guidelines to determine the appropriate duration.

Assurance Options Near Maximum Duration:

Restore and Close: Return to the original condition and close the MOC, requiring revalidation of the original risk assessment.

Extend: If an extension is required, revalidate the risk assessment, provide justification, and obtain management approval.

Convert to Permanent: Transition to a Permanent MOC, requiring a new risk assessment and a new MOC. Ensure the Temporary MOC remains open until the Permanent MOC is authorized.

Change Management Checklist:

Scope and Requirements: The change management checklist Annexure-2 for Temporary Equipment includes standards for the design, procurement, operation, and maintenance of temporary equipment and systems. It ensures that temporary setups meet safety and operational standards. This checklist should be reviewed and completed before the temporary change is implemented to ensure compliance and safety.

5.1.1.3 Emergency Management of Change

An Emergency Change is a modification required in response to an immediate and critical situation where following the normal Management of Change (MOC) procedure could lead to unacceptable safety hazards, significant environmental or security incidents, or severe economic loss. Emergency Changes shall be executed in the following situations:

Safety Hazards:

Immediate Threat: An Emergency Change is needed when there is an immediate threat to the safety of site personnel or the public due to a deficiency that could cause hazardous conditions. For instance, this could include equipment failure that poses an imminent risk of explosion or toxic release.

Environmental Protection:

Prevent Release: If a change is necessary to prevent an imminent environmental release, such as a chemical spill or air pollution event, an Emergency Change should be initiated.

External Threats:

Address External Risks: Changes shall be made to address impending external threats, such as natural disasters (e.g., hurricanes, floods), extreme weather conditions (e.g., unseasonal cold), or security risks (e.g., threats of sabotage). For example, reinforcing structures to withstand an approaching hurricane.

Economic Loss:

Avoid Financial Impact: Immediate action is required to prevent severe economic losses, such as major product spoilage, catalyst degradation, or significant business interruption. For example, quickly repairing a key production line to avoid halting manufacturing.

Process for Emergency Changes:

Immediate Action:

Emergency Changes may commence before the completion of the normal MOC process if they are essential to address the immediate risk.

Documentation and Verification:

All Emergency Changes shall be documented in the MOC system. Verification of the change should be completed within 96 hours post-implementation. Verification involves confirming that the change effectively addresses the emergency and does not introduce new risks.

Control of Work Protocols:

During the emergency, risk management should be handled through established control of work protocols. These protocols include safety checks, operational controls, and communication procedures to manage and monitor the immediate risks until the change is formally authorized.

Authorization:

Emergency Changes require verbal authorization from the On-site Incident Manager (OIM) or an equivalent position. This verbal authorization should be documented in writing as soon as possible, including the date, time, and reason for the authorization.

MOC Process Initiation:

The initiation of the MOC process (either Temporary or Permanent) shall occur within 24 hours after the emergency has been resolved. This initiation includes starting the formal MOC process to confirm the change and facilitate further evaluation.

Progression Through MOC:

After implementation, the Temporary or Permanent MOC for the Emergency Change shall progress through the Authorization Stage of the MOC process within 7 days (168 hours). This includes completing all required evaluations, approvals, and documentation.

Temporary vs. Permanent MOC:

Temporary MOC: Used when the change is expected to be in place for a short term, usually up to 90 days, with a review for extension or conversion required.

Permanent MOC: Used when the change is intended to be long-term or indefinite. The MOC process for a Permanent Change requires a thorough risk assessment and documentation for ongoing implementation.

5.1.2 Categories of Change

5.1.2.1 Technology (Engineering or Operational) Change

A modification that affects the company's hazards and risks, environmental aspects, operation, or technical integrity of the company's assets (Control systems, equipment, machinery, materials, substances, etc.) excluding the "Replacement in Kind. "

5.1.2.2 Personal Change

Any change in position or responsibility within an organization or any change to an organizational policy or procedure that affects process safety, i.e., a permanent change in an organizational structure or change in personnel with specific knowledge or experience.

5.1.2.3 Facility Change

The management of facility changes within Process Safety Management (PSM) requires a structured approach to ensure safety and mitigate risks associated with modifications to facilities.

Examples of Facility Changes Requiring Review:

Subtle Equipment Changes: Modifications such as rerouting piping systems, temporary piping supports, or replacing sections of insulation may have unintended safety consequences and should be reviewed carefully.

Administrative Changes: Adjustments in personnel occupancy levels, rescheduling turnarounds, or modifying maintenance practices also require review. For example, changing from 50-lb paper bags to a 500-lb plastic bulk container for raw materials could increase electrostatic risks, and adjustments in packaging practices need to be assessed for potential hazards.

Operational Adjustments: Operating a process with a known leak or non-functioning safety device on a short-term basis requires careful evaluation to manage associated risks until a full repair can be made.

Infrastructure Changes: Temporary road closures impacting emergency vehicle access or construction affecting facility siting should also be reviewed to ensure they do not compromise safety or emergency response capabilities.

6. ELEMENT-2: MOC PROCESS STEPS

The MOC process is outlined to cover the stages MOC initiation, MOC Approval, MOC Engineering, MOC implementation, and MOC Close-out. This structured approach ensures changes are thoroughly evaluated, implemented, and reviewed.

6.1 MOC INITIATION

The Change Initiation Stage is critical in the Management of Change (MOC) process. It ensures that any proposed changes are well-justified, risks are assessed, and appropriate technical reviews are conducted.

6.1.1 Establishing the Need for Change

- **Identification:** Business/Site shall determine the need for the proposed change, which could be driven by safety concerns, operational efficiency, cost reduction, reliability improvements, quality enhancements, or energy savings.
- **Assessment:** Business/Site shall evaluate the potential risks and consequences of not implementing the change to ensure that the change is necessary and justifiable.

6.1.2 Internal Review

- **Screening:** The change initiator's line manager or supervisor should perform an initial screening of the change request to ensure it aligns with organizational priorities and objectives.

- **Justification:** Prepare a written justification to illustrate why the proposed change is needed and how it will benefit the organization. This includes defining the change priorities and expected outcomes.

6.1.3 Conceptual Design Package

- **Assembly:** Compile a conceptual design package that includes the necessary technical details and supporting information for the change. This package should be comprehensive enough to facilitate a technical review.
- **Coordination:** The change initiator shall coordinate with relevant technical and engineering departments to gather all necessary data and documentation.

6.1.4 Change Proposal

- **Proposer:** Any individual can propose a change, ideally someone with direct knowledge of the affected area. This could be plant operators, engineering personnel, or other stakeholders who understand the operational or technical aspects of the change.
- **Documentation:** The change proposal shall include a written design, drawing, or specification, and be accompanied by the change management form **(referenced as Annexure 1).**

6.2 MOC Approval

The Management of Change (MOC) process involves multiple stages of review and approval to ensure that changes are properly assessed and authorized. The MOC shall pass through the following heads for review:

- **Process Head:** Reviews changes related to the process where the change is occurring.
- **Mechanical Head:** Assesses mechanical aspects and implications of the change.
- **Quality Head:** Evaluates the impact on quality standards and procedures.
- **Electrical & Instrumentation (E&I) Head:** Reviews changes affecting electrical systems and instrumentation.
- **Site Safety Head:** Ensures that safety considerations are thoroughly addressed.

6.2.1 Approval Authority

High-Risk/ Complex Change or Legally Impactful Changes: Approval shall be granted by the Site President. These are changes that have significant safety, legal, or operational implications.

Other Changes: Approval is given by the Site COO. If the COO is unavailable, the Plant Head will sign the MOC.

6.2.2 Approval Process

The approval is based on the technical and Hazard Identification and Risk Assessment (HIRA) studies conducted by the MOC committee on the MOC document package and any comments given by the approver. The MOC committee includes the heads mentioned above and is responsible for reviewing the change's impact and technical feasibility.

The Site Process Safety Leader will endorse the MOC document package after confirming that all safety aspects and provided comments by different heads are addressed. Following this endorsement, the approval is given for detailed design and execution.

6.3 MOC Engineering

This stage involves the design and planning for the execution/implementation of the required change, including option selection, detailed design, technical reviews, and execution of recommendations.

Design and Planning: Prepare detailed design and implementation plans, incorporating feedback from technical and HIRA studies.

Technical Reviews: Conduct detailed technical reviews to ensure all aspects of the change are feasible and safe.

Execution of Recommendations: Implement the recommendations and action plans arising from technical and HIRA studies.

6.4 MOC IMPLEMENTATION

The MOC Implementation Process is the phase where the approved changes are physically executed and put into operation. This stage involves several key activities to ensure that the change is successfully integrated into the facility or system. Here's a detailed overview:

6.4.1 Physical Execution

6.4.1.1 Construction and Installation

- Business/Site shall carry out the physical construction, installation, or modification activities as specified in the approved design and implementation plans.
- Business/Site shall ensure that all work is performed according to safety standards and technical requirements.

6.4.1.2 Mechanical Completion

Business/Site shall complete all mechanical work associated with the change, including assembly, alignment, and testing of equipment and systems.

Business/Site shall verify that mechanical components are installed correctly and functioning as intended.

6.4.2 Documentation Update

6.4.2.1 Update Documentation

Business/Site shall revise and update all relevant documentation to reflect the changes made. This includes drawings, specifications, procedures, and manuals.

Business/Site shall ensure that updated documents are reviewed and approved by relevant stakeholders.

6.4.2.2 Record Changes

Business/Site shall document all aspects of the implementation process, including any deviations from the original plan, challenges encountered, and corrective actions taken.

6.4.3 Pre-Startup Safety Review (PSSR)

6.4.3.1 Conduct PSSR

Business/Site shall perform a Pre-Startup Safety Review to ensure that all safety, operational, and compliance aspects are addressed before the change is put into full operation.

Verify that the change has been implemented correctly and that all safety systems are functional.

6.4.3.2 Verify Readiness

Business/Site shall confirm that the facility or system is fully prepared for startup, including checking that all required inspections, tests, and verifications have been completed.



6.4.4 Authorization of Start-Up

6.4.4.1 Obtain Authorization

Secure formal authorization from the designated authority (e.g., Site President, Site COO, or Plant Head) to proceed with the startup of the changed system or process.

Ensure that all necessary approvals and clearances are in place before commencing operations.

6.4.4.2 Initiate Start-Up

Begin the startup process in accordance with the approved procedures and plans.

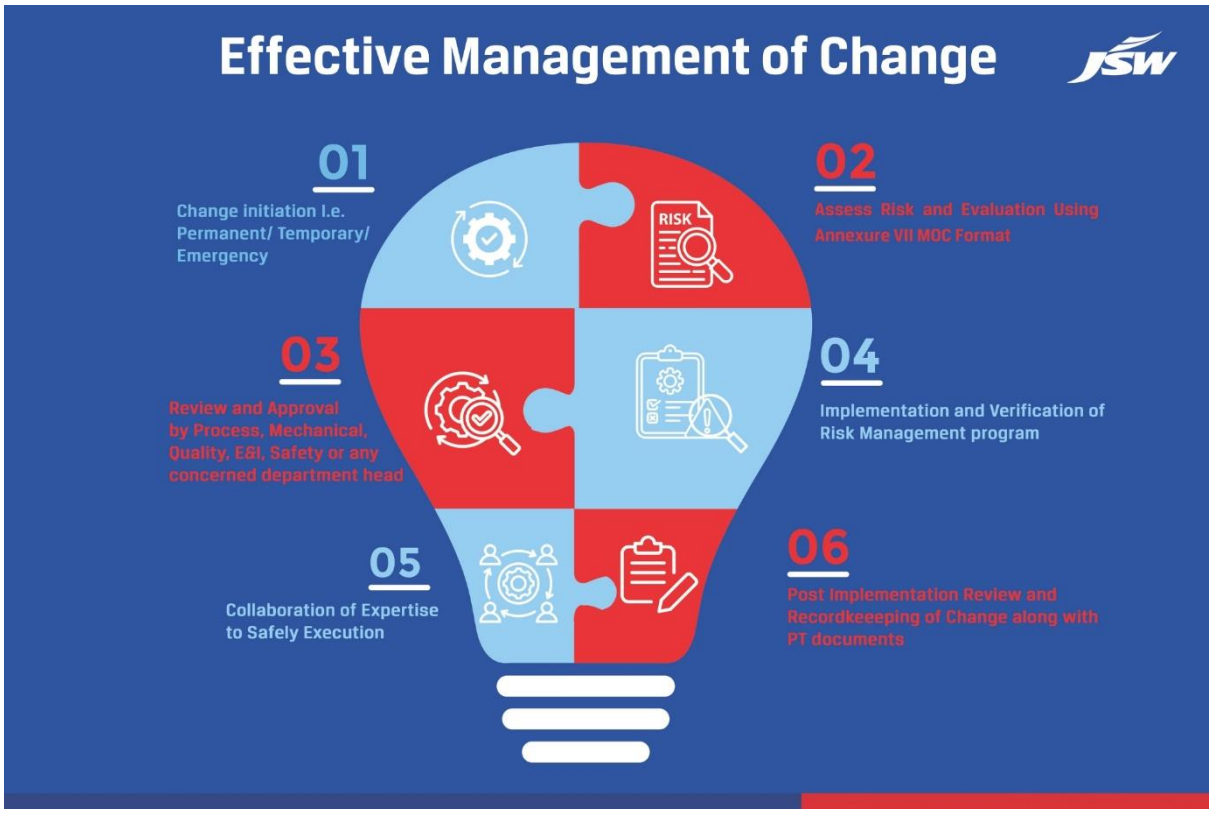
Monitor the initial operations closely to ensure that the change performs as expected and address any issues promptly.

6.4.5 Post-Implementation Review

6.4.5.1 Review Performance

Business/Site shall assess the performance of the change after startup to confirm that it meets the intended objectives and requirements.

Business/Site shall gather feedback from operators and stakeholders to identify any further improvements or adjustments needed.



6.5 MOC CLOSE-OUT

The MOC Close-Out Process is the final phase in the Management of Change (MOC) cycle, focusing on ensuring that all aspects of the change have been effectively implemented and completed. This phase involves monitoring the change's performance, finalizing documentation, and addressing any remaining tasks to confirm that the MOC is fully closed out.

6.5.1 Monitoring the Efficiency of the Change

6.5.1.1 Evaluate Performance

Business/Site shall continuously monitor and assess the efficiency and effectiveness of the change in operation.

Business/Site shall ensure that the change meets its intended objectives and delivers the expected improvements in safety, performance, and reliability.

6.5.1.2 Identify Issues

Business/Site shall track any issues or discrepancies that arise during the early stages of operation.

Business/Site shall address these issues promptly to ensure optimal performance of the change.

6.5.1.3 Review and Close Outstanding Actions

Action Items:

Business/Site shall review all outstanding action items identified during the implementation phase.

Business/Site shall verify that all actions have been completed and documented as per the MOC requirements.

Documentation:

Business/Site shall ensure that all deliverables related to the change are finalized and complete. This includes updated documentation, studies, and action closeout records.

Business/Site shall confirm that all documentation is accurate, complete, and properly filed.

6.5.1.4 Completing Post-Start-Up Action Items

Post-Start-Up Review:

Business/Site shall address any remaining post-start-up action items that were identified during the PSSR or initial operation phase.

Business/Site shall ensure that all corrective actions and adjustments have been made and documented.

6.5.1.5 Training and Risk Control

Training Personnel

Provide necessary training to relevant personnel on the updated procedures, equipment, and safety measures associated with the change.

Ensure that all training is documented and that personnel are competent in their roles.

Implement Risk Controls

Verify that all required risk control measures identified during the MOC process are in place and functioning as intended.

Ensure that any new risks introduced by the change are managed effectively.

6.5.1.6 MOC Closure

Formal Closure:

Complete the MOC closure process by ensuring that all aspects of the change are finalized and that the MOC is formally closed out.

Obtain final sign-off from the appropriate authorities to confirm that the MOC process is complete.

Documentation of Closure:

Document the closure of the MOC, including a summary of the change, final status of action items, and any lessons learned.

Ensure that all closure documentation is properly archived for future reference.

The MOC Close-Out Process ensures that the change has been thoroughly reviewed, completed, and documented, and that all aspects of the change are properly integrated into the facility's operations. This phase is crucial for validating the success of the change and for maintaining the integrity and safety of the operations.

6.6 DELIVERABLES FROM THE CHANGE

Engineering Deliverables: To ensure thorough execution and documentation, the engineering deliverables required for change execution should be clearly defined. These deliverables ensure that all technical and procedural aspects of the change are properly addressed.

Engineering Drawings:

Include: Process Flow Diagrams (PFDs), Piping and Instrumentation Diagrams (PIDs).

Purpose: To provide a visual representation of the system and changes, ensuring all modifications are accurately captured and communicated.

Operating Procedures:

Include: Detailed step-by-step procedures for operating the changed systems or equipment.

Purpose: To guide operators and maintenance personnel in the proper handling and operation of the changed systems.

Equipment Lists:

Include: Comprehensive lists of all equipment involved in the change, including new or modified components.

Purpose: To ensure all equipment is accounted for and properly managed during and after implementation.

Narrative Safeguarding by Instrumentation:

Include: Descriptions of how instrumentation safeguards the system.

Purpose: To detail how instruments contribute to the safety and reliability of the system.

Alarm and Trip Set Points List:

Include: A list of alarm and trip set points relevant to the change.

Purpose: To ensure all safety and operational limits are properly set and documented.

Narrative Process Controls:

Include: Descriptions of process control strategies and changes.

Purpose: To explain how process controls will be adjusted or maintained post-change.

Instrument Loop and Instrument Logic Diagram:

Include: Detailed diagrams showing the logic and connections of instrumentation.

Purpose: To illustrate how instruments are interconnected and controlled within the system.

Documentation and Completion:

MOC Initiator Responsibilities:

Ensure Documentation: The MOC initiator must verify that all engineering deliverables are completed and properly documented.

Track Progress: Maintain records of all deliverables, ensuring that each item is reviewed and approved as necessary.

6.6.1 MOC Timelines

Timeliness is critical in the Management of Change (MOC) process to ensure that changes are effectively implemented within the necessary timeframe. Each MOC should be categorized based on its duration and complexity, with specific timeframes established to manage the change efficiently.

6.6.2 Timeframe Establishment

6.6.2.1 Initial Assessment

Priority and Scope: Determine the priority and scope of the MOC to establish appropriate timeframes for each stage.

Complexity and Risk: Assess the complexity and risk associated with the change to determine the necessary duration for its implementation and review.

6.6.2.2 Standard Timeframes for Each Stage

Initiation: 1-2 weeks for risk assessment and documentation preparation.

Approval: 1-3 weeks for review and approval processes.

Engineering: 3-6 weeks for design and validation.

Implementation: 2-8 weeks for execution, depending on complexity.

Close-Out: 1-2 weeks for performance review and final documentation.

6.6.3 Managing Endless Timeframes

Procedure Definition

Timeframe Requirements: Define specific requirements and milestones for MOCs with indefinite or extended timeframes in the MOC procedures.

Continuous Monitoring: Implement a system for continuous monitoring and periodic review to manage these changes effectively.

Ongoing Monitoring:

Track and Adjust: Continuously track the progress of MOCs with extended timeframes and adjust as needed to address any emerging issues or delays.

Establishing clear categories and timeframes for MOCs ensures that changes are managed effectively and efficiently. By categorizing MOCs based on duration and complexity, setting appropriate timeframes, and implementing procedures for managing extended or indefinite timeframes, organizations can enhance the effectiveness of their MOC process and ensure timely completion of changes.

6.7 MOC CANCELLATION

In certain scenarios, Request for Change (RFC) or Management of Change (MOC) requests may be rejected or cancelled due to technical, financial, HIRA (Hazard Identification and Risk Assessment) studies, or other managerial or project-related concerns. The cancellation process should be handled with clear procedures to ensure all parties are informed and the process remains transparent.

6.7.1 Reasons for Cancellation

Technical Rejection: Based on technical studies or assessments that indicate the proposed change is not feasible or beneficial.

Financial Rejection: Due to financial constraints or cost-benefit analysis not supporting the change.

HIRA-Based Rejection: High-risk or major operability issues identified during the HIRA stage.

Managerial Concerns: Managerial or project-wise concerns that necessitate the change not proceeding.

6.7.2 Cancellation Procedures

6.7.2.1 MOCs Before Approval

Notification to Site Process Safety Leader: The initiator or relevant party shall notify the Site Process Safety Leader in writing about the request for cancellation, providing a brief explanation for the decision.

Formal Cancellation Submission: The Site Process Safety Leader submits the MOC form to the MOC Committee for formal cancellation.

Documentation: Ensure that the reasons for cancellation are documented, and any relevant data or findings from the initial assessments are included.

6.7.3 MOCs After Approval

Notification to Site Head: If the MOC has already been approved but needs to be cancelled, the site process safety leader submits the MOC to the site head for formal cancellation.

Documentation: Include a brief explanation for cancellation, along with any supporting documentation or reasons related to the decision.

6.7.4 HIRA-Based Rejection

Initial Reviewer's Recommendation: If a MOC is rejected based on HIRA studies, the initial reviewer shall submit a HIRA report to the site process safety leader.

Formal Cancellation: The site process safety leader then submits the MOC to the site head for formal cancellation or rejection.

Documentation: Ensure that the HIRA findings are documented, and any implications for safety or operability are clearly explained.

6.7.5 Communication

Notification to Originator: In all cases of MOC cancellation or rejection, the site process safety leader is responsible for notifying the originator about the cancellation decision.

Feedback: Provide feedback to the originator on the reasons for cancellation and any implications for future MOC submissions.

6.7.6 Documentation and Follow-Up

Record Keeping: Maintain a record of all cancelled or rejected MOCs, including reasons and any relevant supporting documentation.

Review and Improvement: Analyse reasons for cancellations or rejections periodically to identify areas for improvement in the MOC process.

7. TRAINING

Effective training is crucial for the successful implementation and operation of the MOC program. All personnel shall be adequately trained to understand and apply the principles and procedures of the MOC program to ensure consistent and effective management of changes.

7.1 TRAINING REQUIREMENTS

7.1.1 Awareness Training

Objective: Business/Site shall ensure all personnel involved in MOC or affected by the introduction of the MOC program are aware of its purpose and how it affects their roles.

Content: Introduction to the MOC program, its importance, and its impact on operations.

7.1.2 Specific Training

For Change Originators/ Initiators: Training on how to identify, document, and submit change requests, including how to complete the MOC form accurately.

For Impact Assessors: Training on conducting preliminary impact assessments and understanding the implications of proposed changes.

For Reviewers and Approvers: Training on the detailed review process, criteria for approval, and the importance of thorough documentation and communication.

Training for Key Personnel:

Not-In-Kind Change Makers: Business/Site shall ensure familiarity with the MOC process, the process of filling out change requests, and understanding the workflow of the MOC system.

Supervisors: Training on their specific roles and responsibilities within the MOC process.

Reviewers: Training on how to assess and provide feedback on MOCs, including handling disagreements and resolving issues.

7.1.3 Training Content

Training should address the following key areas:

Determining Change Control: How to assess whether a change should be controlled by the MOC program.

MOC Log Completion: Instructions on how to accurately complete and maintain the MOC log.

MOC Form Completion: Detailed guidance on filling out the MOC form, including examples.

Types of Changes: Understanding permanent, temporary, and emergency changes and their implications.

Impact Assessment: How to conduct a preliminary impact assessment and a detailed risk assessment.

Approval Process: Overview of the approval process, including roles and responsibilities of each participant.

Documentation and Communication: Best practices for documenting changes, communicating them to relevant parties, and maintaining records.

Handover Procedures: Protocols for the handover of open MOCs during shift or crew changes.

Lessons Learned: How to review and apply lessons learned from previous MOCs to improve future processes.

Refresher Training: Implement refresher training periodically to promote continuous improvement and adaptation to changes in the MOC process.

8. RACI MATRIX

Activity	Section In-charge	Process Safety Coordinator	PSM Sub-committee and Site Safety Head	Change Initiator	Asset Owner Manager	Maintenance Head/ Department HOD	Head Operations
1. Change Identification and Categorization	R	C	I	A	C	C	C
2. Change Evaluation	R	C	I	C	C	A	C
3. Change Proposal Development	R	C	I	C	C	A	C
4. Approval Process	R	I	C	C	C	A	C
5. Implementation Planning	R	I	C	C	C	A	C
6. Change Implementation	R	I	C	C	C	A	C
7. Post-Implementation Review	R	I	C	C	C	A	C
8. Record Keeping	R	I	I	I	I	A	C

Note:

R = Responsible — expected to participate in the activity and contribute the best of his/her abilities
A = Accountable — ultimately responsible for the results
C = Consulted — contributes towards decision making
I = Informed — kept informed but need not participate in the effort.

9. MANAGEMENT OF RECORDS

All MOC documentation is subject to Site/ Business documented information procedures. The original or copies, where no original is available, of all documentation associated with MOC are to be retained by the Site PSM Leader after closure. MOC documentation shall be retained for the entire lifespan of the process site. Using a secure database in the recordkeeping is recommended to avoid scattered copies of MOC documents with Site PSM Leader/ MOC committee members that may not also be strictly accessible.

10. KEY PERFORMANCE INDICATOR

The Appropriate Metrics (KPIs) of the MOC process could include the following: -

- The number of MOCs performed each month.
- The monthly average in the percent of work requests is classified as a change.
- The average backlog of MOCs/active MOCs.
- The average amount of calendar time taken between MOC origination and authorization.
- The percentage of changes reviewed within the MOC system but were reviewed incorrectly.
- The percentage of recent changes that involved the use of backup MOC personnel.
- The percentage of MOCs reviewed that were not documented properly.
- The percentage of MOCs for which the drawings or procedures were not updated.
- The percentage of MOCs for which the workers were not informed or trained.
- The percentage of temporary MOCs for which the temporary conditions were not corrected/restored to the original state at the deadline.

11. Assurance

Each site shall conduct self-assurance program to ensure compliance with this STANDARD as part of its Safety assurance program. Third party system audit shall be conducted by Group Safety or external consultants to ensure compliance with the standard.

12. ANNEXURES

12.1 ANNEXURE-1: CHANGE MANAGEMENT FORM

<table>
<tr><td>Plant:</td><td></td><td>Area:</td><td></td></tr>
<tr><td>Change Title:</td><td></td><td>MOC Number:</td><td></td></tr>
<tr><td colspan="4">Reason for Change (tick whatever is applicable):
Capacity enhancement, Operational Convenience, Reliability improvement, Efficiency improvement, Life extension, To improve safety, To improve environment, To increase productivity</td></tr>
<tr><td colspan="3">Type of Change - Temporary (No. of days) / Permanent / Emergency</td><td></td></tr>
<tr><td colspan="3">Equipment Name & Code</td><td></td></tr>
<tr><td colspan="3">Reference drawing / document number in which modification proposed (old and new to be enclosed</td><td></td></tr>
<tr><td colspan="3">Brief description of existing system / procedure</td><td></td></tr>
<tr><td colspan="3">Change Classification: Simple Change / Complex Change
RISK (Sum Cn+Cm+F) = Score = 3 - Simple Change
OR
= Score > 3 - Complex Change
<table>
<tr><td>Consequence (Cn) of failure.
(e.g. Loss of containment, injury, pollution)</td><td>Minor
1</td><td>Severe
2</td></tr>
<tr><td>Complexity (Cm) of change.
(e.g. number of systems, people or processes involved)</td><td>Simple
1</td><td>Moderate
2</td></tr>
<tr><td>Familiarity (F) with system.
(e.g. change has been made before or on similar equipment)</td><td>Familiar
1</td><td>Novel
2</td></tr>
</table></td><td></td></tr>
<tr><td colspan="3">Draw backs/problems faced with existing system</td><td></td></tr>
<tr><td colspan="3">Impact of proposed modification on Quality of product or work system (Review of existing SOP/SMP to be enclosed with revision as applicable)</td><td></td></tr>
<tr><td colspan="3">Impact of proposed modification on Safety (Review of existing Risk Assessment needs to be enclosed as applicable also HAZOP study to be carried out, if applicable and enclosed)</td><td></td></tr>
<tr><td colspan="3">Impact of proposed modification on Environment (Review of existing EIA needs to be enclosed with revision as applicable)</td><td></td></tr>
<tr><td colspan="3">Impact of proposed modification on Energy (Review of existing Energy intensity needs to be enclosed with revision as applicable)</td><td></td></tr>
<tr><td colspan="3">Is there any statutory clearance required for the proposed change? If so, detailed requirement along with respective act/rule/law to be enclosed</td><td></td></tr>
<tr><td colspan="3">Are there any system /equipment going to be idle /obsolete due to this change? If so, detail plan how the old system/equipment is planned to dispose.</td><td></td></tr>
<tr><td colspan="3">Detailed design calculations of the proposed change if applicable.</td><td></td></tr>
<tr><td colspan="3">Cost of the proposed new system /equipment along with estimation/ offers to be enclosed</td><td></td></tr>
<tr><td colspan="3">Person responsible for training of all the concerned team members on proposed new system/procedures</td><td></td></tr>
<tr><td colspan="3">Cross Functional Team (CFT):</td><td>Name / Signature / Date</td></tr>
<tr><td colspan="3">MOC Initiator *</td><td></td></tr>
<tr><td colspan="3">Operations</td><td></td></tr>
<tr><td colspan="3">E&A</td><td></td></tr>
<tr><td colspan="3">Mechanical Maintenance</td><td></td></tr>
</table>

Safety & Fire Services	
Other	
Review and Approvals by Technical Review Committee: (Simple & Complex)	**Date & Signature**
Head Operations	
Head Electrical Maintenance	
Head Mech. Maint.	
Head Re-Engineering & Drawing	
Section Head Safety	
Others (Environment, EMD etc.as applicable)	
Approvals: ☐ **Change Approved** ☐ **Rejected**	
Complex Change	
Plant HOD	
Operation Head	
Approvals: ☐ **Change Approved** ☐ **Rejected**	
Change Executed and Completed (Confirmation by Executor)	
Verification of MoC by PSM Co-coordinator & Dept. Safety Professional	

*Please note involvement of at least any two discipline is mandatory

MoC Check Point for Simple Change:

Sl. No	Activity	Applicable (Y/N)	Action Details	Responsibility	Target Date
1	Is there any change in existing documentation (Equipment Specifications/P&IDs/SOP/HIRA/ HAZOP/Procedure/Drawings/Process Flow Diagram etc)?				
2	Is there any change in existing operating parameter/Operation & Maintenance practices/ Logic/ Alarms/facility/ESI etc?				
3	Is there any need for Training & Communication because of MOC Changes?				

MoC Check Points for Complex Changes:

Sl. No.	Activity	Applicable (Y/N)	Action Details	Responsibility	Target Date
Checklist for Process Safety Information Updation	Is updation required for drawings? (P&IDs, Process Flow Diagrams, Equipment Layout, Plant layout etc.)				
	Is updation required for Process Design Basis, Equipment Design Basis, Instrument and Electrical Design basis etc. (Specify)				
	Is updation required for Procedures – Safe Operating Procedures, Emergency Preparedness Procedure etc.				
	Is it impacting compliance with regulatory norms (Factory Rules, Mines Rules, PESO, EIA, State Pollution Control Board etc.)				

Sl. No.	Activity	Applicable (Y/N)	Action Details	Responsibility	Target Date
	Is it impacting support/ foundation of installation				
Checklist for Effects on Plant, Equipment's, Structure, Machine foundations, Pipelines, cable routings etc.	Is additional Warning Sign, labelling on pipeline and Panels etc. required.				
	Is there deviation from Design limits of affected plant, equipment, structure				
	Is there change in Maintenance philosophy (frequency/method/criticality)				
	Is Updation required for Energy Source Identification (ESI) documents				
	Is there impact on Shutdown scheduling /additional resources during shutdown				
	Is there impact on functionality/performance on other system/equipment's				
	Is there additional impact on Vibration / Fatigue in equipment's / pipelines / structures				
	Is the existing Inspection and Quality Assurance Plan for equipment's, spares, civil and structural etc.				
	Is there impact on Corrosion, erosion (weather effects)				
	Does the change introduce additional Fire / Explosion hazard, or effect on existing fire protection system?				
	Is it impacting Compliance to TSL Technical Standards, Engineering, Design Standards, Safety Standards, Industry applicable Codes and Standards				
	Is Updation required in SAP				
	Is there impact on Relief / Flare system adequacy				
Checklist for Effects of the Change on Personnel.	Is it affecting response time for corrective actions, communication during emergencies				
	Is there any impact on Exposure to fumes/dust noise/trips and falls/weather/extreme temperatures/Vibration / Toxic Chemicals				

Sl. No.	Activity	Applicable (Y/N)	Action Details	Responsibility	Target Date
	Is there any impact on Physical/Mental workload				
	Is additional Training / Competency required				
	Is there any impact on Access for Maintenance or operation/emergency escape route				
Checklist for Effects of the Change on Electrical Systems	Is there change on Indication of, Trips/Alarms/Emergency Shut Down initiation				
	Is there change in Fire and gas Detection/Protection systems				
	Is there change on Interfaces with any other systems; process, UPS, HVAC, communications facilities, ground protection				
	Is it impacting Electrical system conformation to applicable regulation- IEA etc.				
	Is Identification (Label) of voltage required				
	Is there impact on overload protection System adequate				
	Is Updation in Area Classification Drawing required				
	Is there any change to PLC Software (if yes submit precise details of equipment and system details below)				
Effect on Environment	If yes, need to attach detail sheet (Covers Spillage of Hazardous Material, release of inert/ toxic flammable gases)				

**** These annexures outline the minimum requirements; however, business units should make amendments to comply with any local or state regulations that are more stringent. Additionally, Business units to prepare these forms and get it approved from site PSM leader.*

12.2 ANNEXURE-2: CHECKLIST FOR CHANGE MANAGEMENT

Plant		Area	
Change Title:			
Sl. No	Checkpoint	Yes (√) No (X)	Remarks
1	Is the original design intent being changed		
2	Has the same change been unsuccessful elsewhere		
3	Have risks and hazards associated with this equipment been identified		
4	Has there been any change to material of construction		
5	Could this change hinder access to other equipment		
6	Has this design been previously changed		
7	Could this change impact the supply or consumption of utilities		
8	Could this change create any new hazards during construction or in later service		
9	Is there any change to procedures or operating conditions		
10	Are there any upstream or downstream effects as a result of this change		
11	Is over pressure protection required as a result of this change		
12	Are there any additional features for safety required		
13	Is there any impact on existing safety equipment (trips/alarms etc)		
14	Is there any impact on fire protection / preventive facilities		
15	Will the performance characteristics of the equipment, facility or the system be altered		
16	Are there any changes required to training or procedures as a result of this change		
17	Is there any increase in hazardous or flammable material inventory		
18	Could this change increase or cause any impact on - Air, Water, Land, Flora and Fauna		
19	Will the change cause or increase housekeeping concern -		
20	Will this change increase or cause consumption of resources be including natural resources		
21	Will this change increase or cause wastage of any resources be including natural resources -		
22	Will the change increase the existing risk or create new risk to occupational health (acute or chronic)		
23	Will the change cause risk of damage of any equipment/property		
24	Will this change cause impact on energy performance		

*** *** *These annexures outline the minimum requirements; however, business units should make amendments to comply with any local or state regulations that are more stringent. Additionally, Business units to prepare these forms and get it approved from site PSM leader.*

12.3 ANNEXURE :3 – PRE-START UP SAFETY REVIEW CHECKLIST

PRE-START-UP SAFETY REVIEW SIGN-OFF

PSSR No.	
INSPECTION DATE:	
DEPARTMENT/ PLANT/AREA:	
PROJECT TITLE:	
PROCESS/ EQUIPMENT:	

PSSR TEAM			
	PSSR Team Member's Name	**Department**	**Signature / Date**
Team Leader			
Operations Representative			
Maintenance Representative			
Project Representative			
Safety & Fire Representative			
Environment Representative			
Electrical & Instrumentation Representative			
Mechanical / Civil / Structural Representative			

CLEARANCE FOR START UP	
The signatories below confirm that all PSM criticality A rated findings have been cleared and start up is now authorized.	
PSSR Team Leader	
Project Leader	
HOD (S & FS)	
EVP (Projects)/ EVP (O&M)	

PSSR CHECKLIST

	Yes	No	N/A	Remarks
1. Safety & Health				
General Safety				
Have all relevant personnel, (Operations, Maintenance, Technical, Supervision), received adequate and appropriate **training on the equipment**?				
Has adequate and appropriate PPE (**Personal Protective Equipment**) been specified and provided?				
Have measures been taken to adequately **guard** all dangerous parts of this equipment?				
Has sufficient provision been made for the **electrical and/ or mechanical isolation** of the equipment?				
Are points of isolation clearly marked/labelled and readily accessible?				
Have **bump/ trip** hazards been identified and all sharp edges removed?				
Has proper **guarding, handrails/ barriers,** been provided to prevent falls?				
Have all **hot/ cold surfaces** been adequately guarded to prevent burns?				
Are Safety **Showers and Eye Wash** facilities provided and adequate?				
Has sufficient **lighting** been provided so that operation, servicing, maintenance and repair of the facility can be carried out safely?				
Are display systems for providing operational instructions, **safety warnings** and emergency information provided and positioned so that they are clearly visible and easily read?				
Machine Safety				
Has the machinery been **installed** so that it will be stable and secure during operation?				
Has all access to dangerous **moving parts**, or danger zones created by moving equipment been prevented by the provision of the correct guards, interlocks and/ or fencing?				
Have the correct safety measures been taken to prevent any risk from hot/ cold surfaces, ejection of material, failure of parts and their ejection, overheating/ fire?				
Has safe access been provided to those parts of the machinery that require operator **access for operation, adjustment, service, maintenance or repair**, i.e. elimination of slip, trip, trap, crush, entanglement, fall, bump and cut hazards?				
Is the machinery provided with the properly identified **START/ STOP and EMERGENCY controls** that are positioned for safe operation without hesitation, or loss of time, and without ambiguity?				
Is the machinery provided with a clearly identified **means to securely isolate** it from ALL energy sources?				
Ergonomics				
Has the workstation, workplace, or equipment, been constructed so that the **need for stooping, bending, stretching, over-reacting and working over-head** during operation has been eliminated, or reduced, to the minimum?				
Has the need to **lift, carry, push or pull, heavy loads**, or parts, been eliminated as far as possible?				
Are all display screens, dials, START/STOP/EMERGENCY buttons positioned so that they are easily seen and accessible by those who will operate the equipment, or machine?				
Have Visual Display Screens been positioned so that interference from glare is positioned so that interference from glare is reduced to the minimum?				

Has the workstation been designed and equipped so that a comfortable position can be adopted by the operator? i.e. able to stand, or change position and sit upright, angle at elbows and knees 90 Deg C., feet on floor.				
Does the operation of this equipment increase the risk of Upper Limb Disorder, e.g. repetitive tasks, handling of loads, machine paced work, and prolonged operation?				
Have you consulted appropriate guidelines for the determination of work contribution to ergonomic risk factors?				
Occupational Health				
Have all health risks due to gases, liquids, dusts, mists or vapours used by, contained in or emitted by this process/ equipment been assessed, and where necessary, eliminated or adequately controlled?				
Has adequate Personal Protective Equipment (PPE) and/or Respiratory Protective Equipment (RPE) been specified in the Operating Procedures?				
Has the need for an Occupational Health Monitoring Programme been assessed?				
Have Operating Procedures been reviewed to take into account any additional “hazards to health” which may arise from operation or maintenance of this equipment?				
Has adequate Local Exhaust Ventilation (LEV) been installed, tested, balanced and entered on an Inspection Schedule?				
Have adequate inspection/cleaning ports been provided on all ductworks?				
Are relief facilities directed to a safe place away from the workplace?				
Has a Noise Survey been considered, and a Noise Compliance Plan prepared, if required?				
Has all insulation been identified and labelled?				
Has all pipework, tanks, etc., containing hazardous materials been adequately labelled?				
2. Process Safety Management				
Process Technology				
For components, equipment and systems have PSM critical designations been documented as part of the process technology package?				
Are up to date material safety data sheets available and training of concerned on MSDS provided?				
Have the hazardous effects of inadvertent mixing of different materials including waste streams been considered (i.e. has a chemical interaction matrix been prepared/ updated)?				
Has the process design basis (e.g. SOCs) been documented/ updated?				
Has the equipment design basis (e.g. PFDs/ P&IDs) been documented/updated?				
Management of Change – Technology/ Facilities				
Has a management of change – technology/ facilities document (Change of Design – COD) been approved?				
Has a test authorization (TA) been approved?				
Are all action items, arising from the COD, that were deemed necessary for start-up, complete?				
Have all changes made during construction/ modification been recorded and authorized through MOC/ COD?				
Process Hazards Analysis				
Have project PHAs been approved, and a final project safety report been prepared?				
Are all action items, deemed necessary by the PHA team for start-up, complete?				

Has the facility been approved as **"Safe to Operate"** by the PHA team?				
Quality Assurance (Consult with personnel who have QA responsibilities)				
Have checks and inspections been made to ensure that critical equipment is installed properly and is consistent with design specifications and vendor's recommendations?				
Have quality assurance inspection reports, covering fabrication, assembly and installation, been completed per the project's quality assurance plan and reports filed with the equipment design basis documentation?				
The PSSR team should agree on, and field check specific items:				
(a) Does the construction meet the design specifications.				
(b) Does the construction match the drawings.				
Are pipe supports adequate?				
Confirm if integrity test (pressure testing for leaks, torque test, etc.) has been performed online installed.				
Asset integrity				
Have maintenance procedures been approved and issued?				
Have maintenance personnel been trained?				
Have quality control procedures been approved for maintenance materials and spare parts?				
Have inspections and tests (including regulatory requirements) for the following equipment been included in a maintenance schedule (including to a SAP based system, if applicable)?				
Pressure vessels and storage tanks				
Pressure relief systems, vent systems, and devices				
Critical controls, interlocks, alarms and instruments				
Emergency devices, including shutdown systems and isolation systems				
Fire protection equipment				
Piping systems (including piping components such as valves, excess flow valves, expansion bellows) in critical service				
Key process-to-service tie-ins				
Electrical grounding and bonding				
Emergency alarm and communication system				
Monitoring devices and sensors				
Pumps				
Lifting equipment				
Has reliability engineering analysis been considered for PSM critical equipment?				
Is the equipment inspected by an outside body and certificates on file?				
Have all commissioning tests or inspections been identified? (e.g. pressure or leak tests, passivating procedures)				
Operating Procedures and Safe Work Practices				
Have operating procedures and safe work practices been prepared/ updated and approved?				
(Note: for emergency procedures see section 4 of this checklist).				
Training and Performance				
Has specific process (or job task) training been given to all personnel?				
Have initial/ refresher training records been updated?				
Contractor Safety				
Have all contract personnel been adequately trained in appropriate maintenance and operating activities?				
Interlocks and Alarms				

Has the alarm/ interlock been classified and designed as per standard by a properly constituted team?				
Has the alarm/ interlock been classified into safety (or) process interlocks and appropriate integrity levels are determined?				
Did the team check that the alarm/ interlock action proved, under all conceivable failure conditions, to be failsafe?				
Has an interlock/ critical alarm Standard Operating Procedure for testing been written and implemented prior to this PSSR?				
For alarms/ interlocks with more than one software or hardware circuit, have all possible interlock routes been tested?				
Do you have an appropriate procedure to ensure that your software is protected? (e.g. routinely archived, key/ password protected etc.).				
Has the software been properly documented and filed? (e.g. Logic drawings, schematics, sequence/ batch descriptions).				
Has all software been properly validated and tested?				
Have you ensured that the equipment does not restart either on the resetting of a protective device such as an interlock or the re-establishment of power after an outage?				
3. Environment				
Are all **secondary containment/ bunding** facilities adequate? (Curb walls, Dikes etc.)				
Are all **material storage** facilities adequate and appropriately labelled?				
Have adequate arrangements been made, prior to start-up, for the identification, classification and **safe disposal of all waste materials**?				
Have all materials, used in the system, been entered on the **Area Chemicals Inventory List** (or equivalent)?				
Do **Area Spill Procedures** need to be updated/ developed?				
Are **material Unloading Facilities** adequate and constructed in accordance with Corporate Safety, Health and Environmental Standards?				
Are **relief vents/ facilities adequate** and directed to an environmentally safe location?				
Have the Corporate Project **Environmental Guidelines** followed at design stage?				
Have all **waste streams** been identified, quantified, analyzed and minimized?				
Have **Environmental permits** been reviewed/ updated/ provided?				
4. Community Awareness and Emergency Response (C.A.E.R.)				
Are all necessary **Emergency warning signs**, lights or other devices installed where necessary?				
Have all necessary precautions been taken to ensure that the **equipment inspected is not a source of ignition** to any flammable materials, irrespective of their source?				
Are **fire protection facilities adequate**, e.g. Fire extinguishers, fire walls, sprinkler systems, Alarm Boxes, Foam System etc., and have they been included on an Inspection Schedule?				
Are **Emergency Escape Routes**, including ladders, adequate and properly signposted?				
Is **Emergency Lighting a**dequate & tested?				
Is **sufficient Respiratory Protective Equipment**, such as Escape Sets or Self-Contained Breathing Apparatus (SCBA) available?				
Have **Emergency Procedure**s been prepared, and relevant personnel trained?				
Is the appropriate **authority advised** of proposed new major projects (if applicable)?				

5. Electrical Safety				
Have operations/ areas been electrically **classified**?				
Has the equipment been **properly installed and constructed** to the standards expected and local legislation and does it meet any special installation requirements noted on the manufacturer's certificate?				
Has equipment been **designed and purchased** for the conditions under which it will operate? (e.g. hazardous areas)				
Are all live parts **adequately enclosed** to prevent access?				
Does **earthing/ grounding** comply with own and local standards/ legislation?				
Does **isolation labelling** comply with own and local standards?				
Are fuses with **pullers, circuit breakers, or RCDs (Residual Current Devices)** installed to automatically disconnect the supply when needed?				
Are first aid stations, **single line drawings (SLD)** and PPE requirements available in MCC/ PCC/ Main Load Tension Panel (MLTP)/ ECRs/ Sub stations as appropriate?				
Have all **relevant documentation and drawings** (e.g. P&ID's, SLD's, Schematics, equipment arrangement, I/O, logic, electrical classification and Panel Schedule drawings etc.) been **updated to reflect the current installation**?				
Have all new Substation Breakers, MCC isolators, starters or other appropriate equipment been **registered on to the site inspection schedule?**				
Have hazards due to any **electrical circuits made redundant** by this installation been properly addressed?				
Are MCCs and electrical isolation devises appropriately labeled?				
All electrical (flameproof/ non flameproof) fittings open ports are plugged?				
Lightning arrester/ protection in place?				
Safety or Process Interlocks Available & test report signed?				
Out of Service Equip is De-Energized and tagged?				
Under Erection/ maintenance equipment de energized and tagged.				
Electrical Inspection (Authority) Complete?				
Required Emergency Switches are installed and tested?				
Conduits and Boxes are Sealed?				
Wall/ floor opening through which cable passes is sealed?				
Preventive Maintenance schedule is in Place?				
Accessibility for motors and electrical fixtures for maintenance is adequate?				
Equipment and power source identification is in place?				
MCC feeder of equipment identification & labeling is in place?				
Is the all electrical panels have been identified with power voltage and equipment they served?				
Is level of illumination satisfactory?				
Is Process equipment and electrical equipment earths segregated?				
Is double earthing provided to equipment?				
6. Instrumentation				
Instrument Loop Drawing, Input/ output drawing available and are tested?				
All pressure/ vacuum gauges are of correct ranges installed and Pressure Gauges calibrated				
Temperature Gauges suitable for application? Calibrated?				

Fail Safe Valve Position listed & indicated on valve and computer graphics?				
All Interlocks tested & sensors are calibrated?				
Transmitters calibrated?				
All control valves, ON/ OFF valves are tested & calibrated for operation?				
DCS Process Control Change Form completed?				
Instruments in accessible position for maintenance?				
Instruments visibility for operator/ Maintenance engineer?				
Earthing and grounding completed to all instruments?				
Earthing and grounding test certificate available?				
Identification tags for instruments, cables, air lines etc. provided?				
Smoke detector / manual alarming system are active?				
Adequate communication system like phones, P.A. system installed & operational?				
Equipment under erection/ under maintenance de-energized. (pneumatic/ hydraulic energy)				
7. Civil and Structures				
Statutory approvals obtained from applicable authorities?				
Fire Doors, fire resistance walls available?				
Exits Door Swings, are correct and Emergency Escape available?				
Safety Chains/ Handrails/ Guard Rails in place and adequate?				
Walks, Ladders, Stairs in place and adequate?				
Floor Drainage available?				
Operations/ Maintenance Platforms Provided where Needed?				
FIRE PROTECTION				
Does the site have a written Fire Protection Plan that includes a list of the major workplace fire hazards, proper handling and storage procedures, potential ignition sources (such as welding, smoking and others), and the type of fire protection equipment or systems that can control a fire involving them?				
Are **fire separations/ Fire walls identified** and maintained properly to prevent fire spread including separations between operations and storage areas?				
Does the **site fire water supply** have sufficient capacity to supply the design demand for the specified duration (one to four hours – depending on the severity of the hazard)?				
Can the **fire pumps deliver 100%** of the maximum fire water demand at the required pressure for the largest credible fire expected to occur on the site?				
Have new **sprinkler/ foam systems been tested** to insure they meet the Acceptance Requirements of NFPA 13/ NFPA 16 and will all sprinkler systems be maintained in accordance with NFPA 25 or local authority?				
Are all the facilities that handle flammable liquids fully protected with **water spray, foam, or other automatic suppression system** that complies with a nationally recognized code or standard?				
Is Nomex or garments made from other **flame-resistant fibres** worn by personnel who work with flammable liquids/ gases?				
Is all **portable fire extinguishing equipment** located in proper locations along normal paths of travel, including exits from areas, and will this equipment be properly maintained per NFPA 10 or local authority.				
Is there a **site firm alarm system** and are alarms perceivable and above ambient noise or light levels?				

Has the site established a **site Fire Brigade** and are all fire brigade **members trained** to a level of competency commensurate with the duties members are expected to perform?				
Other Documentation Items/ Procedures				
Project Capex form/ Management of Change form.				
Statutory and Legal compliance				
All Test certificates and Authorization completed?				
P&ID available/ Design documentation complete?				
PHA/ Process Hazards Analysis Recommendations complete?				
Equipment description available?				
Instrumentation Maint./ Calibration available?				
List of Emergency equipment				
Noise level check & within limit report.				
Is level of illumination done and report?				
Test report of earthing continuity.				

**** These annexures outline the minimum requirements; however, business units should make amendments to comply with any local or state regulations that are more stringent. Additionally, Business units to prepare these forms and get it approved from site PSM leader.*

13. DEFINITIONS

Term	Definition
Asset Owner	It is the MOC's custodian department
Authorization Review	Approval mechanism for verifying that all identified hazards have been addressed and associated tasks have been performed before implementing a change.
Change Initiator	Any person authorized to initiate a change proposal by filling in the request for change form and providing initial supporting drawings.
Change Originator	Any individual who identifies the need for a change and initiates the MOC process through a change request
Hazard Review	Identify potential process safety problems (or other problems, such as environmental incidents, if the system scope includes them) to be resolved and required controls to be implemented before and after a change
Initial Review	Preliminary determination of whether a proposed modification is worth pursuing and whether it is a change or a replacement-in-kind, based on MOC system definitions
Management of Change Process	A process to identify, review, and approve all additions, process modifications, or substitute items to equipment, raw materials, and processing conditions - other than "replacement in kind" before implementation
PSM Site Leader	The individual is responsible for the MOC system in all or part of a facility, e.g., an appointed engineer to facilitate the MOC process.
MOC Committee	A committee is formed from the representatives of all relevant departments concerned with studying the requested changes. There may be sub committees affiliated with it at all sites in the case of multi-site companies
MOC Documentation	Records that describe the proposed change, the analyses performed to support the review and authorization of the RFC, any records of follow-up actions necessary to ensure that the change was completed as specified, and all other documents related to the RFC
Request For Change (RFC)	A formal request to modify equipment, chemicals, procedures, organizational structures, staffing, etc. This can be done using an RFC form or integrating RFC information into an existing work request/control document (e.g., maintenance work order).

Technical Basis for Change	An explanation of the proposed modification, including the reason(s) for performing the work, desired results, technical design, and appropriate implementation instructions. Often included on the RFC form, the technical basis for change should be of sufficient detail to allow appropriate supervisory, technical, and management review, including addressing the following questions: What is to be changed and how? What will be achieved by the change? How will the change achieve the intended goal? Is the change safe to make, and why

14. REFERENCE

References Document	Full Title, Brief Description and Web Links
Occupational Safety and Health Administration (OSHA)	OSHA is a part of the United States department of labor to ensure safe and healthful working conditions for workers by setting and enforcing standards by providing training, outreach, education and assistance. eCFR :: 29 CFR 1910.119 -- Process safety management of highly hazardous chemicals.
Occupational Safety and Health Administration (OSHA)	Compliance Guidelines and Recommendations for Process Safety Management (Nonmandatory). 1910.119 App C - Compliance Guidelines and Recommendations for Process Safety Management (Nonmandatory). | Occupational Safety and Health Administration (osha.gov)
JSW Steel, Dolvi Works PSM Standard	JSW Steel Internal PSM standard referred to understand existing structure and elaboration of elements expectation.

JSW Group

MANAGEMENT STANDARD: PROCESS SAFETY MANAGEMENT

JSW/GHS/GS-18

MANAGEMENT STANDARD PROCESS SAFETY MANAGEMENT

Management Standard Title:	**PROCESS SAFETY MANAGEMENT**	**Date of Revision**	10-12-2024
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Date	Revision Number	Change Summary

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1. PURPOSE

The purpose of this Standard is to establish comprehensive procedures to support the Health & Safety program of JSW Group and to ensure compliance with the JSW Safety Policy. This Standard is designed to facilitate a thorough understanding and effective implementation of Process Safety Management (PSM) within JSW Group.

This Standard provides essential requirements and guidance for:

Planning, Conducting, and Implementing PSM: It outlines the systematic approach necessary for the effective integration of PSM practices across JSW facilities.

Managing Process Hazards: The Standard focuses on a methodical process hazard analysis to identify, evaluate, and mitigate risks associated with highly hazardous chemicals and other energy sources.

Integration Across Functional Areas: Effective PSM implementation involves multiple business functions including design, engineering, construction, operations, maintenance, training, and research and development. The Standard provides a cohesive framework for integrating PSM elements across these diverse areas.

Protecting Employees from Process-Related Hazards: By implementing robust management and engineering practices, the Standard aims to identify, recognize, and control hazards associated with process operations, thereby ensuring the safety and reliability of operations.

Preventing Incidents: PSM is an analytical tool designed to prevent releases of highly hazardous chemicals and to reduce the frequency and severity of incidents. The Standard incorporates organizational and operational procedures, design guidelines, audit programs, and other methodologies to support this goal.

Achieving World-Class Performance: Through the consistent application of the PSM elements, the Standard aims to elevate JSW Group's performance to a world-class level in safety and operational reliability.

Continuous improvement through feedback and corrective actions based on performance results.

By adhering to this Standard, JSW Group will enhance its ability to manage process hazards effectively, protect its employees, and maintain safe and reliable operations across its facilities.

2. SCOPE

This Standard applies to all JSW Companies and subsidiaries, including managed sites, corporate offices, research and development facilities, new projects, and entities that have been merged or acquired. The requirements outlined herein are applicable to all JSW employees, contractors, and other personnel involved in the servicing and maintenance of establishments, offices, manufacturing, and project sites throughout their entire life cycle.

The Standard provides guidance on managing process safety across various types of operations, focusing on the identification, evaluation, and control of hazards associated with processes involving highly hazardous chemicals and other energy sources within JSW Group premises. It outlines the responsibilities of all stakeholders in ensuring safe practices related to process safety management.

JSW Sites may implement specific exclusions from certain requirements of this Standard, provided such exclusions are approved by the Business and Group Process Safety Management Subcommittee.

In the Standard, the following verbal forms are used to indicate requirements, recommendations, permissions, or capabilities:

- “shall” indicates a requirement.
- “should” indicates a recommendation.
- “may” indicates a permission.
- “can” indicates a possibility or capability.

3. REVIEW

The Standard shall be reviewed at least every 5 years or when a serious incident or high potential near miss is recorded.

- Process safety incident shall be classified based on actual impact, maximum reasonable consequences, and process loss of containment.
- All reported process safety incidents shall be investigated to a level of detail approved by the Site PSM leader.
- Sites shall conduct annual risk-based audits to assess compliance with the standard and verify the effectiveness of process safety management implementation.
- The scope, schedule and outcomes of internal assurance activities shall be defined and approved by the Site PSM leader.

4. PROCESS FLOW

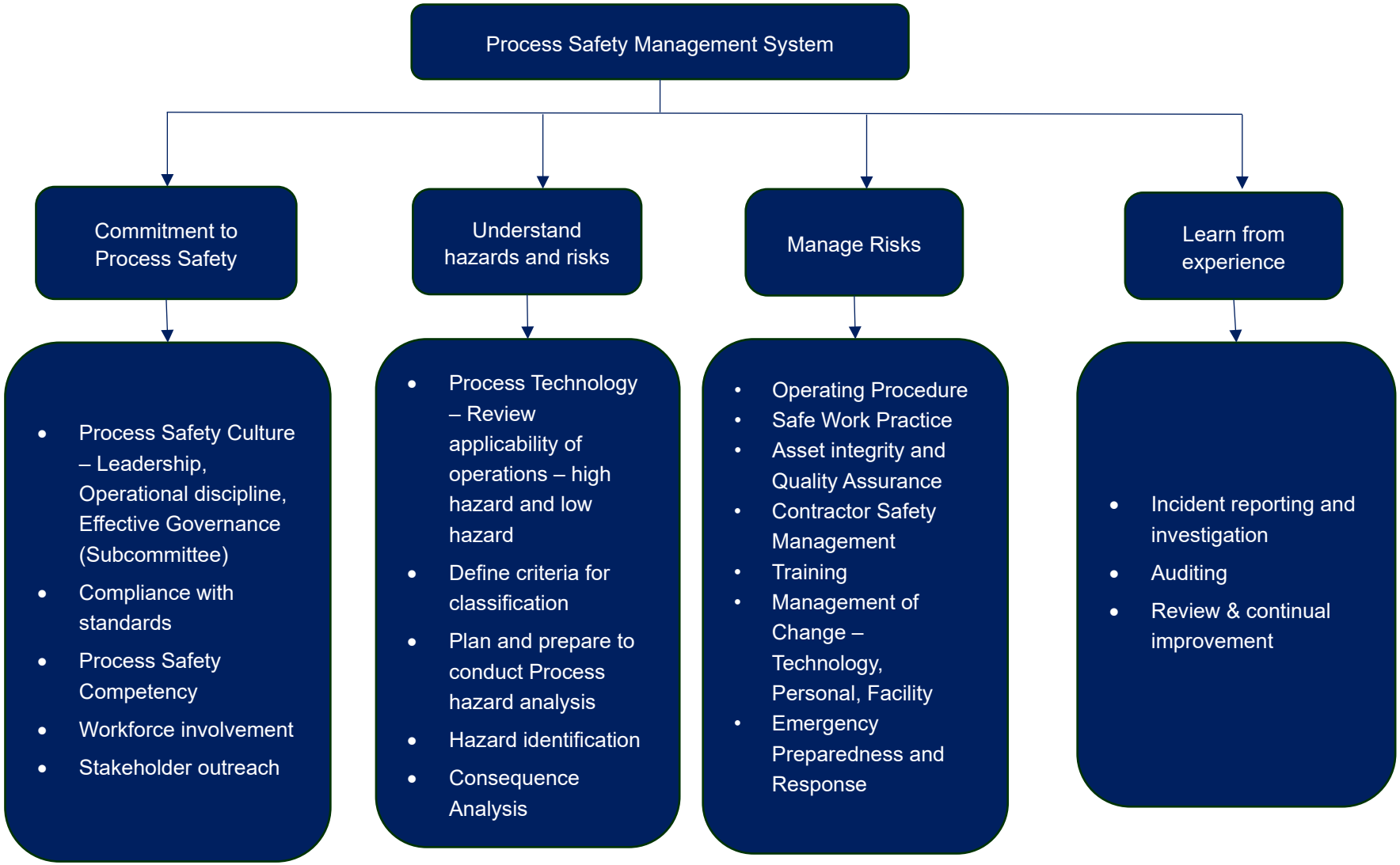


Figure - 1 : Overview of Process Safety Management



Figure - 2 : Implementation Roadmap of PSM

5. PROCESS SAFETY MANAGEMENT, CULTURE AND OPERATIONAL DISCIPLINE

5.1 OVERVIEW

Process Safety Management (PSM) involves the application of engineering and management principles to identify, understand, and control process hazards, ensuring the protection of JSW employees, contractor employees, facility assets, and the environment. PSM aims to prevent serious, process-related chemical incidents that could impact plant personnel, off-site communities, or the environment, or result in significant loss of property or business.

PSM recognizes that incidents are often "high consequence, low-frequency events," meaning that even with a history of few incidents, severe events can still occur if process safety measures are not rigorously maintained. The PSM Standard provides a structured methodology based on fourteen elements to ensure operational integrity and safety, considering design, operational, maintenance, and human factors.

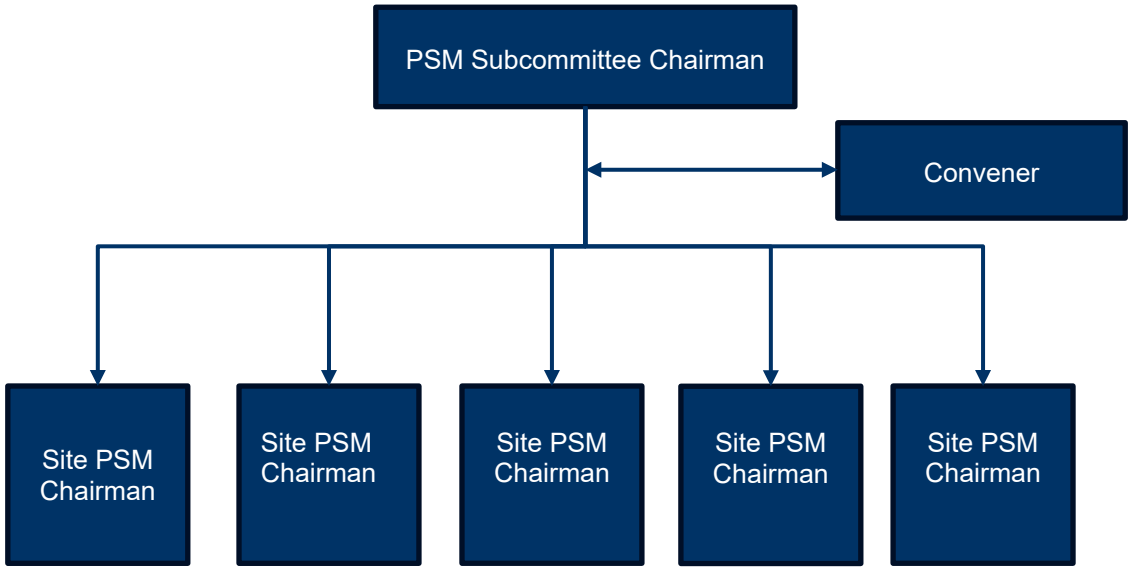
5.2 GROUP SUBCOMMITTEE ON PROCESS SAFETY MANAGEMENT

5.2.1 Description and Purpose

The Group Subcommittee on Process Safety Management (PSM Subcommittee) shall be established to oversee and integrate process safety efforts across JSW's various business units and sites. Its core purpose is to ensure consistent application, review, and improvement of process safety standards, aligned with industry best practices and regulatory requirements.

5.2.2 Formation and Structure

The PSM Subcommittee will have structure as shown below (Site means different business sites).



5.2.3 Expectation from Site PSM Sub-committee

5.2.3.1 Participation and Minutes of Meeting Compliance

- Each business site PSM chairman shall attend the Group PSM sub-committee meeting and in case he/ she is not available then pre-inform the convenor and Group Sub-committee chairman. Also, on behalf nomination shall be done to attend the meeting.
- Site PSM Chairman shall submit the site specific PSM progress in the template given by convener
- Site PSM chairman shall do the needful to comply the Group Sub-committee PSM MOMs and maintain the record of same.

5.3 PROCESS SAFETY MANAGEMENT SYSTEM

The JSW PSM system follows a structured approach:

PLAN:

- **Objectives and Resource Allocation:** Sites shall define the organisational structure, accountabilities and responsibilities as they relate to process safety in accordance with this standard.
- **Engage All Parties:** Governance, communication and engagement processes shall be in place to ensure the management of process safety. This shall include the overall accountability up to the site's PSM leader responsible for the process safety standard.

DO:

- **Identify and Eliminate Risks:** Identify potential risks and establish measures for elimination.
- **Assess Remaining Risks:** Define controls or mitigation measures for residual risks.
- Execute and oversee all activities according to established plans and procedures and implement actions.

CHECK:

- Monitor adherence to plans and verify the effectiveness of risk controls. Track progress and assess opportunities for improvement.

ACT:

- Review outcomes and performance, establish improvement actions, and incorporate learnings into the Safety Management System for continuous improvement.

5.4 PSM ELEMENTS

JSW's PSM program encompasses fourteen elements, essential for effective hazard prevention and management across all facilities:

Element-1 - Process Technology (PT): Apply systems and controls to understand and control process hazards.

Element-2 - Process Hazard Analysis (PHA): Identify and analyse hazards.

Element-3- Operating Procedures: Establish and implement safe work practices to ensure compliance and maintain operational safety.

Element-4- Training: Provide necessary training and ensure personnel performance.

Element-5- Contractor Safety Management: Manage contractor safety and performance.

Element-6- Pre-Start-Up Safety Review (PSSR): Conduct safety reviews before starting new processes.

Element-7-Asset integrity: Ensure the integrity of mechanical systems.

Element-8- Quality Assurance (QA): Maintain quality standards.

Element-9- Management of Change Technology (MOC-T): Manage changes to technology.

Element-10-Management of Change Personal (MOC-P): Manage changes affecting personnel.

Element-11- Management of Change Facilities (MOC-SF): Manage subtle changes to facilities.

Element-12- Incident Reporting and Investigation: Report and investigate incidents, identifying root causes.

Element-13- Emergency Planning and Response (EP&R): Develop and implement emergency response plans.

Element-14- Auditing Conduct audits to verify compliance and effectiveness.



5.5 PROCESS SAFETY CULTURE

The process safety culture influences how PSM is implemented and managed. It includes, but not limited to:

- Clear expectations and high standards for PSM performance.
- Transparent and timely responses to PSM concerns and issues.
- Leadership measures to prevent a “check-the-box” mentality.
- Effective communication and broad employee engagement.
- Continuous organizational learning related to PSM.

Sites shall periodically evaluate their process safety culture by:

- Interacting with site employees and contractors.
- Reviewing audit results and field observations.
- Using assessment results to highlight strengths and develop improvement strategies.

5.6 OPERATIONAL DISCIPLINE

Operational Discipline (OD) is a deeply rooted dedication and commitment by each member of the organization to carry out each task the right way, each time. It is an important component of the PSM program, ensuring that process safety management practices are effectively implemented and maintained across all levels of the organization. OD involves translating the documented PSM program, understanding of process hazards, operating conditions, and layers of protection into tangible, real-world performance results. The goal is to eliminate incidents and protect personnel, the environment, and the community.

6. HIGHER HAZARD OPERATION AND LOW HAZARD OPERATION CLASSIFICATION

6.1 CLASSIFICATION OF OPERATIONS FOR PROCESS SAFETY MANAGEMENT

6.1.1 Classification Overview

At JSW controlled locations, operations are classified into either Higher-Hazard Operation (HHO) or Low-Hazard Operations (LHO). This classification determines the applicable safety and regulatory requirements throughout the facility's lifecycle, based on the potential consequences of hazardous events.

6.1.2 Higher-Hazard Operation (HHO)

A HHO involves activities that manufacture, handle, store, or use hazardous substances with the potential to cause:

- Death or Major Irreversible Health Effects
- Significant Property or Environmental Damage
- Off-site Impacts

The classification of HHO is independent of the quantities or operating conditions involved (e.g., pressures and temperatures).

6.1.3 Prescriptive Criteria for HHO

Operations classified as HHO include:

- **Steam Generation and Combustion Systems:** All pressures, including burner management, steam drums, and related components.
- **Explosives**: Explosives should be stored in approved, secure, and designated areas that comply with relevant safety regulations and standards. Handling procedures should include measures for safe transportation, packaging, and transfer, ensuring that explosives are not exposed to conditions that could trigger detonation.
- **Hazardous Substances:** In quantities subject to PSM regulations based on local laws.

6.1.4 Lower-Hazard Operations (LHO)

An LHO involves activities with minimal risk, where hazardous substances or conditions do not pose significant threats to health, safety, or the environment. For LHOs, **no Consequence Analysis (CA) is required**.

6.1.5 Prescriptive Criteria for LHO

Operations classified as LHO include:

- **Processes Without Hazardous Substances:** e.g., melting, casting, extrusion, tabletting, palletizing.
- **Solids Processing:** Using screw or belt conveying systems.
- **Mechanical and Compressed Gas Operations:** Including drying, dewatering, and packaging.
- **Steam Distribution:** At all pressures and condensate collection.

6.1.6 Consequence-Based Classification

For operations that do not clearly fit into HHO or LHO categories, **a Consequence Analysis (CA) is required**.

The CA shall assess, but not limited to:

Intrinsic Hazards: Nature of the process.

Operating Conditions: Including quantities and scenarios.

The CA shall be conducted by qualified PSM resources following JSW safety management standards, the methodology is explained in Section 7.2.2 and Section 1.13 in JSW/GHS/GS-18-01. Once completed, site management will use the results to classify the process as either HHO or LHO. The CA and its conclusions shall be documented and maintained.

6.1.7 Examples of HHO Classification

Processes that generally fall under HHO include:

- Pressurized Gases (not specified as LHO)
- Flammable Liquids and Gases
- Combustible Liquids (above their flash points)
- Combustible Particulate Solids (with dust fire or explosion hazard)
- Corrosives (acids, caustics, bases)
- High and Extreme Toxicity Materials
- Biogas Systems (handling flammable or toxic gases)
- Including operations such as electric arc furnace (EAF) operations and blast furnaces, which involve high temperatures and flammable materials, posing significant hazards.

6.1.8 Examples of LHO Classification

Processes typically classified as LHO include:

- Combustibles Below Their Flash Points
- High-Energy Rotating Equipment: Handling non-hazardous media (e.g., air, water, inert gases)
- Materials of Moderate Acute Toxicity
- Small Quantities of Hazardous Substances: Such as propane cylinders, unpressurized sulfuric acid, or concentrated acids.
- Such as rolling mills and tempering processes that involve minimal use of hazardous substances or materials with Low hazard profiles compared to HHO operations.

6.1.9 Identification of HHO Criteria

To identify whether a process qualifies as an HHO, assess if it involves:

- Quantities of Pressurized Fuel Gases
- Flammables
- Combustibles Above Their Flash Points
- Explosives
- Reactive Chemicals
- Significant Quantities of Solids, Particulates, or Dust
- High or Moderate Acute Toxicity Materials
- Strong Acids and Caustics
- Steam Generation and Related Systems
- Evaluate if the equipment or processes, such as those involving high-temperature operations or significant volumes of materials, fall under HHO based on their hazardous potential.

If this information is already detailed in the Area's/ Department Scope, it may be referenced directly.

7. PRINCIPLES OF PROCESS SAFETY MANAGEMENT

7.1 ELEMENT-1: PROCESS TECHNOLOGY

Process Technology (PT) is integral to understanding, managing, and ensuring the safety of processes. It involves the collection, documentation, and maintenance of data to identify, evaluate, and manage process safety hazards.

7.1.1 Objectives

- **Develop and Document:** All JSW sites shall develop and maintain comprehensive documentation for every process area, including detailed data on raw materials, intermediates, products, wastes, emissions, and hazards (such as toxicity, flammability, explosivity, and chemical reactivity) under both normal and abnormal operating conditions. All documented parameters should align with applicable legislation and be updated accordingly.
- **Ensure Accessibility:** JSW Sites shall record, store, and maintain PT documentation so that it is readily accessible and up to date.
- **Compliance:** Adhere to all relevant legislation and standards.

7.1.2 Activities to Achieve Objectives

- **Policy Creation:** JSW Sites shall develop a written policy outlining the scope and types of information required for each process unit. Communicate this policy to personnel involved in new facility startups and ongoing operations.
- **Retention Policy:** JSW Sites shall implement and enforce a policy for retaining all PT documentation and records.

7.1.3 Compilation of Information

- **Chemical Hazards:** Include toxicity, Permissible Exposure Limits (PEL), reactivity, physical data (boiling/freezing points), and flammability/explosivity parameters.
- **Process Technology:** Document block flow diagrams, material and energy balances, process chemistry, maximum intended inventory of hazardous substances, and Standard Operating Conditions (SOCs) with Safe Operating Limits (SOLs).
- **Equipment Design:** Include mechanical data sheets, pressure relief systems, ventilation systems, and equipment specifications.
- **Process Incidents:** Include Process Safety Incidents reporting and investigation, such as gas leak, chemical spillage, fire, safety valve activation, gasket failure, tank/vessel overflow, incompatible material transfer, safety interlock bypass, runaway reaction, safety critical alarm activation etc.

Kindly refer Guidance Note on Planning and Preparing to conduct Process Hazard Analysis & PT Forms (JSW-GHS-GS-18-01) for detailed PT forms.

7.1.4 Maintenance and Storage

- **Central Repository:** Store calculations, design data, and similar information centrally to ensure accessibility.
- **Document Management:** Organize documents systematically, e.g., by equipment type rather than project number.
- **Safeguarding:** Protect electronic documents and prevent unauthorized modifications.
- **Periodic Review:** Review and update PT documentation at least every three years or more frequently if significant process changes occur.

7.1.5 Training and Compliance

Training: Provide training on how to use and interpret PT data.

Compliance Review: Ensure that compliance and performance trends are reviewed by management.

7.1.6 Overview Of Process Technology Components: From Hazards to Equipment Design

The Process Technology element consists of three parts:

- Hazards of Materials,
- Process Design Basis, And
- Equipment Design Basis

7.1.6.1 Hazards of Materials

Objective*:* To ensure comprehensive identification, assessment, documentation, and maintenance of hazards associated with materials used in processes.

Requirements

Data Development and Documentation:

- **Toxicity Levels:** JSW Sites shall document Threshold Limit Values (TLVs), Emergency Response Planning Guidelines (ERPGs), Acute Exposure Guideline Levels (AEGLs), etc.
- **Acute Toxicity Data:** Include effects based on exposure routes (oral, inhalation, skin, eye).
- **Physical and Flammability Data:** Record boiling points, freezing points, vapor pressures, flash points, flammability limits (LEL/UEL), minimum ignition energy, dust deflagration index, and autoignition temperatures. Please refer the PSM PT Annexure documents for the chemical properties' checklist.

Reactivity Data

- **Thermal and Chemical Stability:** For substances that self-react, polymerize, or decompose, including shock-sensitive and water-reactive chemicals.
- **Chemical Interactions:** Assess reactivity between process chemicals and equipment, and potential mixing hazards. Please refer to Annexure 7 in PT Forms from supporting documentation.
- **Thermodynamic and Kinetic Parameters:** Document heat of reaction, onset temperatures, adiabatic temperature rises, and hazardous by-products.
- **Corrosivity and Degradation Data:** Relevant to materials engineering, including metallic and polymeric materials.
- **Unique Properties:** Include static accumulation, thermal expansion, and adiabatic compression.
- **Supplier or Industry Guidance:** Incorporate relevant guidance on hazard management practices.

Abnormal Conditions

JSW Sites shall address hazards from deviations in operating conditions such as temperature, pressure, flow, level, pH, and concentrations.

Implementation: Follow the format in Annexure-1 Table 1 for detailed guidelines on documenting and managing material hazards.

7.1.6.2 Process Design Basis (PDB)

Objective: JSW Site shall establish and document the essential elements required for safe and effective process design.

Requirements:

Process Flow Diagrams:

- **Block Flow Diagram:** Provide a high-level overview of the process.
- **Simplified Process Flow Diagram:** Detail the process steps and flow paths.

Material and Energy Balances:

Balances: Include calculations for material and energy inputs and outputs.

Capacity: Document the rated maximum capacity or throughput required for designing and maintaining PSM-critical equipment, including safety systems (HHO Only).

Process Chemistry:

Description: Provide a detailed account of the process chemistry, including any potential for undesirable side reactions or runaway reactions (HHO Only).

Maximum Intended Inventory:

Hazardous Substances: Specify the maximum number of hazardous materials intended for use and the rationale for inventory management (HHO Only).

Standard Operating Conditions (SOCs) and Safe Operating Limits (SOLs):

Documentation: Include maximum, normal range, and minimum conditions for parameters such as temperatures, pressures, flows, levels, pH, reaction rates, agitation, residence times, contaminants, vibration, and compositions.

Review and Reauthorization: SOCs and SOLs should be reviewed and reauthorized alongside related operating procedures.

Rationale: Provide a clear, concise explanation for the numeric values of SOCs and SOLs; avoid general references to other documents.

Consequences: Describe the potential impacts on safety and health, or environmental effects, of deviations from SOCs and SOLs.

Correction Steps: Outline steps to correct or avoid deviations to maintain process safety.

Unique Process Conditions

Process Conditions: Describe any unique conditions such as flow velocities, static energy control, refrigeration, or inerting.

Additives: Include information on process additives like inhibitors, stabilizers, anti-static agents, and substances used to minimize corrosion (e.g., biocides).

Documentation: Refer to supporting document for detailed guidance on implementing these requirements effectively. Please refer to the supporting document for PT Annexures (JSW/GHS/GS-18-1) for all the forms listed.

7.1.6.3 Equipment Design Basis

Objective: The Equipment Design Basis (EDB) ensures that all process equipment is designed, documented, and maintained to support safe and efficient operations in compliance with Process Safety Management (PSM) standards. This includes comprehensive documentation, addressing deficiencies in existing equipment, and managing service-to-process interconnections.

Documentation Requirements

A. General Documentation

- **Specifications:** Provide detailed specifications for each piece of equipment, including materials, dimensions, and performance criteria.
- **Calculations:** Include engineering calculations justifying design decisions, such as load-bearing capacities and pressure tolerances.
- **Drawings:** Create detailed drawings, including:
- **Detailed Equipment Drawings:** Illustrate design details, including dimensions and material specifications.
- **Piping and Instrumentation Diagrams (P&IDs):** Show the layout of piping systems, valves, instrumentation, and control systems.
- **Structural Drawings:** For critical safety structures like dikes and blast barriers.

B. Maintaining Documentation

- **Updates:** Regularly update equipment files to reflect modifications and changes in operating conditions.
- **Old Equipment:** For older units, review and update documentation to ensure it reflects any modifications or changes in service. If the original vendor is unavailable, consider conducting a fitness-for-service evaluation.

Addressing Documentation Deficiencies

- **Modified Equipment:** Ensure modifications are documented, including updating drawings and specifications.
- **Fabrication Drawings:** Prevent unauthorized use or removal of drawings. Ensure any taken for reference are returned and updated.
- **Service Changes:** Verify and document equipment compatibility with new operating conditions if repurposed.
- **Corrosion Allowance:** Update documentation to include corrosion allowances or minimum thickness requirements.
- **Non-compliance with Standards:** Address deviations from recognized engineering practices (RAGAGEP) with proper documentation and analysis.
- **Record Reconstruction:** Attempt to obtain missing records from vendors or perform a fitness-for-service evaluation if records are incomplete.

7.1.7 PSM-Critical Equipment Identification

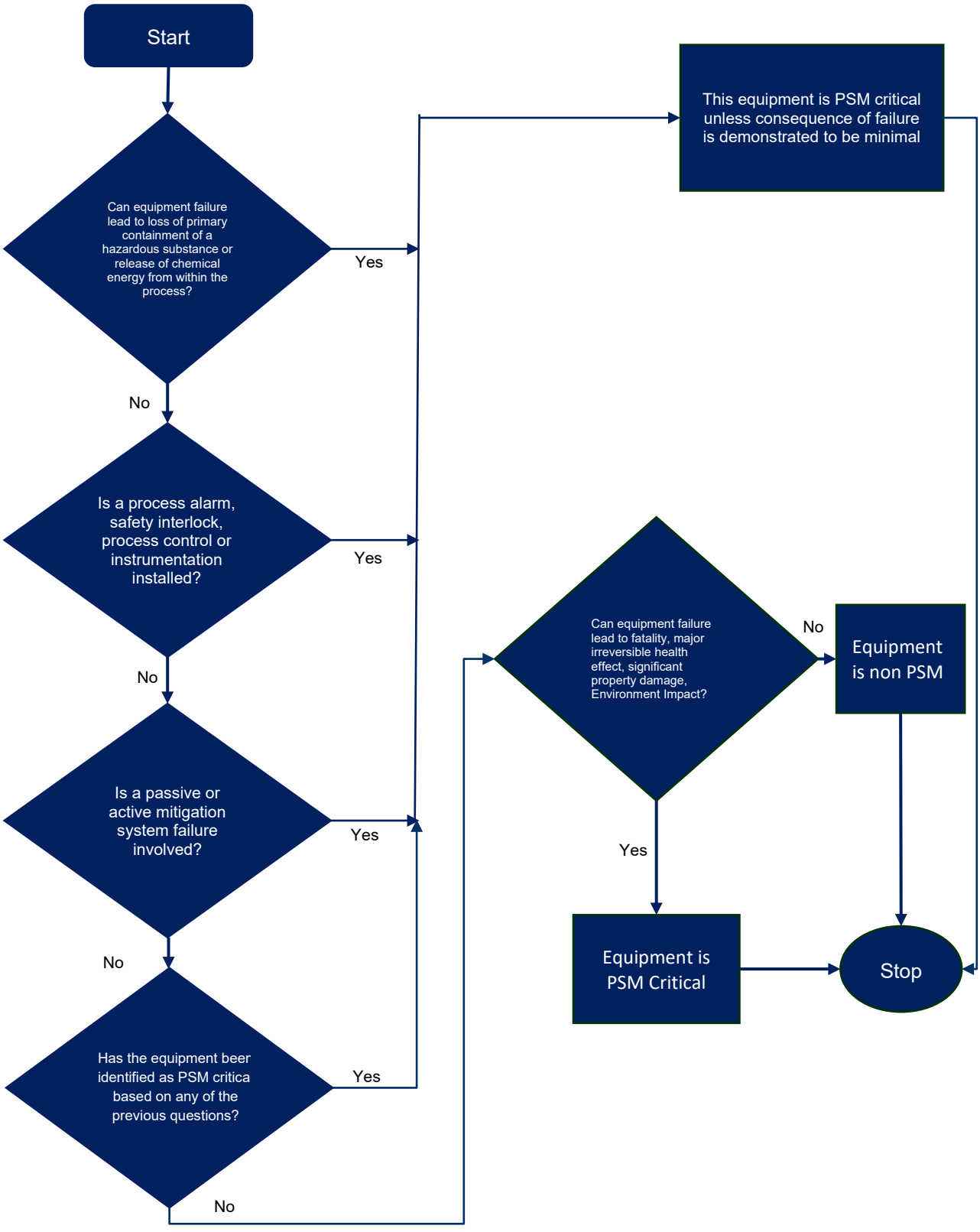


Figure -3: Identifying Process Safety Management Critical Equipment

A. Identification System

Maintain a system to identify and classify all PSM-critical equipment, including a list or database and rationale for classification.

B. Equipment Categories (Guidance on selection of PSM Critical Equipment is provided in Annexure-2)

Prescriptive Equipment: Includes pressure vessels, pressure relief systems, safety interlocks, emergency devices, fire safety systems, and high-energy rotating equipment.

Consequence-Based Equipment (HHO Only): Evaluate equipment based on the potential consequences of hazardous events, including tanks, containment devices, and mitigation systems.

Prevention and Mitigation Systems: Systems designed to prevent or mitigate severe hazards, including static and electrical energy control systems and inerting systems.

C. Categories to Evaluate

Pumps, Piping Systems, and Containment Devices: Evaluate their role in process safety.

Static and Electrical Energy Control Systems: Assess systems managing static electricity and electrical hazards.

Ventilation Systems: Integral systems for safe operations, including process ventilation and pressurization.

Design Basis Documentation

A. General Categories

P&IDs: Detailed diagrams showing piping, instrumentation, and control systems.

Zone Classification: Document zone classifications and safety requirements for each zone. Clearly define the zones based on the nature of the environment, such as Zone 0, Zone 1, and Zone 2 for hazardous areas.

Specifications: For pipes, valves, gaskets, and Safety Instrumented Systems (SIS).

SIS Information: Include safety interlock schematics, SIS software configurations, and calibration settings.

B. Specific Categories

Design Basis: Maintain records of design calculations and specifications for initial equipment fabrication.

Specifications and Standards: Include specifications for equipment purchase and fabrication, design codes, and standards.

Functional Requirements: Document performance requirements for equipment operations.

Vendor Manuals: Manuals for safe design, operation, and maintenance of equipment.

Engineering Practices

A. New Facilities

Compliance: Ensure new designs comply with local regulations and RAGAGEPs or site-selected standards.

Non-conformance: Document reasons for deviations from RAGAGEPs, including supporting engineering analysis and risk assessments.

B. Existing Facilities

Assessment: Conduct safety assessments for equipment designed to outdated codes or standards.

Gaps Analysis: Identify gaps between current RAGAGEPs and original design, and assess risks associated with these gaps.

Redeployment: Review and document redeployed assets to ensure they meet current standards and are suitable for new conditions.

Service-to-Process Interconnections

A. Backflow Prevention

Design interconnections to minimize backflow risk from process systems into service systems.

For connections to potable water, use backflow prevention devices and conduct risk assessments.

B. Automatic Valves

Ensure automatic valves for backflow prevention fail safely in the closed position and are suitable for the application.

C. Documentation and Management

Develop and document Equipment Design Basis or all PSM-critical service and process interconnections according to guidelines.

7.1.8 Process Safety Incident

An incident is reported as a process safety incident if it meets all four of the following criteria:

i) Process involvement

ii) Above minimum reporting threshold

iii) Location

iv) Acute release

An incident is classified as a process safety incident (PSI) only if a process directly contributes to the damage or hazard. A "process" broadly includes equipment and technologies such as reactors, tanks, piping, boilers, cooling towers, and refrigeration systems used in production.

For example:

If a chemical release causes an injury or damage, it is a process safety incident.

If an incident occurs at a process location, but the process itself was not involved (e.g., a slip-and-fall or an office fire on-site), it is not a process safety incident but is instead classified as a workplace safety incident.

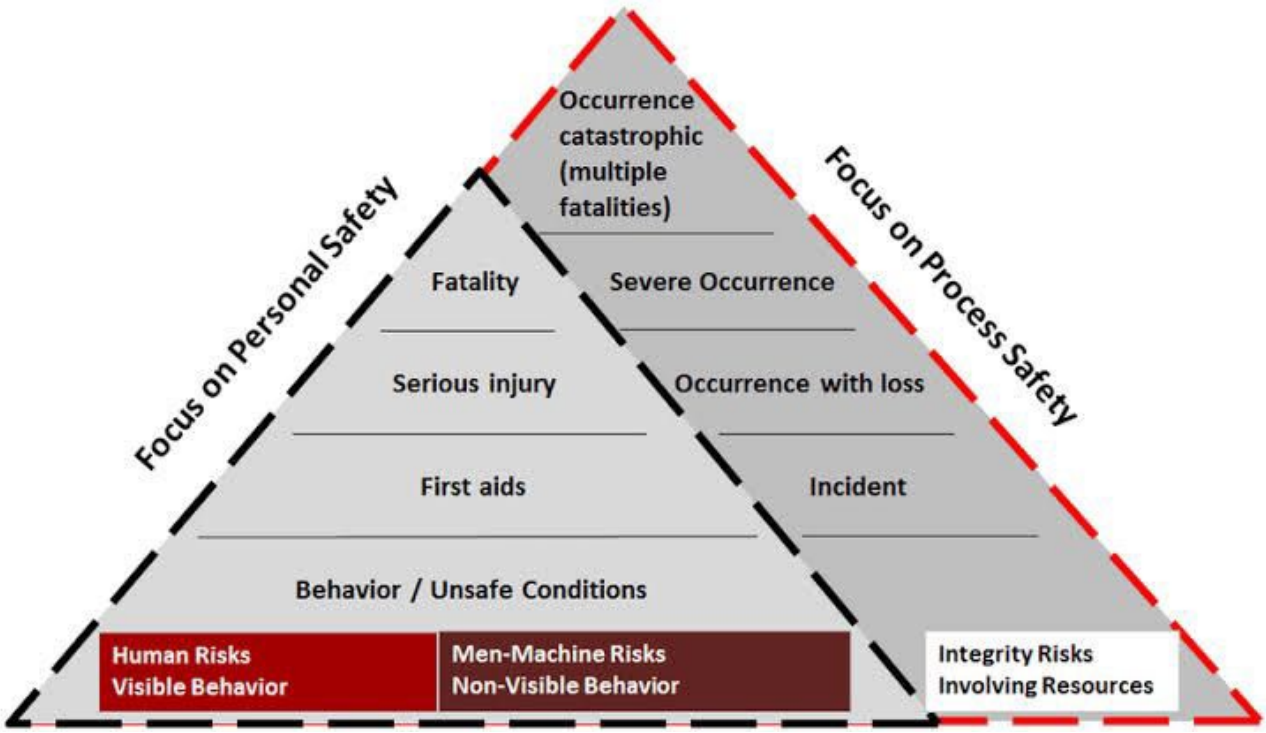
Key Point:

Incidents occurring without direct process involvement, even at a process unit, are classified as workplace safety incidents and should be reported accordingly. For instance:

A fall from a ladder unrelated to a chemical release is a workplace safety incident.

If the fall results from a chemical leak or other process-related issue, it becomes a process safety incident.

To understanding, there is separate differentiation between Process and Workplace incident category which is explained in below pyramid (For more information please refer Incident Reporting and Investigation Standard JSW/GHS/GS-02)



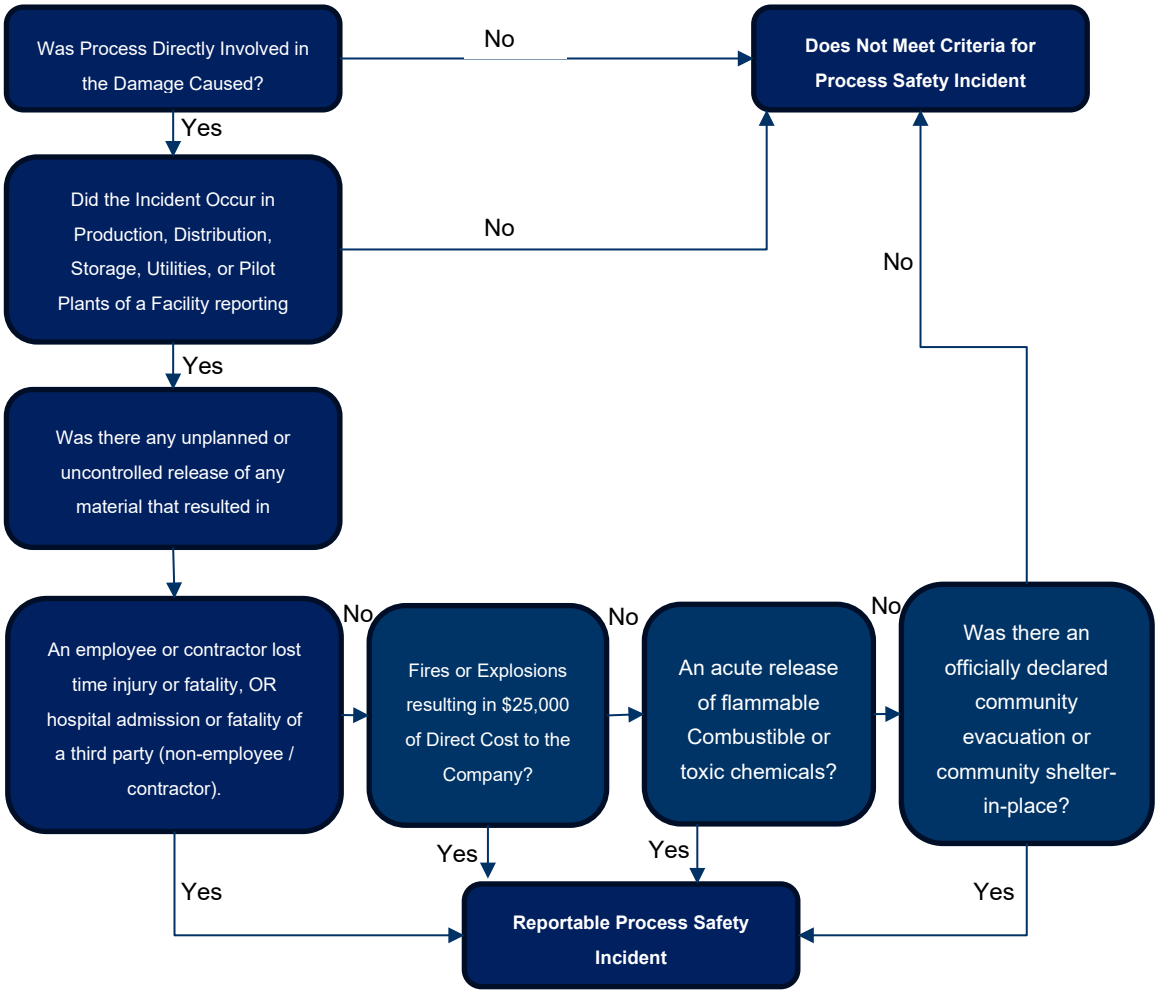
For better understanding, the distinction between Process Safety Incidents (PSIs) and Workplace Safety Incidents is clearly outlined and represented in the table below:

Focus on Personal Safety	Workplace Safety Incident	Process Safety Incident	Focus on Process Safety
	Category-5	Tier-1	
	Category-4	Tier-2	
	Category 3,2,1	Tier-3	
	-	Tier-4	

For more information, please refer Incident Reporting and Investigation Standard JSW/GHS/GS-02.

The criteria for reporting incidents as a PSI described above are illustrated in the below flowchart.

Determining if an incident meets definition of a reportable Process Safety Incident (PSI)



A severity level will be assigned for each consequence category for each process safety incident utilizing the criteria shown in below table.

Process Safety Incidents & Severity Categories

Severity Level	Safety/Human Health	Fire or Explosion (including overpressure)	Potential Chemical Impact	Community/Environment Impact
NA	Does not meet or exceed Level 4 threshold	Does not meet or exceed Level 4 threshold	Does not meet or exceed Level 4 threshold	Does not meet or exceed Level 4 threshold
4	Injury requiring treatment beyond first aid to employee or contractors associated with a process safety incident	Resulting in $25,000 to $100,000 of **direct cost**	Chemical released within secondary containment or contained within the unit.	Short-term remediation to address acute environmental impact. No long-term cost or company oversight. Examples would include spill cleanup, soil and vegetation removal.
3	Lost time injury to employee or contractors associated with a process safety event	Resulting in $100,000 to 1MM of **direct cost**.	Chemical release outside of containment but retained on company property **OR**	Minor off-site impact with precautionary shelter-in-place **OR** Environmental remediation required with

Severity Level	Safety/Human Health	Fire or Explosion (including overpressure)	Potential Chemical Impact	Community/Environment Impact
			flammable release without potential for vapor cloud explosives	cost less than $1MM. No other regulatory oversight required. **OR** Local media coverage
2	On-site fatality – employee or contractors associated with a process safety event; multiple lost time injuries or one or more serious offsite injuries associated with a process safety event.	Resulting in $1MM to $10MM of **direct cost**.	Chemical release with potential for injury off site or flammable release resulting in a vapor cloud entering a building or potential explosion site (congested/confined area) with potential for damage or casualties if ignited	Shelter-in-place or community evacuation **OR** Environmental remediation required and cost in between $1MM - $2.5 MM. State government investigation and oversight of process. **OR** Regional media coverage or brief national media coverage.
1	Off-site fatality or multiple on-site fatalities associated with a process safety event.	Resulting in **direct cost** >$10MM	Chemical release with potential for significant on-site or off-site injuries or fatalities	National media coverage over multiple days **OR** Environmental remediation required and cost more than $2.5 MM. Federal government investigation and oversight of process. **OR** other significant community impact

Sites should ensure following incident information protocol

Incident Information Protocol - Fatality					
Reporting Flow	**Time Frame**	**Action**	**By whom**	**To Whom - Steel & Coated**	**To Whom- Other Businesses**
Preliminary Information	Immediate	Communicate via phone/SMS followed by FIR (First Information Report) within 02 hours for Fatal Cases and Catastrophic Incidents (Major Fire, Explosion, Gas Release, Media Attention) and within the same shift for LTI/ HIPO	**Fatal Cases and Catastrophic Incidents -** Site President/ Site COO/ Business Head **LTI/ HIPO -** Site H&S Head	**Fatal Cases and Catastrophic Incidents -** GSC Chairman, JMD, COO, CHRO, Group Safety Head and GSC Members **LTI/ HIPO -** Group Safety Head and Respective Business Head and HR Head	**Fatal Cases and Catastrophic Incidents -**GSC Chairman, JMD, COO, CHRO, Group Safety Head and GSC Members **LTI/ HIPO -** Group Safety Head and Respective Business Head and HR Head

Incident Information Protocol - Fatality					
Reporting Flow	**Time Frame**	**Action**	**By whom**	**To Whom - Steel & Coated**	**To Whom- Other Businesses**
		Communicate via phone/SMS followed by FIR (First Information Report) within 02 hours	Site H&S head	Group Safety Head and HR Head	Group Safety Head, Business Corporate Safety Head and Business HR Head
Reporting in System	Within 24 hrs	Report in 'MySetu'	Head of the Department	As per 'MySetu'	As per 'MySetu'
Investigation Report	21 Days	Incident Investigation Report Submission	Incident Investigation Team	COO & WTD, CHRO, CEO Coated and Group Safety Heads	Business Heads, COOs, Business Safety Head, Group Safety Head, Business HR Head
Health Status Update for LTIs cases	Every Day	Based on Hospital Report	By Company Doctor and Site H&S Head	Group Safety Head and HR Head	Group Safety Head, Business Corporate Safety Head and HR Head

Examples have been provided in **Annexure 9** to help clarify and address potential incidents in evaluating reportable Process Safety Incidents (PSIs).

7.2 ELEMENT-2: PROCESS HAZARD ANALYSIS (PHA)

7.2.1 Purpose

PHA is a systematic approach to identify, assess, and control potential hazards in processes or facilities. Its goal is to prevent accidents, injuries, and property damage by proactively identifying and mitigating risks throughout the lifecycle of a process.

7.2.2 Objectives

7.2.2.1 Identify Inherent Hazards

Analyse processes to detect scenarios that could lead to accidents or hazardous releases.

Evaluate Hazardous Events: Assess the seriousness of potential consequences and likelihood of occurrences.

Determine Causes: Identify how each hazardous event can occur.

Assess Risk: Evaluate the risk based on potential consequences and event frequency.

Develop Recommendations: Propose measures to eliminate hazards or reduce risks to a tolerable level.

Define Objectives and Scope:

- Identify potential hazards.
- Implement control measures.

Select Methodologies:

- **HAZOP (Hazard and Operability Study):** Examines deviations and operational issues.
- **What-If Analysis:** Considers hypothetical scenarios.
- **FMEA (Failure Mode and Effects Analysis):** Analyses potential failure modes and effects.
- **FTA (Fault Tree Analysis):** Uses logic diagrams to identify root causes.
- **LOPA (Layer of Protection Analysis):** Evaluates existing safeguards and identifies additional protection layers.
- **Bowtie Analysis:** Visualizes the relationship between potential hazards, their consequences, and the controls in place to manage risk.

The choice of methodology depends on the process complexity, equipment, and specific hazards.

Evaluate Process Design and Operations:

- Review process flow, equipment, operating procedures, and human factors.
- Assess aspects like temperatures, pressures, interlocks, alarms, and safety systems.

Identify Hazards:

- Systematically examine process steps, equipment, and operating conditions.
- Identify deviations that could result in accidents, such as chemical reactions, fires, explosions, toxic releases, overpressures, and equipment failures.

Conduct Consequence Analysis:

- Assess potential impacts of identified hazards, including injuries, fatalities, damage, and environmental impacts.

Risk Evaluation and Control Measures:

- Prioritize hazards based on severity and likelihood.
- Develop control measures, including engineering, administrative controls, and procedural changes.

Documentation and Follow-Up:

- Document findings, recommendations, and control measures.
- Track and follow up on recommendations to ensure effective risk management.

Implement Recommendations:

- Address findings and suggestions promptly.
- Document solutions and create schedules for action completion.
- Communicate actions to operational and maintenance personnel.

Periodic Review:

- Conduct a PHA review every five years or when significant changes occur.
- Ensure alignment with current processes and industry standards.

PHA Resolution System: Post-PHA, the team's recommendations are reviewed by relevant parties. An action plan is developed to:

- Document reasons for non-implementation.
- Implement necessary recommendations.
- Record system changes and completed actions.
- Resolution Timeline Guidelines.

Submit PHA results within one week to Engineering/PHA Subcommittee, PSM Subcommittee, and Group Safety.

Record reviews upon receipt.

Develop the resolution plan within two weeks of initial review.

Feasibility Study: Assess the consequences of potential explosions or other significant events.

Documentation: Ensure all processes and findings are well-documented and accessible for ongoing reference and compliance.

Kindly refer Guidance Note on Planning and Preparing to conduct Process Hazard Analysis (JSW-GHS-GS-18-01) for detailed information.

7.3 ELEMENT-3: OPERATING PROCEDURES

7.3.1 Introduction

Effective operating procedures are critical for safe and efficient operations at JSW sites. These procedures should be detailed, aligned with Process Safety Information (PSI), and incorporate findings from Process Hazard Analysis (PHA). They shall provide clear instructions for equipment operation, task performance, and hazard management, ensuring that personnel understand processes, recognize hazards, and apply controls effectively.

7.3.2 Development and Implementation

7.3.2.1 Policy and Management System

Written Policy: JSW Site shall establish a policy for developing, updating, and managing operating procedures, ensuring alignment with PSI and PHA findings. This policy should ensure that procedures reflect best practices and regulatory requirements.

Update and Maintenance: JSW Site shall implement a process for revising procedures as needed based on changes in PSI, PHA results, and operational experiences.

7.3.2.2 Task Identification and Procedure Development

Identify Tasks: JSW sites shall identify all critical tasks performed at each site, particularly those identified as high-risk or complex through PHA.

Validate Tasks: JSW sites shall confirm which tasks require formal procedures based on their risk profile and complexity, as identified in PHA.

Operator Training: JSW sites shall ensure that procedures are integrated into training programs to ensure operators understand the process details and safety measures derived from PSI and PHA.

7.3.3 Procedure Coverage

7.3.3.1 Initial Start-up

Preparation: Procedures should ensure that all aspects related to PSI, such as equipment readiness and system checks, are addressed.

Pre-Startup Tests: Include tests and verifications in line with PSI to ensure all systems and controls are functioning correctly.

Warm-Up Phases: Incorporate steps to gradually integrate systems based on insights from PHA to avoid process upsets.

7.3.3.2 Start-ups After Shutdowns

Re-Start Procedures: Develop procedures that consider risks identified in PHA and ensure safe and controlled restarts.

7.3.3.3 Normal Operation

Standard Operation: Procedures should reflect operational guidelines that align with PSI data and risk controls identified through PHA.

7.3.3.4 Planned Shutdowns

Controlled Shutdowns: Outline steps that consider potential hazards identified in PHA, ensuring safe and efficient shutdowns.

7.3.3.5 Emergency Operations

Emergency Management: Procedures should address emergency scenarios identified in PHA, detailing response actions to manage unusual or upset conditions.

7.3.3.6 Emergency Shutdown

Safe Halting: Include procedures for emergency shutdowns that align with risk mitigation measures identified in PHA.

7.3.3.7 Loss of Utilities

Utility Failures: Provide steps that consider the impact of utility failures on process safety as identified in PSI and PHA.

7.3.3.8 Loss of DCS/HMI

Control System Failures: Develop procedures that address risks associated with the loss of Distributed Control Systems (DCS) or Human-Machine Interfaces (HMI) identified through PHA.

7.3.4 Procedure Format

Ensure that procedures shall include:

Description/Purpose: Align with PSI to provide context and purpose.

Procedure Name: Clearly title the procedure.

Equipment List: Include all relevant equipment as per PSI.

Operating Ranges: Reflect acceptable ranges based on PSI data.

Deviation Consequences: Detail potential deviations and their impacts, aligning with PHA findings.

Correction Steps: Include actions to correct deviations, incorporating risk controls from PHA.

Safety Systems: Information on safety systems, including those identified through PSI and PHA.

Safety and Health: Considerations for protecting health and safety, based on PSI and PHA.

Operator Requirements: Skills and knowledge required, reflecting requirements identified in PHA.

Step-by-Step Instructions: Detailed steps based on PSI and PHA data.

Comments/Revision Section: Space for feedback and updates.

7.3.5 Accessibility and Review

Accessibility: Ensure that procedures are accessible to all relevant personnel and integrated with PSI and PHA documentation.

Review Frequency: Review and update procedures at least every three years, or more frequently as needed, incorporating feedback and changes from PSI and PHA reviews.

7.3.6 Content of Operating Procedures

7.3.6.1 Safety, Health, and Environmental Controls

Include

Hazard Description: Based on PSI and PHA.

Exposure Prevention: Controls and PPE requirements, reflecting PSI and PHA findings.

Containment Measures: Actions for managing loss of containment, aligned with PHA.

Exposure Control: Steps to manage personnel exposure based on PSI and PHA.

Unique Hazards: Specific hazards identified through PHA.

7.3.6.2 Process Steps and Actions

Cover

Initial Start-up: Align with PSI and PHA findings.

Start-ups After Shutdowns: Procedures based on PHA.

Normal Operation: Reflect PSI and PHA data.

Planned Shutdowns: Include safety considerations from PHA.

Emergency Operations: Address emergency scenarios from PHA.

Emergency Shutdown: Procedures for emergency halting, aligned with PHA.

Loss of Utilities: Consider PSI and PHA impacts.

Loss of DCS/HMI: Manage control system failures as identified in PHA.

7.3.6.3 Equipment Procedures

Maintenance: Develop procedures based on PSI and PHA, including safe operation and troubleshooting.

7.3.6.4 Supplemental Operating Procedures

Process Alarm Systems: Include alarm management practices based on PSI and PHA.

Shift Changeover Communications: Document communications in line with PSI and PHA.

Leak Reporting and Housekeeping: Procedures for managing leaks and housekeeping, considering PSI and PHA.

Isolation Valve Controls: Procedures for valve controls based on PSI and PHA.

7.3.7 Periodic Reauthorization

Review and Reauthorization: Ensure all procedures are reviewed and reauthorized every three years, incorporating feedback from PSI and PHA. Document operator involvement and suggestions.

7.4 ELEMENT-4: TRAINING

Site-specific training programs are important elements of Process Safety Management (PSM) at each segment of the manufacturing (line) organization. This training equips operations and engineering personnel with the knowledge, tools, and understanding necessary to align with operating procedures and PSM guidelines. While having key PSM elements in place is important, their effectiveness relies on personnel who are knowledgeable, dedicated, and capable of consistently following documented policies and procedures. Employees shall also be physically capable, mentally alert, and able to exercise good judgment.

Training involves practical instruction delivered in various settings, such as classrooms, workplaces, or on-the-job. Its aim is to help employees meet initial performance standards, maintain proficiency, or qualify for advanced roles. Performance assurance ensures that employees not only understand their training but can apply it effectively in real-world situations.

7.4.1 Key Activities for Training Programs

Developing a Written Procedure: JSW Sites shall create a procedure for managing the training element, including the design, updates, and maintenance of training materials and ensure training procedures reflect current best practices and process changes, aligning with PSM guidelines.

Defining Roles and Responsibilities: JSW Sites shall clearly outline roles and responsibilities related to training within the management system and ensure alignment with PSM requirements.

Identifying Training Needs: JSW Sites shall systematically assess and address employee training needs, including understanding hazards and process safety requirements based on PHA and PSI.

Maintaining Training Materials: JSW Sites shall keep an updated library of approved training materials and ensure they reflect process changes consistent with PHA and PSI findings.

Tracking Training Records: JSW Sites shall implement a system to track training records, including completed courses and performance evaluations in compliance with PSM and regulatory requirements.

Gathering Worker Input: JSW Sites shall collect feedback on necessary training for job tasks, categorized by knowledge, rules, and skills.

Implementing Training Methods: JSW Sites shall utilize a mix of formal courses, coaching, and practical work in training and development programs and ensure methods are relevant to current PSM practice and safety standards.

Developing Training Materials: JSW Sites shall ensure training materials meet quality standards and specify trainer qualifications and are developed by qualified trainers with expertise in PSM.

Determining Training Presentation: JSW Sites shall identify optimal methods and locations for delivering training modules.

Refresher Training: JSW Sites shall schedule refresher training at least every 2 years or more frequently if needed.

Evaluating Training: JSW Sites shall establish methods to evaluate trainee progress, performance standards, and overall training program effectiveness.

Reviewing Training Programs: JSW Sites shall conduct formal reviews of training and development programs to assess effectiveness and identify areas for improvement.

Training Subcommittee Review: JSW Site shall ensure compliance and performance trends are reviewed by the Training Subcommittee at the site level in alignment with PSM objectives.

7.4.2 Training Categories

7.4.2.1 Initial Training

Each employee involved in operating a process, as well as newly assigned employees, shall receive training that includes:

- An overview of the process and operating procedures.
- Specific safety and health hazards.
- Routine and emergency operations, including shutdown procedures.
- Procedures for understanding parameters, identifying abnormal conditions, and restoring systems to normal.

This training is mandatory before assigning any unsupervised tasks. Additional Emergency Response Team Training and other Safety Programs will follow the same approach as for regular employees.

7.4.2.2 On-the-Job Training

Continuous on-the-job training is essential for Operators, Technicians, Supervisors, and Shift In-charges. This includes:

- **Assisting Experienced Operators:** Newer employees will assist more experienced operators in complex tasks.
- **Reviewing Technical Material:** Operators will regularly review the latest technical materials.
- **Participating in Safety Meetings:** Operators will engage in safety meetings to stay updated on safety practices.

7.4.2.3 Refresher Training

Refresher training should be provided at least every 2 years, or more frequently if needed, to ensure all employees understand and follow current operating procedures. Routine changes will be managed through Management of Change procedures, with appropriate training for affected personnel.

7.4.2.4 Basic Skills Training

JSW Sits shall

- Develop an inventory of basic skills required for satisfactory job performance.

- Provide basic skills training to ensure all personnel maintain a minimum level of proficiency.
- Assess and document basic skills training provided by external resources as part of the hiring process.

7.4.2.5 Process Overview and Regulatory Compliance Training

Operating personnel shall receive training that includes:

- A review of material hazards.
- Basic process design basis (including SOCs).
- Block diagrams and process flow diagrams.
- Operating steps and procedures.
- Hazards associated with specific tasks.
- Functionality of safety systems and lines of defence.
- Safe work practices for the employee's assignment.

7.4.2.6 Emergency Response, Control, and Shutdown

Periodic training shall cover:

- Emergency response and control procedures.
- Safe and prompt shutdown of process operations and support facilities based on emergency shutdown procedures.

7.4.2.7 Alarm Management Practices and Procedures:

Personnel involved in process control shall receive training on:

- Alarm management procedures and practices.
- Alarm philosophy.
- Measures to prevent and address nuisance alarms.
- Record Keeping

7.4.2.8 The site shall maintain:

Training Matrix: A summary of employee training status on tasks, procedures, and safe work practices.

Individual Training Records: Records should include:

- Employee identity.
- Date of training.
- Material covered (e.g., course outline).
- Competency evaluation results.
- Identity and qualifications of trainers.

Records shall be maintained for the duration of each individual's employment.

7.4.3 Fitness for Duty and Performance

The Business/Site shall:

- Implement programs to ensure personnel are mentally and physically fit for duty.
- Provide training for supervisors to recognize symptoms of diminished capacity and address them.
- Develop a plan for reporting and managing cases of diminished capacity to ensure job safety.

7.4.4 Training Need Matrix

- Develop a matrix for HAZOP Team members, PSM Coordinators, PSM Plant Subcommittee, and SPOCs safety ensuring alignment with PSM requirements.
- Include elemental knowledge as part of the induction process.
- Communicate the outcomes of PHAs to all stakeholders, including employees and workers.

7.4.5 HAZOP Team Training

Train HAZOP team members on all 14 elements as specified in the standard.

7.5 ELEMENT-5: CONTRACTOR SAFETY MANAGEMENT

Effective contractor safety management is a cornerstone of robust process safety practices, critical to maintaining the integrity of operations and safeguarding both personnel and assets. Contractors, with their diverse roles and specialized skills, are integral to many industrial processes; however, their involvement introduces unique safety challenges that shall be meticulously managed.

The Contractor Safety Management element within the process safety standard is designed to ensure that all contractors engaged in operations adhere to stringent safety protocols and integrate seamlessly with the existing safety systems of the organization. This element is focused on the pre-qualification, selection, and ongoing management of contractors to ensure their compliance with safety standards, regulations, and operational procedures.

Key objectives include pre-qualifying contractors based on their safety capabilities, assessing their competence relative to the specific risks of the work, and ensuring that their safety plans align with the organization's Safety Management System (SMS). The process involves rigorous risk assessments, comprehensive safety orientations, and the continuous monitoring of contractor performance to identify and mitigate potential hazards.

A critical aspect of this element is the alignment of contractor safety practices with the overarching process safety standards, ensuring that contractors not only meet regulatory requirements but also contribute to the overall safety culture of the organization. This involves setting clear expectations, implementing robust inspection and audit programs, and holding contractors accountable for their safety performance.

Through effective contractor safety management, organizations can enhance safety performance, prevent incidents, and foster a culture of safety that permeates every level of operation. This proactive approach not only mitigates risks but also ensures that all stakeholders, including contractors, are fully engaged in maintaining a safe and compliant working environment.

Key aspects of contractor safety management are:

- **Health & Safety Pre-Qualification:** Establish H&S pre-qualification, selection, and retention criteria for contractors, subcontractors, and suppliers based on their safety capabilities and alignment with PSM standards. Conduct a formal H&S risk assessment before issuing an Invitation to Tender to ensure tenders are only extended to contractors who meet these criteria to ensure compliance with safety standards and PSM requirements.
- **H&S Requirements Sharing:** Share JSW H&S requirements with contractors and suppliers for agreement and implementation.
- **Assessment of H&S Competence:** Assess the contractor’s H&S competence against identified process hazard and risks before awarding contracts. Ensure tendering companies understand the risks, have a risk management plan aligned with PSM elements, and demonstrate the capability to manage these risks.
- **H&S Plan Submission:** Mobilization is contingent upon the submission and approval of an H&S Plan tailored to the risk level. For high-risk contracts, provide a rationale on how risks will be reduced to As Low as Reasonably Practicable (ALARP).
- **H&S Inspection/Audit Program:** Implement an H&S inspection and audit program to monitor the effective implementation of the Safety Management System (SMS) and interfaces between the contractor and the Group Company.

- **Contract Specifications:** Contracts shall specify inspection/audit requirements, actions for non-compliance, rewards or penalties related to H&S performance and ensure annual SMS reviews for long-term contracts. Ensure competency and quality assurances meet or exceed Group Company standards.
- **Continuous Improvement:** Demonstrate that contractors' SMS are subject to continual improvement and ensure subcontractors adhere to these expectations. Treat contractor employees as Group Company employees for H&S matters, providing necessary facilities, PPE, and H&S statistics.
- **Contractor Selection Information:** Provide contractors with detailed information on the work required, potential hazards, applicable H&S procedures, and the need for safety supervision. Contractors shall submit their safety management program, previous experience, and employee training documentation.
- **Safety Orientation:** Ensure all contractor employees receive proper safety orientation addressing Group Company's safety rules, incident reporting, and emergency response requirements before entry.
- **Equipment Compliance:** Check and approve all contractor equipment, tools, cranes, and vehicles to ensure they meet JSW Safety Standards and Group Company procedures.
- **Hazard and Risk Assessment:** Perform hazard assessments and risk evaluations with the contractor based on work and workplace risks. Provide contractors with information on how to secure additional details if needed.
- **Employee Monitoring:** Monitor contractor employees to ensure they execute their work in an H&S-responsible manner. Assign supervision responsibilities accordingly.
- **Performance Evaluation:** Periodically evaluate contractor performance through spot checks and field audits. Document and address the results, holding contractor management accountable for any violations of safety rules and regulations.
- **ID Cards and Access Control:** Restrict and control the entry of contractor employees into facilities. Issue ID cards only after they complete a safety orientation and ensure that entry is permitted through the Face Recognition System (FRS).
- **Reporting and Investigation:** Ensure prompt reporting, recording, and investigation of incidents and near misses. Encourage effective incident and near-miss reporting among contractors.
- **H&S Plan Compliance:** Ensure that the H&S Plan is continuously adhered to throughout the contract duration, with regular updates and reviews as necessary.
- **Rewards and Recognition:** Provide rewards or recognition for H&S performance in accordance with Group PCM guidelines, based on adherence to compliance and overall performance.
- **Competency Assurance:** Verify that the contractor's safety professionals and training meet or exceed Group Company standards and are appropriately qualified.
- **Documentation:** Require contractors to submit SMS internal audits, statistics, and H&S statements regularly to the Group Company for review and compliance verification.
- **Final Evaluation:** Assess the contractor's overall H&S performance upon contract completion, using this evaluation to guide future contract awards and ensure continuous improvement in safety practices.
- **Higher Hazard Operation Contractors:** Exclusively identify higher hazard operation contractors. Ensure all workers are trained and present the PQA and CARES scores to the PSM Sub-Committee meeting and chairperson mandatorily.



Figure-4 : JSW Contractor Safety Management

7.6 ELEMENT-6: PRE-START UP SAFETY REVIEW

7.6.1 Principle

The Pre-Start-Up Safety Review (PSSR) is a critical process designed to verify that new and modified equipment or facilities, as well as those involve in the commissioning on new equipment, new projects, shutdowns of more than 48 hours, or after any modifications, meet all Process Safety Management (PSM) requirements and are safe for operation. The PSSR ensures that all aspects of PSM have been addressed satisfactorily, confirming the facility's readiness for start-up.

Note: For capital projects, successful planning for the PSSR begins with assembling a project team and scheduling the review within the project timeline. Effective project management, including thorough planning and coordination of all PSM elements, is essential for a smooth and safe start-up.

PSM focuses on preventing process-related incidents that could impact plant personnel, off-site communities, or the environment, and aims to avoid significant losses in property or business. PSSRs shall be performed for all new and modified facilities where changes affect the documented Process Technology.

Before introducing hazardous substances, the PSSR team shall confirm the following:

Compliance with Design Specifications: Verify that construction and equipment meet design specifications.

PSM Assessment: Ensure all PSM elements have been addressed.

Safety and Environmental Checks: Conduct a physical inspection to confirm basic safety, health, environmental, and fire protection measures.

Facility Readiness: Confirm that the facility is safe to start up, possibly contingent upon addressing specific recommendations.

7.6.2 Documentation and Communication

Detailed Documentation: Ensure detailed documentation of PSSR workflows, team roles, communication methods, and guidance for team members.

Team Composition: Conduct PSSRs with multidisciplinary teams, including operations, technical, design, engineering, and safety representatives. For minor changes, smaller teams may be used.

Team Leadership: PSSR team leaders should foster a constructive review atmosphere and be independent of the facility's operations.

7.6.3 Team Composition

PSSRs should be performed by multidisciplinary teams including:

- Operations representatives (including operators)
- Technical experts
- Design and engineering personnel
- Safety representatives
- Specialists as needed (e.g., electrical, instrumentation, ergonomics)

For minor changes, a smaller team of at least two members from different backgrounds may suffice. For significant changes involving new hazards, additional off-site experts may be included.

7.6.4 PSM Element Assessment

Scale and Timing: Determine the scope and timing of the PSSR based on the Site Head's decision, with input from PSM-SC and relevant administrators.

Checklist Use: Conduct assessments using a PSSR checklist, Annexure-3 to ensure comprehensive evaluation of all PSM elements.

7.6.5 Physical Inspections

Checklist: Use pre-written checklists for physical inspections to cover all basic safety and PSM elements.

Documentation: Ensure all observations are documented, including compliance with safety standards, PSM elements, and regulatory requirements.

7.6.6 PSSR Documentation and Recommendations

Documentation: Document all PSSR findings, with signatures from each team member and authorization from Site Leadership/President.

Recommendation Follow-Up: Establish systems for resolving recommendations before and after start-up. Track and report on the status of recommendations monthly.

Sign-Off: Develop and use standardized formats for PSSR sign-off, checklists, and reports.

7.6.7 Management Systems

Procedures: Develop and integrate procedures in line with this guideline at each location. Review and revise the guideline annually.

Training: Ensure personnel are trained on PSSR responsibilities.

Records: Maintain and retain PSSR documentation for at least five years. Scanned copies of hard copies are acceptable.

Audits: Conduct compliance audits annually by an independent team.

Deviations: Any deviations from this procedure shall be approved in consultation with the corporate safety head.

7.7 ELEMENT-7: ASSET INTEGRITY

The global industry has witnessed numerous significant incidents—such as molten material spills in high-temperature production areas, explosions in manufacturing facilities, and catastrophic failures in energy management piping networks—largely due to the lack of effective Process Safety Management (PSM) practices. These incidents have had severe repercussions, including harm to people, environmental damage, asset loss, and adverse impacts on business performance. A common factor in many of these failures has been the ineffective implementation of Asset integrity principles, which has led to unreliable equipment and compromised process safety performance.

Given this context, it is crucial for businesses across various sectors—such as paint, cement, energy, and more—to adhere to quality assurance principles during construction and commissioning phases, and to maintain high standards of Asset integrity throughout their operational lifecycles. This approach is essential for ensuring equipment safety, reliability, and productivity, with the goal of achieving process safety excellence alongside manufacturing excellence.

For JSW Site, implementing these principles should ideally have been integrated into the project conceptualization phase to establish robust process safety standards from the outset. As the site is currently in the operational phase, there has been a delay in adopting these critical principles, exposing the site to potential process safety risks. Therefore, there is an urgent need to implement Asset integrity principles effectively to manage and mitigate process safety risks to As Low as Reasonably Practicable (ALARP) levels.

7.7.1 Asset integrity Overview

The Asset integrity element is essential for ensuring the reliability and safety of equipment and systems involved in Process Safety Management (PSM). This program spans the entire lifecycle of equipment, from initial installation through decommissioning, and includes several critical components.

7.7.1.1 PSM Critical Equipment (PSMCE) Scope

Primary Focus: The Asset integrity program covers Process Safety Management Critical Equipment (PSMCE) for both Higher Hazard Processes (HHO) and Lower Hazard Operations (LHO).

Additional Equipment: It also includes other PSMCE such as emergency equipment, structural facilities, and non-P&ID equipment (e.g., runners in blast furnaces, flameproof apparatus), as identified by the PSMCE determination methodology in the Process Technology element.

7.7.1.2 Lifecycle Coverage

Initial Installation: Ensuring the proper installation, pre-commissioning, and commissioning of equipment.

Operational Life: Ongoing maintenance and performance monitoring to ensure equipment reliability and safety.

Decommissioning: Safe dismantling and disposal of equipment at the end of its lifecycle.

7.7.1.3 Focus Areas

Testing and Inspection: Equipment shall be tested, inspected, and maintained according to predefined procedures and plans, aligned with relevant maintenance strategies and acceptance criteria.

Resource Management: Effective procurement and management of spare parts, consumables, and services required for the maintenance, inspection, and testing of PSMCE to ensure reliable operation.

Reliability Improvement: Application of reliability engineering principles to continuously enhance PSMCE performance.

Personnel Competency: Ensuring all personnel involved in Asset integrity tasks are adequately trained and competent.

Figure 4 illustrates the various workstreams within the Asset integrity element, highlighting the stages and processes involved in maintaining and improving equipment integrity throughout its lifecycle.

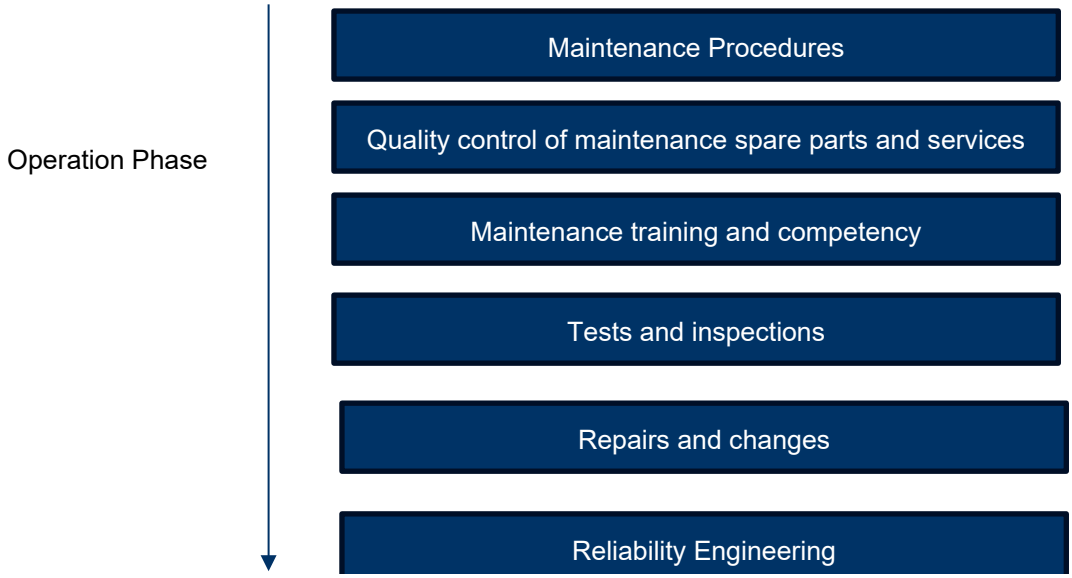


Figure-5 : Workstream in Asset integrity

The entire Asset integrity cycle is depicted in Figure 7 below, which explains the focus of Asset integrity for managing PSM Critical Equipment from design stage until removal from service.

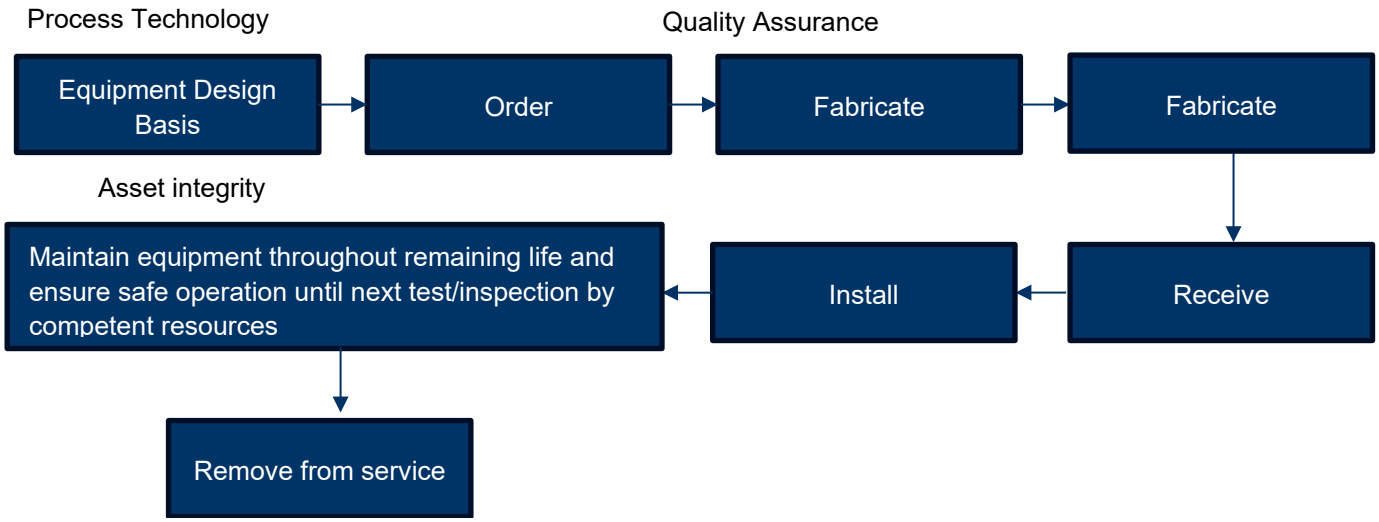


Figure-6 : Equipment Life cycle

To enhance the effectiveness and consistency of Asset integrity and Quality Assurance practices, it is recommended to establish a dedicated Asset integrity network within JSW Site. This network will facilitate the sharing of learnings, issues, best practices, and incident insights related to Asset integrity, thus enabling collective improvement and preventing individual plants from having to independently discover solutions.

7.7.1.4 Asset integrity Structure:

Purpose: Asset integrity aims to promote knowledge sharing and improve practices across the Site by pooling expertise and experiences.

Communities: Asset integrity will include specialized communities, such as but not limited to:

- Hot Metal Systems
- Pressure Systems
- Rotating Machinery
- Plant Electrical Safety

Participation: Sites should ensure that subject matter experts actively participate in these Asset integrity communities.

Champions: Each Asset integrity stream should have a designated topic Champion responsible for leading the community, guiding discussions, and driving improvements.

Knowledge Management and Documentation:

Intranet Portal: An up-to-date intranet folder system or portal should be established and maintained to serve as a comprehensive repository for Asset integrity-related information. This portal will house:

- Asset integrity Procedures
- RAGAGEPs (Recognized and Generally Accepted Good Engineering Practices)
- Standards
- Reference Documentation
- Asset integrity Stream Documentation
- Best Practices

Objective: The portal aims to support knowledge management and promote the application of best practices, thereby advancing process safety and plant reliability.

7.7.2 Equipment Design and Specification

The Site Project Team is responsible for developing comprehensive designs and specifications necessary for the procurement, manufacture, installation, commissioning, and safe operation of equipment. The Project Head or Plant Head of Department (HOD) shall ensure that these designs and specifications are adequate and comply with RAGAGEPs (Recognized and Generally Accepted Good Engineering Practices).

Design packages for all PSMCE shall include:

- **Fabrication, Delivery, and Dispatch:** Measures for each stage.
- **Transportation and Storage:** Procedures to prevent deterioration or damage.
- **Receipt and Storage:** Inspection procedures to verify equipment condition upon arrival and ensure proper storage.
- **Installation:** Procedures to ensure compliance with inspection plans.

7.7.2.1 Documentation Requirements:

- JSW Site shall ensure all necessary documentation travels with the equipment and is stored at the equipment location. This includes design drawings, specifications, and vendor recommendations.
- The project quality plan shall incorporate requirements for managing deviations from specifications through an engineering change management procedure.

7.7.2.2 Critical Equipment Identification

The Site Project Team shall identify PSM critical equipment as per the Annexure- 2.

JSW site shall ensure the quality of suppliers is crucial for the performance and reliability of PSMCE. A comprehensive supplier selection, qualification, and surveillance program is essential.

Design Step:

reference shall be made to the list of approved suppliers for identifying the relevant approved suppliers and passed on to the procurement team, and the list of approved sub-suppliers if any, shall be prepared included in the material specifications (as part of RFQ) to ensure the right sub-supplier quality.

Procurement Step:

Vendor Quality Assessment: Evaluate the supplier's quality program before issuing RFQs.

Supplier Selection and Empanelment: Choose suppliers based on their quality programs.

Deficiency Corrections: Recommend corrective actions for any deficiencies and follow up to ensure they are implemented.

Periodic Audits: Conduct regular audits to verify that suppliers and sub-suppliers maintain quality standards.

Please refer JSW Contractor Safety Management Standard JSW/GHS/GS-03 for selection of suppliers.

7.7.2.3 Assembly, Construction, and Installation at Site

Equipment shall be assembled and installed at the site according to manufacturer instructions and Released for Construction Design Drawings. Procedures and specifications shall be developed and executed by qualified personnel.

Project Engineers: Ensure all key installation requirements and instructions are clearly specified.

Installation Engineers: Participate in design development to provide input that prevents installation issues.

Installation engineers shall provide documentation, including records of construction, installation, calibration, assembly, alignment, and testing, along with "as-built" drawings, to pre-commissioning/commissioning engineers.

7.7.2.4 Inspecting the Quality of PSMCE Fabrication/Construction/Installation

PSMCE fabrication, construction, and installation shall be inspected according to the respective Plan and certified before proceeding to the next project phase.

7.7.2.5 Inspection and Certification

Qualified Personnel: Inspections and certifications shall be performed by competent personnel according to QA specifications.

Third-Party Inspectors: If engaged, they shall adhere to the supplier quality program.

7.7.2.6 Documentation Requirements:

Maintain records of inspections and certifications for the equipment's lifecycle, including:

- Original design basis documentation
- Supplier Asset integrity certifications (e.g., Certificate of Compliance)
- Installation inspection documentation, including a copy of the Pre-Startup Safety Review (PSSR)
- Design basis and criteria, communicated to operating and maintenance personnel as part of the PT package handover.
- For equipment subjected to a PSSR, ensure the review verifies that specifications are met.

The commissioning team should be involved in providing input and performing witness checks during construction and installation to avoid duplication of efforts. Additional follow-up may be conducted by relevant personnel and area staff through PSSR.

7.7.3 Asset integrity Training and Competence

7.7.3.1 Formal Asset integrity Training Framework

Responsibility: Each functional Head of Department (HOD) is responsible for arranging and ensuring adequate Asset integrity training and competency for all relevant team members, including direct, associate, BPO, contract, and temporary personnel.

7.7.3.2 Asset integrity Overview Training

Objective: Introduce Asset integrity principles and their importance in maintaining equipment and systems.

7.7.3.3 Process Safety Awareness

Manufacturing/Utility Process Overview: Focus on Asset integrity related process safety hazards.

Occupational Safety and Health Hazards: Specific Asset integrity-related hazards associated with the process.

Emergency Procedures: Procedures relevant to Asset integrity failures.

Safe Work Practices: Including permit-to-work and confined space entry, as applicable.

7.7.3.4 Task-Specific Training

Objective: Explain why tasks such as mechanical tests, inspections, maintenance, and repairs should be performed in specific ways to ensure mechanical safety and effectiveness.

7.7.3.5 Training Development and Delivery

Determine: Whether training is conducted internally or through external partnerships.

Identify: Qualified Asset integrity trainers (internal or external).

7.7.3.6 Competency Evaluation

Evaluate and Assess: Trainees according to Asset integrity procedures.

Track: Compliance with training and competency requirements using a tracking system.

7.7.3.7 Training Delivery and Evaluating Asset integrity Competency

Integration: Asset integrity training should be integrated into existing safety and technical training programs to avoid duplication or overlaps.

Assessment: Competency can be assessed through formal written tests or by evaluating field performance. Unsuccessful evaluations should lead to formal repeat training sessions.

7.7.3.8 Refresher Training on Asset integrity

Frequency: Refresher training for mechanical tasks shall be scheduled at least once every two years.

7.7.3.9 Training of Temporary Personnel

Training Requirements: Temporary personnel working on mechanical systems shall receive appropriate Asset integrity training before performing tasks.

7.7.4 Maintenance Strategies

7.7.4.1 Scope of Maintenance Strategies

JSW sites shall develop and implement maintenance strategies for PSMCE that include:

System Development: JSW Sites shall create systems for maintenance strategies that ensure risk of equipment failure is minimized as much as practicable.

Scheduling System: JSW Site shall implement a robust scheduling system for timely completion of maintenance works, with mechanisms for highlighting and approving delays.

7.7.4.2 Maintenance Types

JSW Site shall use Time-based or Condition-based strategies (predictive or preventative). The "run to failure" concept is generally avoided except for certain equipment functioning as barriers.

Shutdown Maintenance: JSW Site shall Plan shutdown maintenance programs to test, inspect, maintain, or rectify PSMCE without affecting safe operation. Use structured turnaround management practices.

Reliability Engineering: JSW Site shall apply reliability engineering principles to achieve high reliability of PSMCE.

Breakdown Management: JSW Site shall manage PSMCE breakdowns through systematic reliability principles and optimize breakdown response.

7.7.4.3 Maintenance Management System

JSW site shall Plan, schedule, and record Asset integrity programs in the SAP PM module. Use SAP PM for managing all maintenance, inspection, testing, and repair tasks, with equipment history recorded in SAP Notifications.

7.7.4.4 Prerequisites for Developing Strategies

JSW Sites shall gather all relevant equipment history and best practices before developing strategies:

Existing Equipment History: JSW Site shall compile operational and maintenance history, including maintenance logbooks, operating logs, and repair reports.

Plant Documents: JSW Site shall study regulatory requirements, codes, standards, equipment design basis, PSMCE list, and related procedures.

Failure Patterns: SW Site shall understand failure modes, deterioration mechanisms, vendor information, and industry experience.

7.7.4.5 Test and Inspection Results

JSW Sites shall review past test and inspection results for anomalies and trends.

7.7.4.6 Special Requirements

JSW Sites shall Identify any specific procedures needed for equipment or environments and utilize information from manufacturers, publications, internal experience, and JSW Group Safety Management Standards.

7.7.4.7 Maintenance, Testing, Inspection, and Repair of PSMCE

JSW Site shall develop and implement SMPs (Standard Maintenance Procedures) based on identified strategies.

7.7.4.8 Documenting the SMPs

JSW Site shall ensure SMPs include:

SMP Framework: Objectives, contents, safety features, tools, task steps, post-task requirements, and references.

Types of SMPs:

- Generic: Discipline-wise common procedures.
- Equipment Specific: Plant-specific procedures.
- Process Specific: Process-specific procedures.
- Administrative: Procedures for overall management.

Specific Requirements:

Address special safety considerations, test/inspection methods, acceptance criteria, and training needs.

7.7.4.9 Implementing Strategies, Scheduling, and Executing Tasks

Pre-Execution: JSW Site shall ensure personnel are trained to record pertinent facts and findings.

Post-Completion: JSW Site shall report unexpected findings, review by department lead engineer, and plan follow-up actions.

Equipment Deficiencies: JSW Site shall correct deficiencies before further use or in a safe manner with proper documentation.

7.7.4.10 Changes to Schedules and/or SMPs

All changes shall be approved and evaluated against various factors including failure consequences, equipment history, and changes in conditions.

7.7.4.11 Repair and Changes

Corrective actions include

Repair: Restore equipment to original condition.

Replacement: Install new parts, ensuring correct specifications and quality.

Change: Modify design or settings, following MOC procedures.

Re-rating: Change equipment ratings, requiring calculations and possible pressure tests.

Corrective Action Documentation: Use SAP notifications to document actions taken, including safety considerations and compliance with standards.

Follow-Up: Track corrective actions, ensure management visibility, and document any changes or cancellations.

7.7.4.12 Control and Monitor Deferrals and Overdue

Deferral Approval: JSW Site shall follow a documented process for deferral approvals and ensure safety controls.

Investigate Overdue: JSW Site shall Investigate and address reasons for overdue maintenance.

Highlight Overdue: JSW Site shall report overdue/deferrals at Asset integrity Core Team meetings and relevant sub-committees for resolution and resource allocation.

7.7.5 Reliability Engineering

Reliability Engineering is crucial for enhancing the Asset integrity and safety performance of facilities. It involves evaluating and improving how long systems and components can safely operate before they require maintenance or replacement. By integrating Reliability Engineering, facilities can ensure high levels of operational reliability and safety.

7.7.5.1 Root Cause Failure Analysis (RCFA)

Purpose: To identify and address the fundamental causes of failures or performance issues in PSMCE (Process Safety Management Critical Equipment) and prevent recurrence.

Analysis of Indicators: JSW Sites shall use RCFA to investigate leading indicators such as drifting calibrations, out-of-calibration readings, frequent part replacements, plugging, minor leaks, etc. Assess if these indicators suggest a risk of serious incidents.

Structured Technique: JSW sites shall analyse both minor and major failures in PSMCE to uncover underlying causes. Engage specialists or Asset integrity topic champions as needed.

Trend Analysis: JSW Site shall regularly perform RCFA on minor failures to identify trends and potential risks of future significant issues.

Expert Judgment: Ensure decisions are made by experienced personnel who can understand how small issues might lead to major problems or incidents.

What-If Analysis: JSW site shall consider scenarios where multiple small failures could combine to create a serious problem.

7.7.5.2 Analysis of Failure Modes and Consequences (FMEA)

Purpose: To proactively identify and mitigate potential failure modes before they occur.

FMEA Technique: Focus on predicting failures rather than only addressing chronic problems. Conduct FMEAs for significant equipment in Higher Hazard Operation (HHO) and scenarios with top PSM risks.

Cross-Functional Teams: Assemble teams with comprehensive knowledge of equipment, failure modes, and potential safety impacts to perform FMEAs.

7.7.5.3 Reliability Improvement Actions

Recommendations for System Improvements:

Procedures: Enhance test, inspection, job, and operating procedures.

Training: Implement or improve training and competency practices.

Foundational Practices: Update design, documentation, and communication systems.

Change Management: Ensure that all redesign or change efforts follow the Management of Change (MOC) standard.

Documentation and Training: Keep documentation up-to-date and provide training based on changes or improvements. This includes updating the PSMCE list as needed.

Human Interface: Address the "soft side" of reliability, including how human factors impact system performance.

Continuous Improvement: Apply lessons learned to similar systems to drive ongoing reliability improvements and maintain a cycle of continuous enhancement.

Updating PSMCE List: Revise the list of PSM Critical Equipment as new failure modes are discovered or if equipment no longer meets PSM Critical criteria.

7.8 ELEMENT-8: QUALITY ASSURANCE

The Quality Assurance (QA) element is critical in ensuring that new Process Safety Management Critical Equipment (PSMCE) is designed, installed, and commissioned effectively. This process covers the full lifecycle of equipment, from initial design through to final commissioning, ensuring adherence to quality standards and effective implementation.

7.8.1 Quality Assurance of New Equipment

Objective: JSW Site shall ensure that all new PSMCE meets Quality Assurance requirements throughout its lifecycle, including design, procurement, fabrication, installation, and commissioning.

QA Implementation Steps: The QA process is divided into several stages, each illustrated in Figures 8, 9, and 10, focusing on Design, Procurement & Fabrication, and Installation & Commissioning

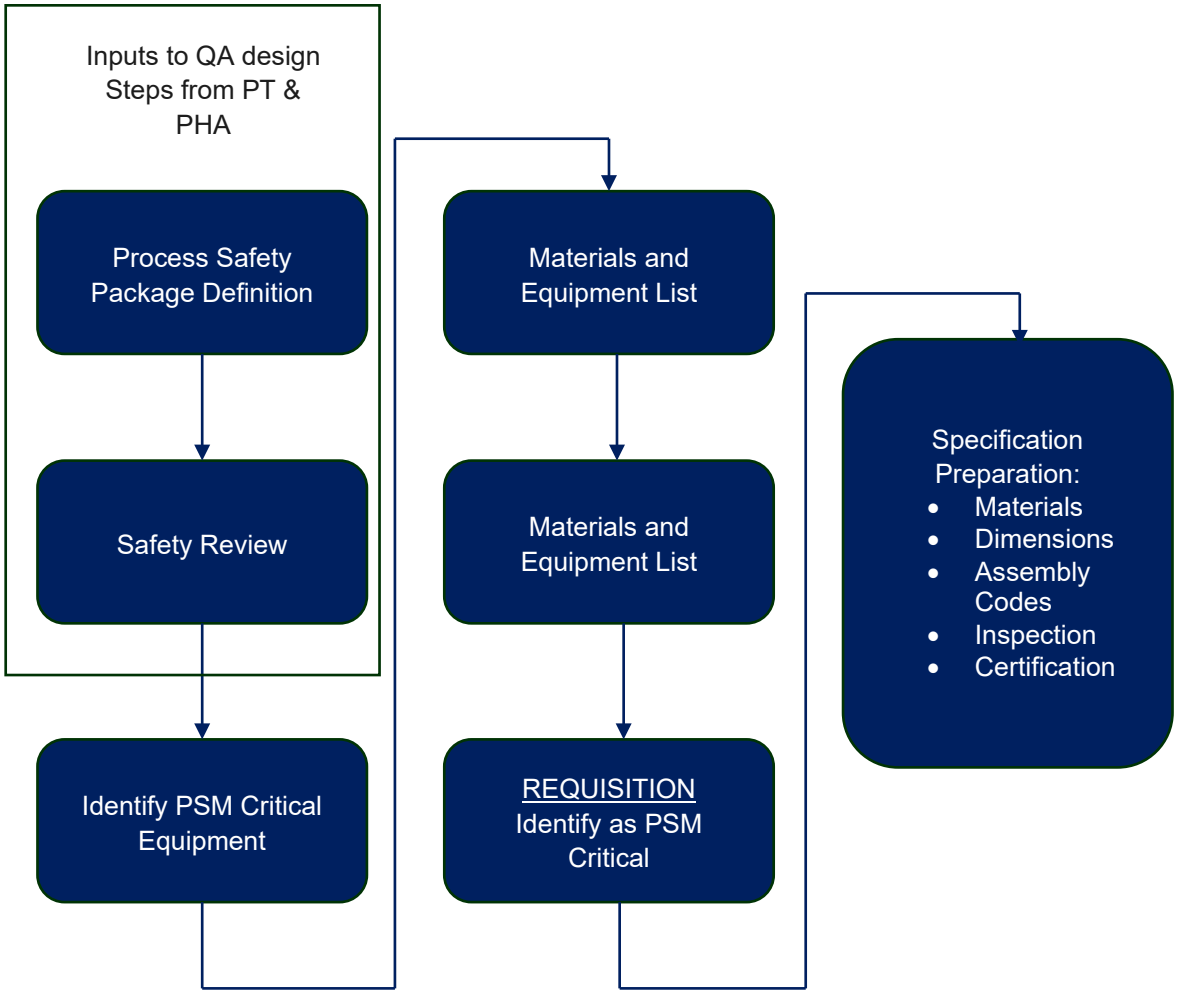


Figure-7 : Design Steps in Quality Assurance

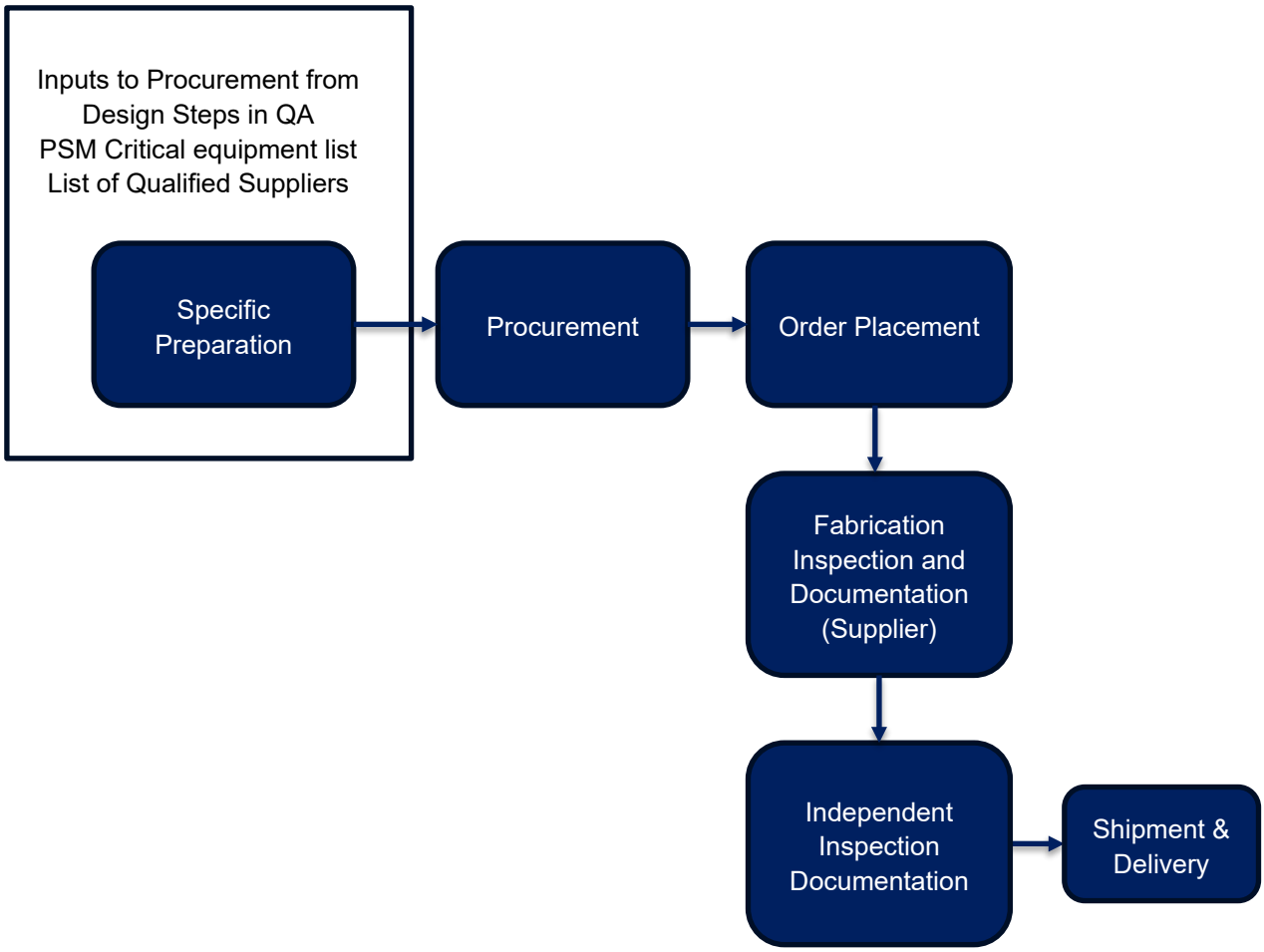


Figure-8 : Procurement & Fabrication Quality Assurance Steps In QA

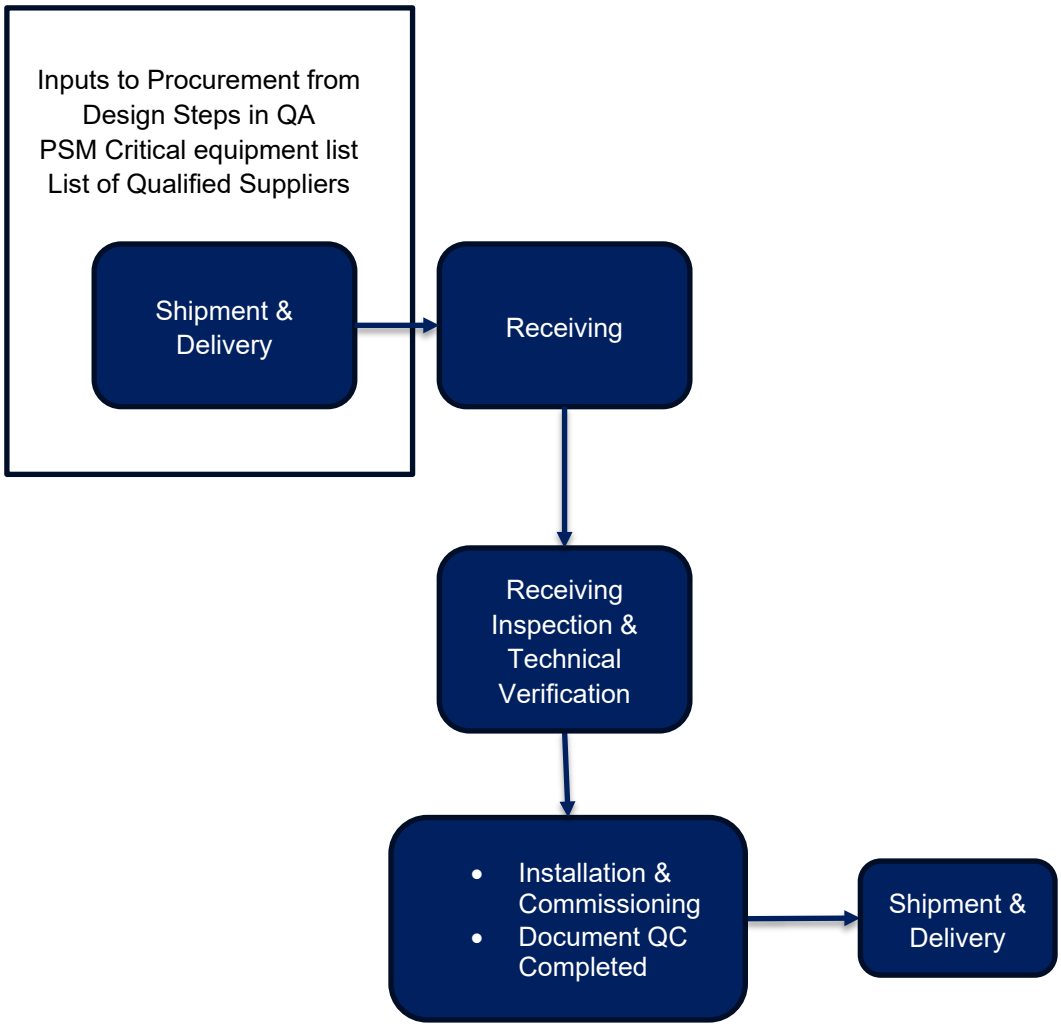


Figure 9: Installation & Commissioning Quality Assurance Steps In QA

7.8.2 Key Actions

7.8.2.1 Establishing the QA Plan

JSW Sites shall develop and authorize a Quality Assurance Plan (QAP) with the Project Leader or Head of Department (HOD) before awarding contracts or purchase orders.

7.8.2.2 Vendor QC Procedures Review

JSW sites shall review and approve the vendor's Quality Control (QC) Procedures, particularly for critical components like hot metal systems and primary pressure containment equipment.

7.8.2.3 QC Inspection Tasks

JSW Sites shall ensure all QC inspection tasks are completed as outlined in the vendor's QC Test Plan.

7.8.2.4 Equipment Suitability Verification

JSW Sites shall confirm that equipment is suitable for its intended service, including material compatibility and adherence to relevant codes (e.g., Indian Standards, ASME, ANSI).

7.8.2.5 Construction and Installation Compliance

JSW Sites shall verify that construction and installation of PSMCE adhere to engineering specifications, codes, and regulatory requirements.

7.8.2.6 Installation Quality Assurance

JSW Sites shall ensure installation tasks meet quality standards.

7.8.2.7 Engineering Change Requirements

JSW Sites shall address and implement any necessary engineering changes.

7.8.2.8 Documentation Collection and Transfer

JSW Sites shall collect and transfer all relevant documents, including:

- Design drawings and calculations
- Design specifications
- Operating and maintenance procedures
- Emergency procedures
- Troubleshooting guidelines

7.8.2.9 Inclusion in QA Program

JSW Sites shall include new PSMCE in the QA program, setting up Inspection, Test, and Preventive Maintenance (ITPM) procedures, defining ITPM intervals, and ensuring personnel competency.

7.8.3 Quality Control of MRO Materials and Services

This section addresses the quality control measures for Maintenance, Repair, and Operating (MRO) materials and services post-project handover.

7.8.3.1 Material Masters for Spares / Materials Associated with PSMCE

Material Description: JSW Sites shall ensure accurate descriptions in SAP material masters.

Linkage to PSMCE: JSW Sites shall connect materials to the PSMCE Bill of Material (BOM) and ensure identification in SAP equipment masters.

Identification of Spares: JSW Sites shall properly denote spares related to PSMCE.

Duplicate Material Codes: JSW Sites shall identify and block duplicate codes.

7.8.3.2 Qualification of Suppliers for MRO Materials and Services

Implement requirements from Contractor Safety Management Standard (JSW/GHS/GS-03) for qualifying suppliers who provide MRO materials and services.

7.8.3.3 Performing Receiving Inspection of MRO Materials and Services

Inspection Templates: JSW Sites shall develop templates for various material categories and upload them in SAP/document server.

Communication of Acceptance Criteria: JSW sites shall share essential parameters and criteria with suppliers.

Competent Inspectors: JSW Sites shall use qualified inspection engineers knowledgeable in measuring tools and NDT techniques.

Service Acceptance: JSW Sites shall define acceptance criteria for MRO services in the scope of work.

Handling Nonconformance: JSW Sites shall document and analyse nonconformance issues, perform Root Cause Failure Analysis (RCFA), and review supplier rejection data.

7.8.3.4 Perform Last Chance Inspection Before Use

Inspection Upon Receipt: JSW Sites shall verify parts/equipment were inspected upon receipt and stored correctly.

Correct Equipment: JSW Sites shall confirm suitability for PSMCE application.

Reporting Issues: JSW Sites shall report non-conformance and develop mitigation plans to prevent recurrence.

7.8.4 Quality Assurance Training and Competence

Formal Quality Assurance Training Framework

Responsibility: Each functional Head of Department (HOD) is responsible for arranging and ensuring adequate quality assurance training and competency for all relevant team members, including direct, associate, BPO, contract, and temporary personnel.

7.8.4.1 Quality Assurance Overview Training

Objective: Introduce quality assurance principles and their importance in ensuring compliance with standards and specifications.

7.8.4.2 Process Safety Awareness

Manufacturing/Utility Process Overview: Focus on quality assurance-related process safety hazards.

Occupational Safety and Health Hazards: Specific hazards related to quality assurance activities.

Emergency Procedures: Procedures relevant to quality assurance issues.

Safe Work Practices: Including permit-to-work and confined space entry, as applicable.

7.8.4.3 Task-Specific Training

Objective: Explain why quality assurance tasks such as tests, inspections, maintenance, and repairs should be performed in specific ways to ensure quality and compliance.

7.8.4.4 Training Development and Delivery

Determine: Whether training is conducted internally or through external partnerships.

Identify: Qualified quality assurance trainers (internal or external).

7.8.4.5 Competency Evaluation

Evaluate and Assess: Trainees according to quality assurance procedures.

Track: Compliance with training and competency requirements using a tracking system.

7.8.4.6 Training Delivery and Evaluating Quality Assurance Competency

Integration: Quality assurance training should be integrated into existing safety and technical training programs to avoid duplication or overlaps.

Assessment: Competency can be assessed through formal written tests or by evaluating field performance. Unsuccessful evaluations should lead to formal repeat training sessions.

7.8.4.7 Refresher Training on Quality Assurance

Frequency: Refresher training for quality assurance tasks shall be scheduled at least once every three years.

7.8.4.8 Training of Temporary Personnel

Training Requirements: Temporary personnel working on quality assurance tasks shall receive appropriate training before performing tasks.

7.9 ELEMENT-9: MANAGEMENT OF CHANGE – TECHNOLOGY

The Management of Change (MOC) element is designed to systematically manage and implement changes to processes, equipment, or systems, ensuring that safety, operability, and compliance are maintained. The MOC process covers three main types of changes: Permanent, Temporary, and Emergency, with further categorization into Technical, Administrative, and People changes.

7.9.1 Types of MOC

7.9.1.1 Permanent Changes

Definition: Changes that result in a lasting alteration to processes, equipment, or systems.

Categories

Technology: Modifications affecting the technical aspects of processes or systems.

Administrative: Changes to procedures, documentation, or administrative processes.

People: Changes related to staffing, roles, or responsibilities.

7.9.1.2 Temporary Changes

Definition: Changes implemented for a finite period, typically for trials, testing, or temporary modifications. Temporary “Changes” are typically part of a test, optimization trial, improvement project or similar Change. Temporary “Changes” are typically planned and executed under normal working conditions.

Categories:

Technology: Short-term changes in technical systems or processes.

Administrative: Temporary procedural or administrative adjustments.

People: Temporary changes in staffing or roles.

All temporary changes shall also be subject to management of change procedure.

7.9.1.3 Emergency Changes

Definition: Urgent changes required to address immediate risks, equipment damage, personnel hazards, environmental violations, or severe economic penalties.

Categories:

Technical: Immediate technical adjustments to mitigate risks.

Administrative: Quick administrative decisions to address the emergency.

People: Emergency changes affecting personnel or their roles.

A short but important list of key people who will do the hazard review shall be maintained. Hazard review (HAZOP/What if) checklist shall be filled up and attached with the emergency change proposal for approval. The authority for determining the change as emergency change, as per above, rests same as per normal.

7.9.2 MOC Process Flow

7.9.2.1 Initiation

Proposer: Any individual can propose changes aimed at improving safety, operability, cost, reliability, quality, or energy savings. Ideally, proposals should be made by individuals with direct knowledge of the affected area, such as plant operators or engineering personnel.

Documentation: All changes shall be accompanied by a written design, drawing, or specification and shall be accompanied with change management form Annexure 4, 5, & 6.

Change Categories

Technical Changes: Additions, deletions, or modifications of engineered components, physical systems, or facilities that may alter performance or function.

Operating Changes: Modifications that significantly impact the technical integrity of engineered systems, components, or operations, including process changes like stream compositions, operating conditions, reaction chemistry, production output, energy balances, and product quality.

Technical Evaluations: Data analysis and evaluations that significantly influence business decisions.

7.9.2.2 Assessment and Risk Evaluation

Change Management Format

To determine if a change falls under the purview of the MOC procedure, use the Change Management Format outlined in Annexure-5. This format is designed to assess the nature of the proposed change and its potential impact.

Assessment Criteria: The format includes a series of questions or criteria that help in identifying whether the change is significant enough to require a formal risk assessment.

Trigger for Risk Assessment: If a “yes” response is given to any of the questions in Annexure-6, it indicates that the change should undergo a formal risk assessment to evaluate potential impacts and ensure safety.

Unintended Changes:

Definition: Any change made without proper planning, such as purchasing incorrect process raw materials, which may adversely impact the process, is classified as an unintended change.

Actions Required: Unintended changes require immediate corrective actions to address and mitigate any negative impacts. These actions should be documented and managed under the MOC process.

Documentation: The details and actions related to unintended changes will be captured and reviewed according to the guidelines provided in Annexure-6.

7.9.2.3 Hazard Review

Review Purpose: The hazard review ensures that the change does not compromise plant safety and integrity while achieving its economic goals.

Review Process: The same team responsible for techno-economic feasibility also reviews safety and integrity aspects. This review is conducted through structured methods like HAZOP or What-If analyses.

HAZOP study team shall be a multi-disciplinary team and shall be trained in carrying out such activities. All HAZOP studies shall be the responsibility of the HODs / Line Managers of respective departments. All process modifications and new facilities shall warrant a HAZOP study.

Based on the risks identified, appropriate changes to procedures and practices shall be brought out and documented as applicable. The responsibility for this as well as identifying personnel for skill updating training shall be that of the concerned HODs.

7.9.3 Review and Approval of MOC

The MOC shall pass through the following heads for review:

- Process Head (where change is happening)
- Mechanical Head
- Quality Head
- Electrical & Instrumentation (E&I) Head
- Safety Head

7.9.3.1 Approval Authority

- For high-risk or legally impactful changes, the Site President shall approve.
- For other changes, the Site COO is the approver. If the COO is unavailable, the Plant Head will sign the MOC.

7.9.4 Implementation and Verification

7.9.4.1 Physical Verification

Operation, Mechanical, Electrical, and Instrumentation teams, along with Safety and Environmental representatives, shall verify job status and update relevant technical documents, including plot plans, P&IDs, and specifications.

7.9.4.2 Risk Management

If the risk introduced by the change cannot be reduced to a level as low as reasonably practicable (ALARP) through controls, the change will not be authorized. An alternative solution shall be identified.

If risk can be mitigated to ALARP levels, the change will be authorized. Implementation plans shall outline corrective actions, accountabilities, responsibilities, timescales, resource requirements, and performance measures.

7.9.4.3 Document Updates

HODs are responsible for verifying updates to work instructions, risk assessments, and environmental records.

Relevant technical documents, such as plot plans, P&IDs, and specifications, shall be updated by the concerned departments.

7.9.4.4 Supervision and Implementation

The Area In-charge and their team, who raised the MOC request, are responsible for supervising and implementing modifications. The operations and concerned departments handle commissioning activities.

7.9.5 Documentation and Tracking

7.9.5.1 Change Control Forms

All approved Change Control Forms shall be stored in the system available to respective departments for reference and tracking.

7.9.5.2 Implementation Program

Based on the risk assessment and outcomes, an implementation program should be developed, incorporating significant risks into departmental and company objectives and targets.

Documentation and Record Keeping:

All records related to the MOC process shall be retained along with Process Technology (P.T.) documents for future reference and compliance.

7.10 ELEMENT-10: MANAGEMENT OF CHANGE – PERSONAL

7.10.1 Essential features

7.10.1.1 Maintaining minimum levels of direct process experience

Site shall develop and implement criteria and guidelines regarding MOC-P to help ensure that minimum levels of specific, direct, process experience and minimum levels of staffing, knowledge, and skill in managing process safety are maintained within vital PSM roles and functions.

At a minimum, experience, knowledge, and staffing criteria and guidelines shall be applied to the following vital PSM roles and functions that have been established within the site:

- Site managers
- Operations line management, including first line supervision
- Technical personnel (e.g., technology guardians, area process and maintenance engineers, process control engineers, E&A engineers, DCS engineers)
- PSM and SHE leaders and specialized resources (e.g., PHA leaders and facilitators, layer of protection analysis [LOPA] resources)
- Site Asset integrity or QA leaders
- Maintenance resources, including reliability engineers, planners, and schedulers
- Operators and service workers
- Mechanical, E&A technicians
- Equipment inspectors and examiners (e.g., non-destructive evaluation)
- Training and development specialists and resources
- Contract field coordinators
- Emergency response team and crisis management personnel (see JSW Site On-site Emergency Response Planning)
- Non-JSW Site personnel who perform vital PSM roles (e.g., engineering designers, long term contract maintenance supervisors, or JSW Site retirees in technology support roles)

Site management shall adhere to pre-established criteria and guidelines for MOC-P. Individual staffing level changes that may impact process safety shall be evaluated to assess potential effects on the safety of operations and to maintain personnel expertise.

Changes to operator staffing levels within each process area shall include an assessment and documentation of the capability of operators to perform the following:

- Safely complete all critical tasks, operating procedures, and safe work practices
- Detect and diagnose a hazardous scenario (e.g., staffing of control rooms)
- Control or recover from a hazardous scenario, including emergency communications, process shutdown, and emergency response

7.10.1.2 Analysis and reassignment of personnel with specific process safety management skills, knowledge, and roles

Site shall develop and implement procedures to conduct periodic reviews of PSM resource needs based on existing or anticipated skills, knowledge, site PSM initiatives, leading indicators (e.g., metrics), and workload balance. This review shall include an analysis of immediate-, short-, and long-term PSM resource developmental or replacement needs.

Incumbent personnel who are exiting key PSM roles due to transfer, reassignment, retirement, or other personnel changes may possess critical PSM-related skills, roles, knowledge, and capabilities that should be reassigned or developed in new or existing site personnel. Sites shall develop and implement procedures to analyse and document critical PSM skills that should be reassigned or developed as a result of changes to incumbent personnel. These analyses shall be conducted prior to the incumbent departure and completed by the line organization with input from site PSM resources as necessary. These skills shall involve, but are not limited to, the following specific areas of PSM expertise where applicable.

Note: Other special skills not listed for vital PSM roles may also apply and shall be considered.

- PHA leadership and facilitation (including LOPA facilitation)
- PT development and maintenance
- Consequence Analysis
- Quantitative risk analysis Certifications or specialized skills for tests and inspections or reliability engineering

- Equipment QA tests and inspections or repairs (including welding)
- Incident investigation and root cause analysis (RCA)
- SIS competency, including evaluation, design, operation, maintenance, and testing of Safety Instrumented Systems
- Emergency response site incident controller
- Site PSM leader
- Fire safety systems management resource

Site shall also develop and implement procedures to analyse and manage open or incomplete PSM-related individual work activities that should be reassigned as a result of changes to incumbent personnel prior to their departure and to help ensure timely completions of open actions. These procedures shall include

- Corrective action items assigned within the site tracking system (e.g., incident or PHA recommendations).
- Open or incomplete PSM activities (e.g., facilitation of cyclic PHAs, PSM-related annual objectives, scheduled audits, MOC-T/F, process incident investigation reports, and procedure reviews).
- Access and updates to electronic databases or participation in PSM networks.

7.10.1.3 Newly assigned personnel in vital process safety management roles and functions

Site shall provide appropriate and specific PSM-related training to site leadership, line management, technical personnel, reliability engineers, operators, mechanics, and support personnel newly assigned to processes involving hazardous substances or associated energies. Such training shall address the following elements:

- Principles and essential features of PSM
- An overview of significant past site process safety incidents (history) as applicable
- PT, major process hazards, hazardous process event and emergency plans, and PSM layers of protection and mitigation devices specific to the operation
- Roles, responsibilities, and site-specific PSM program procedures and practices, including MOC-T, MOC-F, incident investigations, PSM metrics and action item tracking, PSM critical equipment management, and emergency response.

Line management, including operating supervision, technical personnel, R&D, maintenance supervision, reliability engineers, and in-charge for the contractor personnel, newly assigned to processes involving hazardous substances and energy should be developed and demonstrated a minimum degree of proficiency within a period not to exceed three months. Completed MOC-P competency demonstrations shall be reviewed by the employee's supervisor and the site PSM leader to help ensure the employee can demonstrate the minimum knowledge and proficiency for their role.

For newly assigned site managers, the following additional requirements shall be implemented:

- Head O&M will participate in induction of new site managers in PSM from time to time.
- A formal knowledge demonstration with a panel of experienced technology, Asset Integrity or Quality Assurance, and PSM/ SHE resources shall be completed and shall include the following:
  - Current PSM program status
  - Plant resources, experience, and capabilities related to process safety
  - Unique site and community issues

A supplemental MOC-P training and competency demonstration process shall be conducted within three months for new operations, technical, maintenance, and support personnel assigned to or in direct support of unit operations.

The date, method (e.g., written test, oral panel, or field demonstration), and results of the proficiency demonstration, including approvals to confirm successful knowledge demonstration, shall be documented for each newly assigned individual.

In addition to the individual three-month proficiency demonstrations, the site line management shall review and document the current skills, knowledge, capabilities, and qualifications of newly assigned personnel in key PSM roles. The site line management shall also develop a long-term training and targeted development plan

where gaps or skill development needs are identified to maintain resources and knowledge to manage process-related risks. This development plan shall be documented within the first three months of assignment, tracked, and reviewed annually with updates, as necessary, until the training plan is fully completed.

7.10.1.4 Changes in site functional or organizational structures

When significant changes occur to site operations, support functions, organizational structures, or regulatory requirements that can impact existing PSM programs, a review of the potential PSM effects of these changes shall be completed and approved by site leadership prior to the change. When these changes impact the PSM program, a plan of action shall be developed, documented, and tracked to closure in order to mitigate potential negative impacts. Organizational changes to site operations include, but are not limited to, centralization or decentralization of functional groups, consolidation of independent operating groups, consolidation of vital PSM roles, migration to new PSM-related data management systems, or expanded use of external contracting services.

The analysis and action plan shall be used to evaluate and identify any potential changes or impacts on the site or unit PSM program, including, but not limited to, the following:

- Personnel changes, including staffing levels, skills, knowledge, and job-related competency, or reallocation of roles and responsibilities that affect process safety
- Revision of written PSM programs, policies, and procedures
- Performance metrics and data management (tracking) systems
- Coordination and interface of specific PSM elements (e.g., training, written procedures, first- and second-party auditing, and/ or incident investigation)

7.11 ELEMENT-11: MANAGEMENT OF CHANGE – FACILITY

The management of facility changes within Process Safety Management (PSM) requires a structured approach to ensure safety and mitigate risks associated with modifications to facilities. This process is crucial for maintaining safe operations and involves several key steps:

Initial Evaluation: Begin by thoroughly evaluating proposed changes to understand their potential impact on process safety. This step involves assessing the nature of the modification and its implications for existing safety systems and protocols.

Risk Assessment: Conduct a detailed risk assessment to identify any new or altered hazards introduced by the change. This assessment helps in determining the necessary controls to manage these risks effectively.

Approval Process: All proposed changes shall be reviewed and approved by relevant stakeholders. This approval process ensures that all safety considerations have been addressed and that the change aligns with safety standards and regulations.

Documentation: Meticulously document the change, including the rationale behind it. Proper documentation ensures an accurate record of what modifications were made and why, which is essential for future reference and audits.

Implementation: Carry out the change according to a well-defined plan. This includes updating safety measures and procedures to reflect the modification. A key aspect of implementation is ensuring that affected personnel are trained on the new procedures or equipment.

Post-Implementation Review: After the change has been implemented, conduct a review to verify that the modification has been effective and has not introduced new safety issues. This step helps in confirming that the change has achieved its intended outcomes without compromising safety.

Communication: Throughout the entire process, effective communication is vital. All involved parties should be kept informed and prepared for the changes to ensure a smooth transition and maintain safety.

Examples of Facility Changes Requiring Review

Subtle Equipment Changes: Modifications such as rerouting piping systems, temporary piping supports, or replacing sections of insulation may have unintended safety consequences and should be reviewed carefully.

Administrative Changes: Adjustments in personnel occupancy levels, rescheduling turnarounds, or modifying maintenance practices also require review. For example, changing from 50-lb paper bags to a 500-lb plastic bulk container for raw materials could increase electrostatic risks, and adjustments in packaging practices need to be assessed for potential hazards.

Operational Adjustments: Operating a process with a known leak or non-functioning safety device on a short-term basis requires careful evaluation to manage associated risks until a full repair can be made.

Infrastructure Changes: Temporary road closures impacting emergency vehicle access or construction affecting facility siting should also be reviewed to ensure they do not compromise safety or emergency response capabilities.

7.12 ELEMENT-12: INCIDENT REPORTING AND INVESTIGATION

7.12.1 Objective

To ensure timely reporting, thorough investigation, and effective resolution of all incidents and high-potential occurrences, thereby maintaining a robust safety management system and fostering a culture of continuous improvement and transparency.

7.12.2 Reporting Procedures

Follow below reporting flow/ guidelines for different categories of incidents

Incident Information Protocol - Fatality

Reporting Flow	Time Frame	Action	By whom	To Whom - Steel	To Whom- Other Businesses
Preliminary Information	Immediate	Communicate via phone/SMS	Site President/ Site COO/ Site Unit Head	Mr. Parth Jindal, JMD, COO, CHRO, Group Safety Head and GSC Members	Mr. Parth Jindal, JMD, COO, CHRO, Group Safety Head and GSC Members
		Communicate via phone/SMS	Site H&S head	Group Safety Head and HR Head	Group Safety Head, Business Corporate Safety Head and HR Head
Video clip	Immediate	Upto 2 minutes video clip of the actual incident site/ spot/ scenario	Site H&S head	Group Safety Head and HR Head	Group Safety Head, Business Corporate Safety Head and HR Head
FIR	0 - 8 hrs	First Information Report (FIR) through e mail as per template	Site President/ Site COO	Mr. Parth Jindal, JMD, COO, CHRO, Group Legal Head, Group Safety Head, CSO and GSC Members	Mr. Parth Jindal, JMD/ CEO, COO, CHRO,Business Legal Head, group Legal Head, Group Safety Head, Business Corporate Safety Head, CSO and GSC Members
		This FIR to be submitted in E mail body (Do not send as an attachment)			
	0 - 24 hrs	First Information Report (FIR)	Group Safety Head	All business CEO/ COO and Sub-Committee Chairmans and Business Corporate Safety Heads of other businesses	All business CEO/ COO, Sub-Committee Chairmans and Business Corporate Safety Heads of other businesses
	Within 24 hrs	Report in 'MySetu'	Head of the Department	As per 'MySetu'	As per 'MySetu'
		(as per approved FIR)			

Incident Information Protocol - LTI and HIPO

Reporting Flow	Time Frame	Action	By whom	To Whom - Steel	To Whom- Other Businesses
Preliminary Information	Immediate	Communicate via phone/SMS	Head of the Department	Site H&S head and HR Head	Site President/ Unit Head/ Site COO/ Site H&S head and HR Head
		Communicate via phone/SMS	Site H&S head	Group Safety Head and HR Head	Group Safety Head, Business Corporate Safety Head and HR Head
Video clip	Immediate	Upto 2 minutes video clip of the actual incident site/ spot/ scenario	Site H&S head	Group Safety Head and HR Head	Group Safety Head, Business Corporate Safety Head and HR Head
FIR	0 - 24 hrs	First Information Report (FIR) through e mail as per template	Site President/ Site COO/ Site Unit Head	Group Safety Head, Business CHRO, COO & WTD -Steel	Group Safety Head, Business CHRO, COO
		This FIR to be submitted in E mail body (Do not send as an attachment)			
	Within 24 hrs	Report in 'MySetu'	Head of the Department	As per 'MySetu'	As per 'MySetu'
		(as per approved FIR)			
Health Status Update	Every Day	Based on Hospital Report	By Company Doctor and Site H&S Head	Group Safety Head and HR Head	Group Safety Head, Business Corporate Safety Head and HR Head

Incident Information Protocol - RWC

Reporting Flow	Time Frame	Action	By whom	To Whom - Steel	To Whom- Other Businesses
Preliminary Information	Immediate	Communicate via phone/SMS	Head of the Department	Site H&S head and HR Head	Site President/ Unit Head/ Site COO/ Site H&S head and HR Head
		Communicate via phone/SMS	Site H&S head	Group Safety Head and HR Head	Group Safety Head, Business Corporate Safety Head and HR Head
Video clip	Immediate	Upto 2 minutes video clip of the actual incident site/ spot/ scenario	Site H&S head	Group Safety Head and HR Head	Group Safety Head, Business Corporate Safety Head and HR Head
FIR	0 - 24 hrs	First Information Report (FIR) through e mail as per template	Site H&S head	Group Safety Head and HR Head	Group Safety Head, Business Corporate Safety Head and HR Head
		This FIR to be submitted in E mail body (Do not send as an attachment)			
	Within 24 hrs	Report in 'MySetu'	Head of the Department	As per 'MySetu'	As per 'MySetu'
		(as per approved FIR)			

Incident Information Protocol - MTC and FAC

Reporting Flow	Time Frame	Action	By whom	To Whom - Steel	To Whom- Other Businesses
	Within 24 hrs	Report in 'MySetu'	Head of the Department	As per 'MySetu'	As per 'MySetu'
		(as per approved FIR)			

7.12.3 Investigation Procedures

7.12.3.1 Investigation Team Formation

The investigation team is responsible for categorizing incidents and conducting investigations based on those categories. This includes defining classifications such as near misses, minor incidents, major incidents, and recurring incidents.

Categories of Incident and their investigation team

- **Categories 5**: Fatal, Major Fire, High Potential or Dangerous occurrence and Property Damage Incident

  Investigation Team: For fatal incidents, a high-level investigation committee shall be formed by the respective business head. This committee will include the concerned business safety resource (s), process expert from different location, and at least one member from Group Safety. For other cat 5 incidents investigation team formation recommended similar to Fatal.

- **Categories 4**: Lost Time, Property Damage and Fire incident

  Lost Time Injurie Investigation Team: Investigations of lost time injuries shall be led by the Head of Department (from a different department than where the incident occurred), Site safety head and will involve the section In-charges.

- **Categories 3, 2 & 1**: RWC, MTC, FAC and Minor Fire incident

  Investigation Team: For minor incidents, the investigation shall be led by the Head of Section (from a different department than where the incident occurred) and will involve the relevant engineer, supervisor, and the Site Safety Head to facilitate the process.

  All categories incident recommendation shall be presented to unit APEX for their compliance status.

  CAPA as shared by the group will be complied by different department heads assigned as responsible.

7.12.3.2 Investigation Process

Initial Response and Reporting: Ensure an immediate response to the incident and initiate a preliminary report.

Formation and Role of Investigation Team: Assemble a qualified investigation team and outline their roles and responsibilities.

Information Gathering: Collect relevant information from the incident site, including witness interviews, equipment drawings, and design details.

Procedure Review: Evaluate the procedures that should have been followed and assess their level of adherence.

Causal factors and Root Cause Analysis: Identify causal factors and root causes related to equipment, infrastructure, human factors, and processes, and determine why the business management system failed to prevent the incident.

Corrective and Preventive Actions: Develop a list of possible corrective and preventive actions and make recommendations for their implementation within a specified timeframe.

Communication of Findings: Communicate investigation findings to all relevant parties.

Action Tracking: Use the online digital platform tracking module to monitor the implementation of recommended actions and ensure their effectiveness.

Incidents shall be investigated in a timely manner, with accountabilities assigned and progress on recommended actions shall be monitored until close-out. Incident (including near miss, Fire, Property damage,

process incident etc.) up to the severity of Lost Time Injuries investigation shall be completed within 01 week whereas Fatal and High Potential incident shall be completed within 21 days.

7.12.3.3 Methodologies and Tools

Utilize appropriate investigation methodologies and tools, such as the Why-Why Tree, to analyse incidents. These tools help identify physical, human, procedural, or systemic causes and establish effective preventive measures.

7.12.3.4 Lessons Learned and Communication

Dissemination of Lessons Learned

Corrective Actions: Implement and document any changes in procedures resulting from corrective and preventive actions. Ensure that lessons learned are communicated to relevant personnel and contractors.

Communication System: Establish a communication system within the Group and respective business units to inform employees about incident summaries and key learnings, particularly for Category 5 (fatalities) and Category 4 (lost time injuries) incidents.

7.12.3.5 Continuous Improvement

Review and Feedback: Regularly review incident reports and investigation outcomes to improve safety practices and prevent recurrence. Encourage feedback from employees to enhance the incident reporting and investigation process.

7.13 ELEMENT-13 : EMERGENCY PLANNING AND RESPONSE

An emergency is a sudden, urgent, usually unexpected occurrence or event requiring immediate action, Emergency management is the overall approach for preventing emergencies and managing / mitigating from the aftermath effects.

Training employees on emergency planning and response procedures is essential to ensure their readiness and effective actions during emergencies. By providing comprehensive training, Business Unit equip employees with the necessary knowledge and skills to manage various emergency situations, such as natural disasters, fires, chemical spills, or medical emergencies.

The following activities are the minimum requirements to achieve the element performance

expectations:

- Develop a written site-specific emergency management plan that specifies all of the activities that support this element including actions to protect and account for employees, contractors, and visitors.
- Define the scope of the emergency response plan including the physical scope, types of emergencies considered, and define roles and responsibilities.
- Designate a single person who has overall responsibility for the facility’s emergency management.
- List accident scenarios that represent the range of consequences identified in previous hazard identification and risk assessment work activities.
- Establish unit or building preplans that address the range of accident scenarios that have been identified.
- Establish a mutual aid scheme involving relevant third parties and external emergency services.
- Based on the plans that are developed, provide the facilities and equipment necessary to execute the plans including equipment for emergency communications.
- Ensure Adequate numbers of competent personnel are available to fulfil the defined roles in the emergency plans.
- Identify emergency response and evacuation equipment, including required inspections, tests, and other preventive maintenance or replacement activities, and establish a system to ensure that equipment is properly maintained and tested.

- Train incident commanders and all Emergency Response Team (ERT) members on all of the skills needed to mount an emergency response or rescue effort effectively and safely.
- Ensure that all personnel are aware of the emergency response program, understand the actions to take in an emergency, and know how to recognize and report an emergency.
- Train managers and technical personnel who take an active role in emergency management, but who do not direct or actively participate in the tactical response.
- Maintain emergency response plans current and accurate, and periodically review the plans.
- Periodically conduct drills to assess the effectiveness of the plan and state of readiness of the Emergency response team and conduct tabletop exercises or other actions to train managers and other personnel who would help manage the crisis.
- In addition to exercises and drills, periodically evaluate the emergency management plan to ensure that all of the elements required to maintain a dependable practice are in place and remain effective.
- Record any deficiencies or recommendations for improvement resulting from exercises, drills, assessments, and audits; resolve them into action plans, and implement the action plans.
- Ensure that element compliance and performance trends are reviewed by specified levels of management.

During emergency situations, the following protocol will be observed:

- Form an emergency task team involving appropriately trained and qualified operators or maintenance, Fire & Rescue and other relevant team members as per site specific operations.
- The emergency team evaluates the safety and environmental implications of the required action.
- If deemed safe, proceed with the necessary measures.
- Immediately complete the Management of Change (MOC) form after the emergency to document the implemented changes.

Each JSW Business and site shall develop a detailed emergency preparedness and response plan to effectively manage potential emergency situations, guided by the risks identified through the risk evaluation process. This plan should include:

- A defined organizational structure to manage emergencies.
- Internal and external communication systems.
- Training programs for all stakeholders.
- Mock drill plans to assess the ongoing suitability of preparedness measures.

Moreover, the plan should outline detailed procedures for implementation, clearly delineating the roles and responsibilities of individuals according to defined organization structure.

The training encompasses various aspects, including evacuation procedures, communication protocols, first aid techniques, use of emergency equipment, and roles and responsibilities during emergencies. By enhancing employees' preparedness through training, JSW strengthens their capability to respond swiftly, mitigate risks, and safeguard the well-being of employees, visitors, and the local community. For further details, please refer to JSW's emergency planning and response procedure.

7.14 ELEMENT-14: AUDITING

Objective: To ensure that each site adheres to the PSM standard and continuously improves its safety management system by conducting thorough audits.

The site should establish and maintain a first-party Process Safety Management (PSM) audit program that includes regular audits of all process units, ensuring alignment with the key elements of this standard. These audits should also verify compliance with local laws and regulations. The PSM audit program should evaluate system implementation, performance, and the effectiveness of all PSM components, highlighting leadership, management, and operational commitment across all JSW units. An annual first-party PSM audit is mandatory, following documented protocols, and should apply appropriate data sampling methodologies based on

population size. Audit teams shall include trained personnel expert in PSM principles and technical aspects, with additional experts involved for specialized equipment audits.

Results should be documented, reviewed by the site's PSM sub-committee, and actions for addressing findings should be recorded. Audit records shall be maintained for at least five years, with provisions for electronic documentation and corrective action linkage where applicable.

Audit Program Requirements:

Program Development:

Develop an audit program that includes scope, scheduling, staffing, resolution of recommendations, and documentation.

Roles and Responsibilities:

- Establish an audits element owner.
- Define roles and responsibilities for the audit team.

Audit Protocols and Training:

- Develop and review audit protocols for each element.
- Define required skills for audit team members.
- Provide necessary training to audit team members.
- Audit Independence and Scheduling:
- Ensure auditor independence and implement controls to avoid conflicts of interest.
- Establish baseline audit schedules and identify triggers for additional audits.

Team Selection and Preparation:

- Select and assign audit team members based on expertise and availability.
- Distribute relevant information to team members for preparation.

Audit Planning and Execution:

- Plan audit activities and prepare the onsite agenda.
- Gather data through records review, observations, and interviews.
- Assess strengths, weaknesses, and gaps relative to established requirements.

Reporting and Follow-Up:

- Report preliminary findings in periodic meetings.
- Conduct an audit close-out meeting.
- Prepare and issue a draft report, followed by a final report after review.
- Develop an action plan to address findings, assign responsibilities, and set deadlines.
- Follow up to ensure resolution of recommendations and document outcomes.

Ongoing Improvement:

- Monitor process safety element performance over time and identify weaknesses.
- Implement enhancements through corrective actions.
- Share best practices and strengths with other facilities.

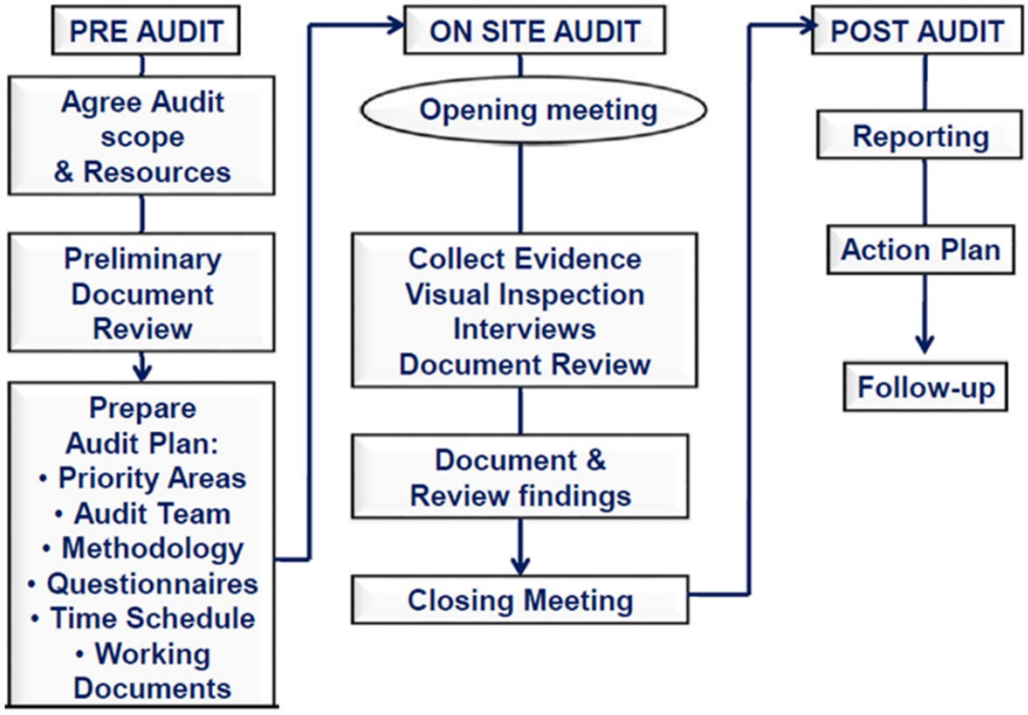


Figure-10: Typical Audit Flow Chart

8. RACI MATRIX

PSM Element	Section In-charge	Head Maintenance	Head of Department	Head Operations	PSM Subcommittee
Element-1 Process Technology	A	C	R	C	I
Element-2 Process Hazard Analysis	I	C	R	A	C
Element-3 Operating Procedures	I	R	A	C	C
Element-4 Training	I	R	A	C	C
Element-5 Contractor Safety Management	R	C	C	A	I
Element-6 Prestart up safety review	I	C	R	A	C
Element-7 Asset integrity	I	A	R	C	I
Element-8 Quality Assurance	R	C	A	C	I
Element-9 Management of Change-Technology	C	C	R	A	I

Element-10 Management of Change – Personal	R	C	A	C	I
Element-11 Management of Change – Facilities	R	C	A	C	I
Element-12 Incident Reporting and Investigation	R	C	A	C	I
Element-13 Emergency Planning and Response	R	C	A	C	I
Element-14 Auditing	I	I	R	A	C

RACI chart

R: Responsible: People who are expected to actively participate in the activity and contribute to the best of their abilities.

A: Accountable: The person who is ultimately responsible for the results.

C: Consulted: People who have the specific expertise and can contribute to decision making.

I: Informed: People who are kept informed, but do not necessarily participate in the effort.

9. MANAGEMENT OF RECORDS

To ensure the effective implementation and monitoring of Process Safety Management (PSM), JSW sites shall maintain comprehensive and accurate records. These records enable traceability, regulatory compliance, and continuous improvement. The following categories of records should be maintained:

- **Incident Records**

  Classification Details: Comprehensive records of incident classifications, including the impact, consequence, and any loss of containment.

  Classification Criteria: Documentation of criteria used for classification, along with any updates or changes made over time.

- **Investigation Records**

  Detailed investigation reports specifying the level of investigation, findings, and approved corrective or preventive actions.

  Approvals: Documentation of approvals from the site's PSM leader for investigations, recommendations, and actions.

- **Audit Documentation**

  Internal Audit Records: Plans, scopes, and schedules of internal PSM audits.

  Findings and Evaluations: Records of audit findings, including compliance assessments, effectiveness evaluations, and gaps identified.

  Follow-Up Actions: Documentation of actions taken to address audit findings, including their status and resolution timelines.

- **Meeting Documentation**

  Agendas and Minutes: Meeting agendas and minutes for review teams, PSM committees, and Subcommittee meetings to capture decisions, discussions, and follow-ups.

- **Performance Metrics**

  Performance Data: Records of key safety performance indicators (KPIs) and trends, enabling the monitoring of system effectiveness and continuous improvement.

All records shall be retained in accordance with the site's record retention policy and be readily available for review during audits, inspections, or performance evaluations.

10. LEGAL AND OTHER REQUIREMENTS

JSW site shall access, identify, evaluate, and keep up to date the Safety Management System requirement as per prevailing law in operation.

11. KEY PERFORMANCE INDICATORS

To ensure conformance to the requirements of this Standard, the element wise indicative list of KPI's is captured in Annexure 8. JSW Business/site shall refer the same and device site specific KPI's for evaluating the business/site performances against PSM standard expectations.

12. ASSURANCE

Each site shall conduct self-assurance program to ensure compliance with this STANDARD as part of its Safety assurance program. Third party system audit shall be conducted by Group Safety or external consultants to ensure compliance with the standard.

13. DEFINITIONS

Term	Definition
Accident	An incident in which, there is actual undesirable consequences (e.g., adverse impact on people, property, the environment, or the business).
Administrative controls	Procedures for directing and/ or checking human performance on a plant or process task (e.g., vessel entry, hot work permits, lockout/ tag out procedures).
As Low as Reasonably Practicable (ALARP)	Means to reduce a risk to a level which is as low as reasonably practicable and involves balancing reduction in risk against the time, trouble, difficulty and cost of achieving it. This level represents the point, objectively assessed, at which the time, trouble, difficulty and cost of further reduction measures becomes unreasonably disproportionate to the additional risk reduction obtained. To demonstrate achieving ALARP concept, organization may be required to perform full quantification of risk through Quantitative Risk assessment (QRA) in addition to cost benefit analysis (CBA).
ALARP demonstration	The procedure by which an ALARP case is confirmed through an appropriate Cost / Benefit Analysis.
Area at risk	The geographical zone in which potential consequences from a hazardous event could exceed a defined level of harm, selected as the consequence evaluation criterion.
Asset Integrity	The ability of an Asset to perform its required function, effectively and efficiently in order to achieve business objectives, safeguarding people, environment, asset and Company reputation.
Basic Process Control System (BPCS)	A collection of measurements, control and sequential functions, final control elements, alarms, and process interlocks that normally maintains the process operation within acceptable operating limits
Blast	A transient change in gas density, pressure, and velocity of the air surrounding an explosion point. The initial change can be either discontinuous or gradual. A discontinuous change is referred to as a shock wave, and a gradual change is known as a pressure wave.
Blast wave	Overpressure wave traveling outward from an explosion point; a generic term used to describe both shock waves and pressure waves.
Block Diagrams (BDs)	It represents the simplest form of flow sheet which sets the basic concept of the process. They show only what each step has to achieve but not how it is done.
Barriers	Barriers are the tangible Plant, Process, People risk reduction measures that are intended to prevent the incident occurring and/or control its impact or frequency and/or mitigate its effect on people, the environment, or our business.
Catastrophic	Instantaneous release of total inventory of hazardous material/ energy. Generally affecting a large number of persons, major damage to asset and environment.
Cause (of a Risk Event)	Uncertainties (in conditions, circumstances, choices, practices or activities) that could lead to a Risk Event occurring. Cause(s) are the source of a risk and could be internal or external to Oil and Gas Holding Companies and its Subsidiaries and Affiliates.
Consequence	The potential effects of hazards on people, property, the environment, the community, business, and the company's reputation. Consequences represent the direct, undesirable results of an accident sequence, typically involving incidents such as fire, explosion, or the release of toxic materials.
Consequence analysis	The development of potential scenarios describing hazardous events that may occur due to loss of engineering or administrative controls and the evaluation of resulting impact on site personnel, off-site communities, and the environment. Consequences are analysed independently of the event's probability or frequency of occurrence.
Controls, safeguards, and barriers	These terms are often used interchangeably to describe the layers of protection in-place or proposed that either prevent an undesirable event prior to its occurrence or mitigate the consequences of such an event.
Control room	A continuously occupied room from which a process is monitored and controlled.

Term	Definition
Decision analysis	The process of evaluating decision options and deciding what reasonable options to implement to further reduce or mitigate risk.
Design intent	Definition of how the plant is expected to operate in the absence of deviations.
Deviations	Departures from the design intention are discovered by systematically applying the guide words to process parameters (flow, pressure, etc.) resulting in a list for the team to review (no flow, high pressure, etc.) for each process section.
Emergency Control Centre (ECC)	A centralized facility where designated personnel coordinate emergency management functions.
Emerging Risk	Risks identified during the operational phase that require further assessment.
Endorsement	The process of obtaining formal support for risk management measures and resources required for continued operations.
Engineering controls	Systems or interlocks involving the operation of physical components (e.g., sensors, transmitters, valves, or other control elements) without human intervention (i.e., “automatically”).
Episodic release	A release of limited duration, usually associated with an accident.
Ergonomics	The scientific study of the relationship between humans and their working environment; the application of knowledge relating human performance (physiology, anatomy, psychology) to the improvement of the work system by properly matching the demands of tasks to the capabilities and limitations of humans.
Explosion	A release of energy that causes a blast.
Explosion hazard zone	A portion of a facility where analysis indicates the credible potential for buildings to be exposed to an explosion side-on overpressure of 0.3 bar or greater.
Facility	The physical structure or area within which a given process or process segment is operated. It includes any plant, R&D operation, pipeline, distribution point (e.g., warehouse and tank farm), or other plant operation.
Facility Owner	A senior member of line management (e.g., area manager, operations superintendent).
Facility siting	The activity of designing, locating, and evaluating buildings relative to hazardous processes, for the purpose of protecting personnel and/or critical equipment from the effect of fires, explosions, and/or toxic releases.
Failure Mode and Effects Analysis (FMEA)	A qualitative hazard evaluation method in which all the known failure modes of components or features in a system or process are analysed in turn for undesired outcomes.
Failure of a Control	The non-occurrence or defective occurrence of an intended action or event.
Fire	A combustion reaction accompanied by the evolution of heat, light, and flame.
Fireball	A burning fuel/air cloud whose energy is emitted primarily in the form of radiant heat. The inner core of the cloud consists almost completely of fuel, whereas the outer layer (where ignition occurs) consists of a flammable fuel/air mixture. As the buoyancy forces of hot gases increase, the burning cloud rises, expands, and assumes a spherical shape.
Fire hazard zone	A portion of a facility where analysis indicates the credible potential for buildings to receive thermal exposures as a result of direct contact with fireballs, flash fires, or jet fires or exposure to a thermal radiation intensity of 12.5 kw/m2 (66 Btu/ft2/min) or greater.
Frequency	The number of times an event is estimated to occur over a specified period.
Hazard	An inherent property or characteristic of a material, system, or process, that has the potential for causing serious injury to people and/or property or environmental damage.
Hazardous event	Undesired, dangerous release of materials or energy (e.g., toxic/corrosive discharges, fires, and explosions) with potential for causing serious injury to people and/or significant property or environmental damage. It may result from a single unplanned event or sequence of events.
Hazardous substance	Any substance that, when released or ignited, or when its energy is released, can result in death or irreversible human health effects, significant property damage, or significant

Term	Definition
	environmental harm because of the substance's acute toxicity, flammability, explosiveness, corrosiveness, thermal instability, latent heat, or compression.
Higher-hazard Operation (HHO)	Any activity manufacturing, handling, storing, or using hazardous substances that, when released or ignited, can result in death or irreversible human health effects, significant property or environmental damage, or off-site impacts due to acute toxicity, flammability, explosiveness, corrosiveness, thermal instability, latent heat, or compression. Local regulations may add additional considerations for processes in this category. Examples of hazardous substances include the following when their use poses a potential for causing any of the effects listed above: quantities of pressurized fuel gases, flammables, combustibles above their flash points, reactive chemicals, explosives, combustible dusts, materials of highly acute and moderately acute toxicity, strong acids and alkalis, and steam generation.
Impaired Safety Critical Element (SCE)	An SCE that does not fully meet, or may not fully meet, one or more of its Performance Standard criteria. Impairment includes: • SCE overdue maintenance, inspection & testing. • Failed SCE (not meeting the performance criteria). • Degraded SCE (partial failure to meet its functionality). • Unavailable SCE.
Implied cost to avert a fatality	Defined by the net cost of the risk reducing measures divided by the statistical number of potential fatalities averted by the measures. It provides a useful indication of the effectiveness of the safety.
Incident	An unplanned or unusual event, or a series of events and circumstances that resulted in loss of containment and adverse or undesirable safety process, health, fire and environmental consequences. Undesirable consequences related to H&S Incidents include, but are not limited to following Injuries/illnesses, Environmental impact, Impact on public, Property damage, Business interruption, Damage to reputation
Independent Protection Layer	Device, system, or action that can prevent a postulated accident sequence from proceeding to a defined, undesirable endpoint. An IPL is • independent of the event that initiated the accident sequence and • independent of any other IPLs. IPLs are normally identified during the layer of protection analyses.
Individual risk	Combined fatal risks to a named individual. IR takes into account factors such as: • Total risk: The sum of risk contributions from all hazards to which the individual is exposed. • Occupancy: The proportion of time a workgroup individual is exposed to workplace hazards.
Inherently Safer Design	Any approach, process and following action applicable at all levels of design and operation from conceptual design to plant operations having the specific attention to the elimination or significantly reduction of hazards rather than the control of hazards assessed.
Instantaneous release	Escape of a quantity of material over a short time span (typically a few seconds).
Isolated Quantity	quantity of a hazardous substance where its location at the facility is such that it cannot on its own initiate a major incident elsewhere at the facility.
Local Community	This is defined as: • meaning, at a minimum, all persons within a 1 km radius of any point on the perimeter of a Major Hazard Facility (MHF), and • including all persons in an area which might be affected by a major incident occurring at a MHF. The words 'at a minimum' mean the 1 km radius does not mark the extent of the definition. Paragraph (b) may extend the scope of the definition well beyond 1 km in some circumstances.

Term	Definition
Lower-hazard operation (LHO)	Any activity that exclusively manufactures, handles, stores, or uses any substances with low potential for death or irreversible human health effects, significant property or environmental damage or, Off-site impacts, due to toxicity, physical or mechanical hazards, or asphyxiation. Examples of Low-hazard substances include combustibles maintained at temperatures below their flash points, inert cryogenic gases, steam distribution and condensate return systems (all pressures), fuel gases below 5 psig (0.32 atm), materials of low acute toxicity, chronic toxics, and lesser quantities of hazardous substances. Examples of Low-hazard mechanical operations would include high-speed rotating equipment, spinning, rolling, mechanical drying, and solids processing operations.
Loss of Primary Containment	An unplanned or uncontrolled release of any material from primary containment, including non-toxic and non-flammable materials (e.g., steam, hot condensate, nitrogen, compressed CO2, or compressed air) irrespective of whether the material is released into the environment, or into secondary containment, or into other primary containment not intended to contain the material released under normal operating condition. For drilling operations, any unplanned or uncontrolled release to the surface (seabed or ground level) are included.
Major Accident Hazard	A hazard with the potential that if realized, it would lead to major impact to employees' safety, environment, and the business. MAH event could result in: • Multiple fatalities or severe injuries; or • Extensive damage to structure, installation or plant; or • Large-scale impact on the environment (e.g. persistent and severe environmental damage that can lead to loss of commercial or recreational use, loss of natural resources over a wide area or severe environmental damage that will require extensive measures to restore beneficial uses of the environment)." Major accident Hazard could be substances, activities, operations or conditions.
Major Hazard Facility	Any process plant, storage Facility, terminal, pipeline, offshore installation, drilling rig or any other Facility handling or storing dangerous materials that has Major Accident Potential at any time in the course of routine and/or non-routine operations.
Manageability	An expression of the ability to mitigate a threat or leverage an opportunity, demonstrated by creating response plans that are expected to be effective.
Management of change (MOC)	A systematic procedure for the analytical review of changes (including subtle changes) to the documented process technology and/or facilities and/or personnel for consideration of potential hazards being introduced to the process, system, or operation, and their elimination or control.
Material/Safety Data Sheet (MSDS)	The Material Safety Data Sheet (MSDS) is a detailed information bulletin usually prepared by the manufacturer or importer of a chemical that describes the physical and chemical properties, physical and health hazards, routes of exposure, precautions for safe handling and use, emergency and first-aid procedures, and control measures.
Asset integrity	The establishment and implementation of systems and written procedures to maintain the lifecycle integrity of the process equipment for compliance with the PSM Standard. These procedures include a comprehensive set of instructions for the inspection, testing, maintenance and repair of PSM critical equipment.
Mitigation	Lessening of the impact of a hazardous event by reducing the magnitude of the event (e.g., its size or duration) and/or the exposure of people, property, or the environment.
Mothballed	A condition of deactivation, idling for a significant duration, or long-term protective storage of a process or significant segments of an operation for possible future use, or to keep in reserve.
Near miss	An unplanned incident with clear potential for undesirable consequences (e.g., adverse impact on people, property, the environment, or the business), even though no actual consequences occurred.
Occupied	A building is considered to be occupied if the occupancy exceeds that equivalent to two full-time workers (i.e.., 336 person-hours/week). Additionally, any building in which

Term	Definition
	personnel are instructed to remain during an emergency (e.g., a control room) or in which personnel would be expected to assemble during an emergency (e.g., a temporary safe haven) is considered occupied
Occupied buildings	Buildings or parts of buildings that meet the criteria for being considered occupied
Operating procedures	A comprehensive set of instructions for the operation of a process. They should provide a clear understanding of the detailed operating parameters and limits for safe operation in all process modes (e.g., start-ups, normal operation, shutdowns), including an explanation of the consequences of operation outside the process limits and a description of steps to be taken to correct and/or avoid deviations.
Operational discipline (OD)	Deeply rooted dedication and commitment by each member of the organization to carry out each task the right way each time.
Overpressure	Any pressure, above atmospheric, caused by a blast.
Performance Standard	A specification, quantitative or qualitative, of the design characteristics and operational performance required for the Safety Critical Systems (and their contributory safety critical elements) to be used as a basis for design and management of the hazard. It shall, where possible, be expressed in terms of functionality, availability, reliability, survivability and dependency. • "A qualitative or quantitative statement of the required performance of a safety critical element (SCE) that contains the information necessary to validate its effectiveness during design, construction, testing, commissioning, operation and decommissioning".
PHA resource/facilitator	An individual trained and experienced in the application of hazard evaluation methodologies.
Piping & Instrument Diagram (P&ID):	P&IDs show all process pipes and valves (including drains and vents) with numbers and sizes which refer to pipe and valve lists, all pressure relief valves and bursting discs. • The objective of a P&ID is to indicate all service lines, instruments, controls and data necessary for the design groups. • The PFD is the principal source of information for developing the P&ID.
Primary Containment	It is the first level of containment of a fluid, such as a pipe, tank, vessel, truck, rail car, or other equipment designed to keep a material within it, typically for purposes of storage, separation, processing or transfer of gases or liquids. Note: Primary containment for a specified material may comprise a vessel or pipe that is inside another vessel that is also designed as primary containment for a different material; for example, a heating tube is primary containment for fuel gas or fuel oil, even though the tubes may be inside a firebox which is in turn within an oil-water separator.
Process	Any activity conducted by an employer as part of manufacturing / processing steps that involves hazardous material, including any use, storage, manufacturing or handling of these materials.
Process Flow Diagrams (PFDs)	PFD show all major equipment items with descriptions and interconnecting flow lines for process materials. Design flow rates, temperatures, pressures and stream compositions are also shown.
Process hazard	A condition that has the potential to result in a release of, or exposure to, a hazardous substance, or in the release of energy (mechanical or chemical), which in turn can cause serious injury to personnel, significant property damage or significant environmental harm.
Process hazards analysis (PHA)	The application of organized, methodical approaches to identify, evaluate, and control the hazards associated with process facilities. It includes some or all of the following activities: hazard identification, consequence analysis, hazards evaluation, human factors evaluation, facility siting evaluation, inherently safer process evaluation, risk analysis, and development of recommendations.

Term	Definition
Process incident	An incident involving the release of hazardous substances or involving the release of the energy of hazardous substances that directly involves or could involve process equipment and materials, including on-site storage and handling of process materials. Note: personnel safety incidents (e.g., slips; trips; falls; being hit, struck, or crushed by non- process equipment; and hand lacerations of employees associated with either non process equipment or process equipment that is not operating/in use) are not considered process incidents.
Process interlock	A system or function that detects an out-of-limits (abnormal) condition or improper sequence and either halts further action or takes corrective action. A process interlock operates automatically; no operator action is involved. It consists of a sensing function, a control function, and a final control element. A process interlock is generally part of the BPCS and is carried out with the same equipment and the same level of security as normal sequencing and other start and/or stop functions in the BPCS. Process interlock is synonymous with non-safety interlock. Failure of a process interlock does not result in serious injury to personnel or have significant environmental impact. (note: also see safety interlock definition)
Process safety	Safeguarding person, asset and environment from catastrophic and episodic release of hazardous substance or energy arising due to deviation of process parameter beyond the designed limit.
Process safety near miss	An event having the potential for the release of hazardous substances or release of energy that directly involves process equipment, on-site storage and handling of process materials. This includes operating errors, functional failure of safeguards, or failure of process safety management element that could release a hazardous substance from process.
Process safety management (PSM)	Application of management systems and controls (programs, procedures, audits, evaluations) to a manufacturing or chemical process in a way that process hazards are identified, understood, and controlled so that process-related injuries and incidents are prevented.
Process safety management sub-committee (PSMSC)	A site committee charged with developing site process safety management policy and guidelines, auditing implementation of such policy, and providing training to site personnel in the principles and essential features of process safety management.
Process technology (PT)	Documentation of all knowledge and understanding of the following three subject areas: hazards of materials, process design basis and equipment design basis.
Project process hazards analysis	The comprehensive set of process hazards analyses (PHA) and related documentation associated with the execution of projects for the design and construction of capital process facilities, including the following: • Screening PHA and report, • Preauthorization PHA and report, • Detailed PHA(s) and report(s), • Final project safety report, • Pre-start-up safety review
PSM critical equipment (PSMCE)	Components, equipment, or systems whose failure could result in, allow, or contribute to the release of or exposure to sufficient quantities of hazardous substances or their energy (e.g., fires and explosions) that could result in death or irreversible health effects, significant property damage, or significant environmental impact. The PSMCE are identified as per the pt procedure and the list of PSMCE is maintained in the pt package.
Qualitative Risk Assessment	An approximate assessment of risk using knowledge, judgement and analogue information, but without quantitative analysis. Qualitative techniques include the definition of risk, the recording of risk details and relationships, and the categorization and prioritization of risks relative to each other.
Quantitative Risk Assessment	It is a formal and systematic approach of combining actual or estimated numerical values of inputs with an assumed or known relationship between values, using

Term	Definition
	arithmetic or statistical techniques, to determine a range of likely outcomes, or to understand how variance in one or more inputs is likely to affect the outcome. In QRA statistical values are derived for potential loss of life and damage to resources and environment. Note: • These values should never be interpreted as unavoidable and acceptable losses. It should always be recognized that the calculated fatality (or loss) figures are based on experience, statistical failure and incident rates representing an average historical quality of management. Incident investigations usually show that these 'historical' incidents were, with the benefit of hindsight, quite preventable. • QRA is a tool which helps to translate this hindsight into foresight (planning) in order to assist management in deciding the best approach and show ways and means (e.g. improved engineering, procedures, supervision, etc.) to prevent the potential incidents from happening. QRA is not to be used to justify or encourage risk taking.
Reactive risk response	An action or set of actions to be taken after a risk event has occurred (as defined by the trigger condition) in order to reduce or address the effect of the threat or maximize the effect of the opportunity.
Recognized and generally accepted good engineering practices (RAGAGEP)	These practices are defined in consensus codes and recommended industry practices and guidelines (e.g., Bureau of Indian Standard [IS]; American National Standards Institute [ANSI]; American Petroleum Institute [API]; Instrumentation, Systems and Automation Society [ISA]; National Fire Protection Association [NFPA]; American Society of Mechanical Engineers [ASME]; British Standards, Chemical Industries Association [CIA] Publications; Dutch Standards, Nederland's Normalization Institute [NEN]; and China National Standards [CNS]).
Replacement in kind (RIK)	Replacement of an instrument or electrical, piping, or other process equipment component with an identical part or an approved equivalent part.
Risk	The product of the expected frequency (events/unit time) and the consequences (effects/ event) of a single hazardous event or group of hazardous events. Typically, it is used as a measure of potential economic loss or human injury in terms of the probability of the loss or injury occurring and the magnitude of the loss or injury if it occurs.
Risk Identification	Process of finding, recognizing and describing risks. Notes: • Risk identification involves the identification of risk sources, events, their causes and their potential consequences. • Risk identification can involve historical data, theoretical analysis, informed and expert opinions, and stakeholder's needs.
Risk Management	The overall process whereby risk is identified, described, understood and responses to the risks are formulated, justified, planned, initiated, progressed, monitored, reviewed, adjusted and closed.
Risk Management Framework	Set of components that provide the foundations and organizational arrangements for designing, implementing, monitoring, reviewing and continually improving risk management throughout the organization. Notes: • The foundations include the policy, objectives, mandate and commitment to manage risk • The organizational arrangements include plans, relationships, accountabilities, resources, processes and activities. • The risk management framework is embedded within the organization's overall strategic and operational policies and practices.
Risk Management Maturity	A measure of the extent to which an organization formally applies effective and efficient risk management to support decision-making and increase business value.

Term	Definition
Risk Management Measure	A measure or activity intended to reduce the Likelihood (i.e. control or prevention barrier) or Impact (i.e. contingency or mitigation barrier) of a Risk Event or a check that the controls and/or contingencies are working as intended. These comprise: • Existing risk management measures already in place; and • Additional actions intended to improve management of the risk.
Risk Management Process	Systematic application of management policies, procedures and practices to the activities of communicating, consulting, establishing the context, and identifying, analysing, evaluating, treating, monitoring and reviewing risk.
Risk Rating	measure of risk importance, usually using a combination of probability and impact. May be expressed semi-quantitatively or quantitatively.
Risk Reduction	Actions taken to lessen the probability, negative consequences, or both Risk Reduction associated with a particular risk. A semi quantitative analysis includes aspects of both qualitative and quantitative analyses.
Risk Register	A repository for recording risks and risk management information (it could be a software or spreadsheet or database) containing all the risks identified for an organization, along with a description of each risk and a documentation of information relevant to the ownership, assessment and response of each risk. It gives an accurate figure about the status of recommended actions that shall be taken to eliminate / minimize each risk.
Risk Response	Action taken to reduce the probability of a threat arising or to reduce its impact if it were to arise. For an opportunity, the response aims to increase the probability of it arising and to increase its beneficial impact. Proactive risk responses (mitigations) are funded from within the budget, while reactive responses (interventions) are funded from contingency.
Risk Status	At any point in the life of a risk, it is either ‘active’, ‘dormant’, ‘accepted’ or ‘closed’.
Risk Treatment	Process to modify risk. Note: Risk treatment can involve: • Avoiding the risk by deciding not to start or continue with the activity that gives rise to the risk. • Taking or increasing risk in order to pursue an opportunity. • Removing the risk source. • Changing the probability. • Changing the consequences. • Sharing the risk with another party or parties (including contracts and risk financing); and • Retaining the risk by informed decision.
Risk-weighted	The result of impacting one or more outcomes from an uncertainty assessment with risk(s). Risks might take the form of specific losses (i.e., costs), the impact of failure (failure to achieve a goal), or other representations. It is typically expressed in a risk-weighted value such as a Net Risk-Weighted value, an Economic-Risk-Weighted-Resource value, (or various other risk-weighted parameters), and/or by impacting the probability intercept of a cumulative-frequency curve on a cumulative frequency plot.
Safe haven	A room or building that, by virtue of its construction and heating, ventilation, and air conditioning features, prevents infiltrations of intolerable concentrations of toxic vapours when the building is subjected to a toxic cloud of specified concentration and duration
Safe operating limit	The maximum value of a process variable that is considered to be within the acceptable range for running the process without resulting in a hazardous condition. Reaching or exceeding this value will typically trigger some type of alarm or interlock function

Term	Definition
Safeguard:	The Layer of Protection, Safeguard, Safety Critical Element or Line of defence that prevents a threat from becoming an incident (like Loss of Containment) or that controls an incident by reducing the actual consequence severity. Safety barriers are physical and/or non-physical means planned to prevent, control, or mitigate undesired events or accidents". This definition allows for both hardware barriers (e.g. Emergency Shutdown Systems) and for procedural barriers (e.g. Emergency shutdown, evacuation) and this allows the management of barriers in a comprehensive major accident protection system to be properly mapped
Safety instrumented system (SIS)	A system consisting of sensors, logic solver, HMI, and final elements for the purpose of taking the process to a safe state when predetermined conditions are violated. The SIS deals with events having the potential for serious injury to personnel and/or significant environmental impact
Safety interlock	A system or function that detects an out-of-limits (abnormal) condition or improper sequence and brings it to a safe condition. A safety interlock operates automatically; no operator action is involved. It consists of a sensing element, a control function, and a final control element. The safety interlock control function (logic solver) should be separate from the logic solver performing the bpcs control functions. A safety interlock deals with events having the potential for serious injury to personnel and/or significant environmental impact
Significant environmental harm	Damage to the environment that, in turn, could lead to irreversible human health effects or lasting damage to sensitive ecosystems.
Significant property damage	Loss of plant facilities and equipment that exceeds business tolerance levels.
Site	The entire area within a geographical boundary, which houses one or more facilities, under the regulation of a common management structure.
Secondary Containment	An impermeable physical barrier specifically designed to prevent release of materials into the environment that have already breached primary containment (i.e., an LOPC). Secondary containment systems include, but are not limited to tank dikes, curbing around process equipment, drainage collection systems into segregated oily drain systems, the outer wall of double walled tanks, etc.
Societal Risk	Societal risk is defined as the frequency per time period, usually per year, that N or more fatalities can occur as a result of industrial activities. When presented graphically, the plot is usually known as "F-N curve".
Standard	A set of either mandatory requirements or optional guidelines based on corporate policy, government regulations, or consensus industry experience/practice
Standard operating condition (SOC)	The normal value, and range of values, for a process parameter, usually includes maximum, minimum, and aim/preferred range, as well as information on consequences of deviations and the steps to avoid or correct deviations
Structure	Means anything that is constructed, whether fixed, moveable, temporary, or permanent, including: • buildings, masts, towers, frameworks, pipelines, quarries, bridges, and underground works (including shafts or tunnels) • any component of a structure • part of a structure.
Subtle change	Any change within the documented process technology that is not "replacement in kind."
TIER	One of the four levels of the Process Safety KPIs, which is in turn based on the API/ANSI RP 754.
TIER 1	Is a PSE / LOPC with the greatest consequence as defined by ANSI/API RP 745. A Tier (1) PSE is an unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials (e.g., steam, hot water, nitrogen, compressed CO2, or compressed air), from a process that results in one or more of the Tier (1) consequences.

Term	Definition
	Notes: • Some non-toxic and non-flammable materials (e.g., steam, hot water, or compressed air) have no threshold quantities and are only included in this definition because of their potential to result in one of the other consequences. • PRD, SIS, or manually initiated emergency de-pressure discharge is a LOPC due to the unplanned nature of the release. • - An internal fire or explosion that causes a LOPC from a process triggers an evaluation of the Tier (1) consequences.
TIER 2	Is a PSE / LOPC with lesser consequence. A Tier (2) PSE is an unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials (e.g., steam, hot water, nitrogen, compressed CO2, or compressed air), from a process that results in one or more of the Tier (2) consequences, and is not reported as a Tier (1) PSE. Notes: • Some non-toxic and non-flammable materials (e.g., steam, hot water, or compressed air) have no threshold quantities and are only included in this definition because of their potential to result in one of the other consequences. • A PRD, SIS, or manually initiated emergency de-pressure discharge is a LOPC due to the unplanned nature of the release. The determination of Tier (2) PSE is based upon consequences and threshold quantities described in ANSI/API RP 754 - Table. • Fire or explosion that causes a LOPC from a process trigger as in Tier (2) consequences.
TIER 3	Typically represents challenges that progressed along the path to harm but is stopped short of a Tier (1) or Tier (2) PSE consequence. Indicators at this level provide an additional opportunity to identify and correct weaknesses within the barrier system. They are too facility specific for benchmarking or developing industry applicable criteria and are intended for internal company use and can be used for local (facility) public reporting. The most common examples of Tier (3) metrics are safe operating limit (SOL) excursions, primary containment inspection outside acceptable limits, demands on safety systems, and other LOPCs (less than that defined as Tier (1) or Tier (2)).
TIER 4	These metrics represent the most leading process safety performance indicators (process safety metrics). These indicators provide an opportunity for a company to identify and correct weaknesses within the barrier system. Tier (4) indicators can dramatically enhance the process safety culture and the process safety performance of a COMPANY. Indicators at this level provide an opportunity to identify and correct isolated system weaknesses. They are indicative of process safety system weaknesses that may contribute to future Tier (1) or Tier (2) PSEs. In that sense, they may identify opportunities for both learning and systems improvement. As well as they are too facility-specific for benchmarking or developing industry applicable criteria. They are intended for internal company use and for local reporting.
Uncertainty Assessment	The process of combining uncertainties, to generate output parameters expressed as probability distributions. No involvement of risk is implied. Example: Multiplying ranges of possible lengths, and widths to arrive at a range of resulting possible areas.
Unoccupied remote facility	A facility that is operated, maintained, or serviced by employees who visit the facility only periodically to check its operation and to perform necessary operating or maintenance tasks. No employees are permanently stationed at the facility.
Worker	A person who carries out work in any capacity for an operator. It covers almost all working relationships, including employees, contractors, subcontractors, and volunteer workers.
Workplace	place where work is carried out for an operator, including any place where a worker goes, or is likely to be, while at work.

14. ANNEXURES

14.1 ANNEXURE-1: PROCESS TECHNOLOGY REFERENCE LIST

This list can be used by site to identify sources of information that can be used as references for preparing process Technology and as a checklist for identifying where records are typically stored.

Process Technology documentation item	References to sources of information and documentation format
Hazards of materials	
Physical property data	JSW Site Chemical database, Chemwatch MSDS
Flammability	NFPA Fire Protection Guide, JSW Site chemical database Chemwatch MSDS
Toxicity	Chemwatch MSDS, USP database for pharmaceutical products
Chemical reactivity	JSW Site Chemical Reactivity Database, JSW Site Process safety laboratory, Chemical Interaction Matrix
Process design basis	
Block flow diagrams	Site process design basis document, OEM
Description and document of process chemistry	OEM, site process design basis document,
Material and energy balances	OEM
Quality control/quality assurance/equipment and material specifications	Capital project equipment specifications, capital project QA reports, plant specifications for maintenance materials
Process steps and SOCs safe upper/Low limits	OEM
Consequence of deviation from these limits	OEM
Alarm/interlock settings	OEM or alarm/interlock records
Equipment design basis	
Material and equipment list	SAP MM & PM Module
Drawing schedule (drawing database)	JSW Sites
Process flow diagram (including material balance)	JSW Sites
Equipment calculations	Equipment Supplier
Equipment specification drawings and sheets	Equipment Supplier
Equipment purchases specifications	Engineering specifications,
Vendor prints and equipment blueprint file (operating instructions)	JSW Sites

Process Technology documentation item	References to sources of information and documentation format
Hazards of materials	
Materials of construction	Equipment Supplier
Pump specifications/ characteristics	Equipment Supplier
Relief system—design basis and calculations	Equipment Supplier, Documents
P&IDs	JSW Sites
Pipe codes	BIS Standard

Process Technology Documentation Requirements

Process Technology documentation item	References to sources of information and documentation format
Instrument design basis	JSW Sites
Loop/calibration sheets	JSW Sites
Interlock logic diagrams	JSW Sites
Interlock classifications and safety integrity levels (SILs)	JSW Sites
Agitation design basis	JSW Site's standards, capital project equipment specifications, vendor specifications, Document
Control valve calculation	JSW Site's Design Standard and JSW Site's Engineering Specifications
Protective safety systems (interlock schematics, settings, detection, and suppression systems)	JSW Sites
Electrical diagrams	JSW Sites
Electrical area classifications	JSW Sites
Ventilation system design basis	For bought out items Equipment Supplier and for other JSW Sites
Fire protection systems	NFPA standard for design basis compliance and rest as per Equipment supplier
Quality assurance inspection reports – • New equipment (COC) • Equipment in service	JSW Sites
Design codes and standards employed	See equipment specification, equipment detail drawings, equipment calculations
Vendor instruction manuals	Vendor supplied documents
**** These annexures outline the minimum requirements; however, business units should make amendments to comply with any local or state regulations that are more stringent. Additionally, Business units to prepare these forms and get it approved from site PSM leader.*	

14.2 ANNEXURE-2: PSM CRITICAL EQUIPMENT GUIDANCE

14.2.1 Principle

This annexure provides guidance for identifying components, equipment, and systems designated as Process Safety Management (PSM) Critical. Note that HHO and LHO designations classify manufacturing processes and associated equipment, not buildings or locations. PSM Critical pertains to equipment and its components.

14.2.2 Scope and Applicability

The Process Technology team at each site is responsible for designating processes as HHO, LHO, or Exempt from PSM standards.

Sites shall prepare a list of hazardous substances, including materials and their concentrations, pressure, and temperature (e.g., steam, hot water, coal dust, hydrogen, anhydrous ammonia, acids, alkalis). This list should guide the identification of PSM Criticality for future cyclical and project PHAs.

14.2.3 Essential Features

14.2.3.1 Methodology Used

Methods for determining PSM Critical equipment are detailed in the Equipment Design Basis section 7.1.6.3. All listed methods may be utilized.

A team approach should be employed for identifying PSM Critical equipment for both new and existing facilities. This team should review the process technology package, identify hazardous events, and evaluate their consequences, monitoring, control, and mitigation measures. For new projects, the PSM site leader should ensure the PSM Critical identification list is provided early in the project, before equipment procurement.

14.2.3.2 PSM Critical Criteria

Equipment is designated PSM Critical for one or more of the following reasons:

Prescriptive: Equipment types are inherently PSM Critical due to their functions or hazards (e.g., pressure vessels, high-energy rotating equipment, pressure relief systems). This approach avoids the need for additional consequence analyses.

Consequence-Based: Equipment failure that could cause loss of primary containment or release of chemical energy resulting in severe consequences (e.g., death, major irreversible health effects, significant property damage, or environmental impact). This applies to HHOs only.

Prevention/Mitigation: Equipment designed to prevent or mitigate the consequences of hazardous events, which could cause severe consequences. This can include equipment in HHOs and LHOs.

14.2.3.3 Prescriptive Equipment

Certain equipment types are prescriptive PSM Critical based on inherent hazards or function. These include:

Pressure Vessels: Handling high pressure (>15 bar) or high temperature (>150°C).

Pressure Relief Devices: Including valves, vent systems, and related components. Not prescriptive for non-associated services or specific applications like vacuum breakers.

Safety Interlocks: Includes sensors, logic controllers, and final control elements. Not prescriptive for process interlocks.

Emergency Devices: Includes process emergency shutdown systems and isolation systems.

Fire Safety Systems: Includes alarm systems, suppression systems, and other fire protection equipment critical to process safety.

High-Energy Rotating Equipment: Equipment with potential to release kinetic energy that could cause significant hazards.

14.2.3.4 Consequence-Based (Loss of Containment)

Identify PSM Critical substances and ensure all equipment in contact with these substances is considered PSM Critical.

Perform consequence analyses if necessary to determine if equipment should be classified as PSM Critical based on the impact of its failure.

14.2.3.5 Prevention/Mitigation (P&M)

Consider equipment for PSM Critical designation based on its role in preventing or mitigating hazardous events:

Containment Controls: Includes relief valves, vent systems, and backflow protection.

Shutdown Controls: Includes safety interlocks and emergency isolation valves.

Controlled Release Systems: Includes systems designed for controlled release or scrubbing of hazardous substances.

Safety Monitoring and Emergency Communication Systems: Includes detection systems and emergency alarms.

Active Mitigation Systems: Includes systems like emergency generators and fume scrubbing systems.

Passive Prevention and Mitigation Systems: Includes systems like explosion-proof walls and fire-retardant coatings.

Service and Utility Systems: Includes critical utilities like UPS for DCS functionality and steam turbines for backup power.

14.2.3.6 Documentation of PSM Criticality

Maintain a controlled list of PSM Critical equipment and the rationale for its classification.

Store this information in the Process Technology database on the site server/SAP system for consistency and ease of reporting.

14.2.3.7 PSM Critical Equipment Parts and Accessories

Parts or components of PSM Critical equipment are also deemed PSM Critical if their failure could lead to a hazardous event.

Electrical Grounding and Bonding: Essential for preventing fires/explosions due to static sparks. Should be included in the Asset integrity program.

Piping and Flanged Connection Components: Include parts like bolts and gaskets in Asset integrity and Quality Assurance programs.

Sight Glasses: Identified and evaluated based on their role in PSM Critical equipment.

Sensing Elements: Generally, not considered PSM Critical unless they are critical to containment scenarios.

Insulation and Fireproofing: Fireproofing on PSM Critical equipment should be included in Asset integrity inspections.

Structural Supports: Included in Asset integrity programs.

14.2.3.8 Documentation of Interlock Systems Design (RAGAGEP Statement)

Interlock design is captured in P&IDs, electrical schematics, loop diagrams, and PLC software.

Interlocks comply with ANSI/ISA Standard S84.01 and NEC requirements. Components should be "Proven in Service."

14.2.3.9 Documentation of Process Equipment Design (RAGAGEP Statement)

Equipment Design Basis should state whether the design complies with recognized and generally accepted good engineering practices (RAGAGEP). Document any deviations and their reasons.

14.2.3.10 Test/Inspection Program

Test and inspection requirements for PSM Critical equipment are detailed in the Asset Integrity or QA Manual.

14.3 ANNEXURE-3: PSSR CHECKLIST

PRE-START-UP SAFETY REVIEW SIGN-OFF

PSSR No.	
INSPECTION DATE:	
DEPARTMENT/ PLANT/AREA:	
PROJECT TITLE:	
PROCESS/ EQUIPMENT:	

PSSR TEAM			
	PSSR Team Member's Name	**Department**	**Signature / Date**
Team Leader			
Operations Representative			
Maintenance Representative			
Project Representative			
Safety & Fire Representative			
Environment Representative			
Electrical & Instrumentation Representative			
Mechanical / Civil / Structural Representative			

CLEARANCE FOR START UP	
The signatories below confirm that all PSM criticality A rated findings have been cleared and start up is now authorized.	
PSSR Team Leader	
Project Leader	
HOD (S & FS)	
EVP (Projects)/ EVP (O&M)	

PSSR CHECKLIST

	Yes	No	N/A	Remarks
1. Safety & Health				
General Safety				
Have all relevant personnel, (Operations, Maintenance, Technical, Supervision), received adequate and appropriate **training on the equipment**?				
Has adequate and appropriate PPE (**Personal Protective Equipment**) been specified and provided?				
Have measures been taken to adequately **guard** all dangerous parts of this equipment?				
Has sufficient provision been made for the **electrical and/ or mechanical isolation** of the equipment?				
Are points of isolation clearly marked/labelled and readily accessible?				
Have **bump/ trip** hazards been identified and all sharp edges removed?				
Has proper **guarding, handrails/ barriers,** been provided to prevent falls?				
Have all **hot/ cold surfaces** been adequately guarded to prevent burns?				
Are Safety **Showers and Eye Wash** facilities provided and adequate?				
Has sufficient **lighting** been provided so that operation, servicing, maintenance and repair of the facility can be carried out safely?				
Are display systems for providing operational instructions, **safety warnings** and emergency information provided and positioned so that they are clearly visible and easily read?				
Machine Safety				
Has the machinery been **installed** so that it will be stable and secure during operation?				
Has all access to dangerous **moving parts**, or danger zones created by moving equipment been prevented by the provision of the correct guards, interlocks and/ or fencing?				
Have the correct safety measures been taken to prevent any risk from hot/ cold surfaces, ejection of material, failure of parts and their ejection, overheating/ fire?				
Has safe access been provided to those parts of the machinery that require operator **access for operation, adjustment, service, maintenance or repair**, i.e. elimination of slip, trip, trap, crush, entanglement, fall, bump and cut hazards?				
Is the machinery provided with the properly identified **START/ STOP and EMERGENCY controls** that are positioned for safe operation without hesitation, or loss of time, and without ambiguity?				
Is the machinery provided with a clearly identified **means to securely isolate** it from ALL energy sources?				
Ergonomics				
Has the workstation, workplace, or equipment, been constructed so that the **need for stooping, bending, stretching, over-reacting and working over-head** during operation has been eliminated, or reduced, to the minimum?				
Has the need to **lift, carry, push or pull, heavy loads**, or parts, been eliminated as far as possible?				
Are all display screens, dials, START/STOP/EMERGENCY buttons positioned so that they are easily seen and accessible by those who will operate the equipment, or machine?				

	Yes	No	N/A	Remarks
1. Safety & Health				
General Safety				
Have Visual Display Screens been positioned so that interference from glare is positioned so that interference from glare is reduced to the minimum?				
Has the workstation been designed and equipped so that a comfortable position can be adopted by the operator? i.e. able to stand, or change position and sit upright, angle at elbows and knees 90 Deg C., feet on floor.				
Does the operation of this equipment increase the risk of Upper Limb Disorder, e.g. repetitive tasks, handling of loads, machine paced work, and prolonged operation?				
Have you consulted appropriate guidelines for the determination of work contribution to ergonomic risk factors?				
Occupational Health				
Have all health risks due to gases, liquids, dusts, mists or vapours used by, contained in or emitted by this process/ equipment been assessed, and where necessary, eliminated or adequately controlled?				
Has adequate Personal Protective Equipment (PPE) and/or Respiratory Protective Equipment (RPE) been specified in the Operating Procedures?				
Has the need for an Occupational Health Monitoring Programme been assessed?				
Have Operating Procedures been reviewed to take into account any additional “hazards to health” which may arise from operation or maintenance of this equipment?				
Has adequate Local Exhaust Ventilation (LEV) been installed, tested, balanced and entered on an Inspection Schedule?				
Have adequate inspection/cleaning ports been provided on all ductworks?				
Are relief facilities directed to a safe place away from the workplace?				
Has a Noise Survey been considered, and a Noise Compliance Plan prepared, if required?				
Has all insulation been identified and labelled?				
Has all pipework, tanks, etc., containing hazardous materials been adequately labelled?				
2. Process Safety Management	**NO**	**YES**	**N.A.**	
Process Technology				
For components, equipment and systems have PSM critical designations been documented as part of the process technology package?				
Are up to date material safety data sheets available and training of concerned on MSDS provided?				
Have the hazardous effects of inadvertent mixing of different materials including waste streams been considered (i.e. has a chemical interaction matrix been prepared/ updated)?				
Has the process design basis (e.g. SOCs) been documented/ updated?				
Has the equipment design basis (e.g. PFDs/ P&IDs) been documented/updated?				
Management of Change – Technology/ Facilities				
Has a management of change – technology/ facilities document (Change of Design – COD) been approved?				

	Yes	No	N/A	Remarks
1. Safety & Health				
General Safety				
Has a test authorization (TA) been approved?				
Are all action items, arising from the COD, that were deemed necessary for start-up, complete?				
Have all changes made during construction/ modification been recorded and authorized through MOC/ COD?				
Process Hazards Analysis				
Have project PHAs been approved, and a final project safety report been prepared?				
Are all action items, deemed necessary by the PHA team for start-up, complete?				
Has the facility been approved as **"Safe to Operate"** by the PHA team?				
Quality Assurance (Consult with personnel who have QA responsibilities)				
Have checks and inspections been made to ensure that critical equipment is installed properly and is consistent with design specifications and vendor's recommendations?				
Have quality assurance inspection reports, covering fabrication, assembly and installation, been completed per the project's quality assurance plan and reports filed with the equipment design basis documentation?				
The PSSR team should agree on, and field check specific items:				
(a) Does the construction meet the design specifications.				
(b) Does the construction match the drawings.				
Are pipe supports adequate?				
Confirm if integrity test (pressure testing for leaks, torque test, etc.) has been performed online installed.				
Asset integrity				
Have maintenance procedures been approved and issued?				
Have maintenance personnel been trained?				
Have quality control procedures been approved for maintenance materials and spare parts?				
Have inspections and tests (including regulatory requirements) for the following equipment been included in a maintenance schedule (including to a SAP based system, if applicable)?				
Pressure vessels and storage tanks				
Pressure relief systems, vent systems, and devices				
Critical controls, interlocks, alarms and instruments				
Emergency devices, including shutdown systems and isolation systems				
Fire protection equipment				
Piping systems (including piping components such as valves, excess flow valves, expansion bellows) in critical service				
Key process-to-service tie-ins				
Electrical grounding and bonding				
Emergency alarm and communication system				
Monitoring devices and sensors				
Pumps				
Lifting equipment				
Has reliability engineering analysis been considered for PSM critical equipment?				

	Yes	No	N/A	Remarks
1. Safety & Health				
General Safety				
Is the equipment inspected by an outside body and certificates on file?				
Have all commissioning tests or inspections been identified? (e.g. pressure or leak tests, passivating procedures)				
Operating Procedures and Safe Work Practices				
Have operating procedures and safe work practices been prepared/ updated and approved?				
(Note: for emergency procedures see section 4 of this checklist).				
Training and Performance				
Has specific process (or job task) training been given to all personnel?				
Have initial/ refresher training records been updated?				
Contractor Safety				
Have all contract personnel been adequately trained in appropriate maintenance and operating activities?				
Interlocks and Alarms				
Has the alarm/ interlock been classified and designed as per standard by a properly constituted team?				
Has the alarm/ interlock been classified into safety (or) process interlocks and appropriate integrity levels are determined?				
Did the team check that the alarm/ interlock action proved, under all conceivable failure conditions, to be failsafe?				
Has an interlock/ critical alarm Standard Operating Procedure for testing been written and implemented prior to this PSSR?				
For alarms/ interlocks with more than one software or hardware circuit, have all possible interlock routes been tested?				
Do you have an appropriate procedure to ensure that your software is protected? (e.g. routinely archived, key/ password protected etc.).				
Has the software been properly documented and filed? (e.g. Logic drawings, schematics, sequence/ batch descriptions).				
Has all software been properly validated and tested?				
Have you ensured that the equipment does not restart either on the resetting of a protective device such as an interlock or the re-establishment of power after an outage?				
3. Environment				
Are all **secondary containment/ bunding** facilities adequate? (Curb walls, Dikes etc.)				
Are all **material storage** facilities adequate and appropriately labelled?				
Have adequate arrangements been made, prior to start-up, for the identification, classification and **safe disposal of all waste materials**?				
Have all materials, used in the system, been entered on the **Area Chemicals Inventory List** (or equivalent)?				
Do **Area Spill Procedures** need to be updated/ developed?				
Are **material Unloading Facilities** adequate and constructed in accordance with Corporate Safety, Health and Environmental Standards?				
Are **relief vents/ facilities adequate** and directed to an environmentally safe location?				
Have the Corporate Project **Environmental Guidelines** followed at design stage?				

	Yes	No	N/A	Remarks
1. Safety & Health				
General Safety				
Have all **waste streams** been identified, quantified, analyzed and minimized?				
Have **Environmental permits** been reviewed/ updated/ provided?				
4. Community Awareness and Emergency Response (C.A.E.R.)				
Are all necessary **Emergency warning signs**, lights or other devices installed where necessary?				
Have all necessary precautions been taken to ensure that the **equipment inspected is not a source of ignition** to any flammable materials, irrespective of their source?				
Are **fire protection facilities adequate**, e.g. Fire extinguishers, fire walls, sprinkler systems, Alarm Boxes, Foam System etc., and have they been included on an Inspection Schedule?				
Are **Emergency Escape Routes**, including ladders, adequate and properly signposted?				
Is **Emergency Lighting a**dequate & tested?				
Is **sufficient Respiratory Protective Equipment**, such as Escape Sets or Self-Contained Breathing Apparatus (SCBA) available?				
Have **Emergency Procedure**s been prepared, and relevant personnel trained?				
Is the appropriate **authority advised** of proposed new major projects (if applicable)?				
5. Electrical Safety				
Have operations/ areas been electrically **classified**?				
Has the equipment been **properly installed and constructed** to the standards expected and local legislation and does it meet any special installation requirements noted on the manufacturer's certificate?				
Has equipment been **designed and purchased** for the conditions under which it will operate? (e.g. hazardous areas)				
Are all live parts **adequately enclosed** to prevent access?				
Does **earthing/ grounding** comply with own and local standards/ legislation?				
Does **isolation labelling** comply with own and local standards?				
Are fuses with **pullers, circuit breakers, or RCDs (Residual Current Devices)** installed to automatically disconnect the supply when needed?				
Are first aid stations, **single line drawings (SLD)** and PPE requirements available in MCC/ PCC/ Main Load Tension Panel (MLTP)/ ECRs/ Sub stations as appropriate?				
Have all **relevant documentation and drawings** (e.g. P&ID's, SLD's, Schematics, equipment arrangement, I/O, logic, electrical classification and Panel Schedule drawings etc.) been **updated to reflect the current installation**?				
Have all new Substation Breakers, MCC isolators, starters or other appropriate equipment been **registered on to the site inspection schedule?**				
Have hazards due to any **electrical circuits made redundant** by this installation been properly addressed?				
Are MCCs and electrical isolation devises appropriately labeled?				
All electrical (flameproof/ non flameproof) fittings open ports are plugged?				

	Yes	No	N/A	Remarks
1. Safety & Health				
General Safety				
Lightning arrester/ protection in place?				
Safety or Process Interlocks Available & test report signed?				
Out of Service Equip is De-Energized and tagged?				
Under Erection/ maintenance equipment de energized and tagged.				
Electrical Inspection (Authority) Complete?				
Required Emergency Switches are installed and tested?				
Conduits and Boxes are Sealed?				
Wall/ floor opening through which cable passes is sealed?				
Preventive Maintenance schedule is in Place?				
Accessibility for motors and electrical fixtures for maintenance is adequate?				
Equipment and power source identification is in place?				
MCC feeder of equipment identification & labeling is in place?				
Is the all electrical panels have been identified with power voltage and equipment they served?				
Is level of illumination satisfactory?				
Is Process equipment and electrical equipment earths segregated?				
Is double earthing provided to equipment?				
6. Instrumentation				
Instrument Loop Drawing, Input/ output drawing available and are tested?				
All pressure/ vacuum gauges are of correct ranges installed and Pressure Gauges calibrated				
Temperature Gauges suitable for application? Calibrated?				
Fail Safe Valve Position listed & indicated on valve and computer graphics?				
All Interlocks tested & sensors are calibrated?				
Transmitters calibrated?				
All control valves, ON/ OFF valves are tested & calibrated for operation?				
DCS Process Control Change Form completed?				
Instruments in accessible position for maintenance?				
Instruments visibility for operator/ Maintenance engineer?				
Earthing and grounding completed to all instruments?				
Earthing and grounding test certificate available?				
Identification tags for instruments, cables, air lines etc. provided?				
Smoke detector / manual alarming system are active?				
Adequate communication system like phones, P.A. system installed & operational?				
Equipment under erection/ under maintenance de-energized. (pneumatic/ hydraulic energy)				
7. Civil and Structures				
Statutory approvals obtained from applicable authorities?				
Fire Doors, fire resistance walls available?				
Exits Door Swings, are correct and Emergency Escape available?				
Safety Chains/ Handrails/ Guard Rails in place and adequate?				
Walks, Ladders, Stairs in place and adequate?				

	Yes	No	N/A	Remarks
1. Safety & Health				
General Safety				
Floor Drainage available?				
Operations/ Maintenance Platforms Provided where Needed?				
FIRE PROTECTION				
Does the site have a written Fire Protection Plan that includes a list of the major workplace fire hazards, proper handling and storage procedures, potential ignition sources (such as welding, smoking and others), and the type of fire protection equipment or systems that can control a fire involving them?				
Are **fire separations/ Fire walls identified** and maintained properly to prevent fire spread including separations between operations and storage areas?				
Does the **site fire water supply** have sufficient capacity to supply the design demand for the specified duration (one to four hours – depending on the severity of the hazard)?				
Can the **fire pumps deliver 100%** of the maximum fire water demand at the required pressure for the largest credible fire expected to occur on the site?				
Have new **sprinkler/ foam systems been tested** to insure they meet the Acceptance Requirements of NFPA 13/ NFPA 16 and will all sprinkler systems be maintained in accordance with NFPA 25 or local authority?				
Are all the facilities that handle flammable liquids fully protected with **water spray, foam, or other automatic suppression system** that complies with a nationally recognized code or standard?				
Is Nomex or garments made from other **flame-resistant fibres** worn by personnel who work with flammable liquids/ gases?				
Is all **portable fire extinguishing equipment** located in proper locations along normal paths of travel, including exits from areas, and will this equipment be properly maintained per NFPA 10 or local authority.				
Is there a **site firm alarm system** and are alarms perceivable and above ambient noise or light levels?				
Has the site established a **site Fire Brigade** and are all fire brigade **members trained** to a level of competency commensurate with the duties members are expected to perform?				
Other Documentation Items/ Procedures				
Project Capex form/ Management of Change form.				
Statutory and Legal compliance				
All Test certificates and Authorization completed?				
P&ID available/ Design documentation complete?				
PHA/ Process Hazards Analysis Recommendations complete?				
Equipment description available?				
Instrumentation Maint./ Calibration available?				
List of Emergency equipment				
Noise level check & within limit report.				
Is level of illumination done and report?				
Test report of earthing continuity.				

**** These annexures outline the minimum requirements; however, business units should make amendments to comply with any local or state regulations that are more stringent. Additionally, Business units to prepare these forms and get it approved from site PSM leader.*

14.4 ANNEXURE-4: CHECKLIST FOR CHANGE MANAGEMENT

Plant		Area	
Change Title:			

Sl. No	Checkpoint	Yes (√) No (X)	Remarks
1	Is the original design intent being changed		
2	Has the same change been unsuccessful elsewhere		
3	Have risks and hazards associated with this equipment been identified		
4	Has there been any change to material of construction		
5	Could this change hinder access to other equipment		
6	Has this design been previously changed		
7	Could this change impact the supply or consumption of utilities		
8	Could this change create any new hazards during construction or in later service		
9	Is there any change to procedures or operating conditions		
10	Are there any upstream or downstream effects as a result of this change		
11	Is over pressure protection required as a result of this change		
12	Are there any additional features for safety required		
13	Is there any impact on existing safety equipment (trips/alarms etc)		
14	Is there any impact on fire protection / preventive facilities		
15	Will the performance characteristics of the equipment, facility or the system be altered		
16	Are there any changes required to training or procedures as a result of this change		
17	Is there any increase in hazardous or flammable material inventory		
18	Could this change increase or cause any impact on - Air, Water, Land, Flora and Fauna		
19	Will the change cause or increase housekeeping concern -		
20	Will this change increase or cause consumption of resources be including natural resources		
21	Will this change increase or cause wastage of any resources be including natural resources -		
22	Will the change increase the existing risk or create new risk to occupational health (acute or chronic)		
23	Will the change cause risk of damage of any equipment/property		
24	Will this change cause impact on energy performance		

**** *** These annexures outline the minimum requirements; however, business units should make amendments to comply with any local or state regulations that are more stringent. Additionally, Business units to prepare these forms and get it approved from site PSM leader.*

14.5 ANNEXURE-5: CHANGE MANAGEMENT FORM

MOC FORM

<table>
<tr><td>Plant:</td><td></td><td>Area:</td><td></td></tr>
<tr><td>Change Title:</td><td></td><td>MOC Number:</td><td></td></tr>
<tr><td colspan="4">Reason for Change (tick whatever is applicable):
Capacity enhancement, Operational Convenience, Reliability improvement, Efficiency improvement, Life extension, To improve safety, To improve environment, To increase productivity</td></tr>
<tr><td colspan="3">Type of Change - Temporary (No. of days) / Permanent / Emergency / Trial</td><td></td></tr>
<tr><td colspan="3">Equipment name & Code</td><td></td></tr>
<tr><td colspan="3">Reference drawing / document number in which modification proposed (old and new to be enclosed</td><td></td></tr>
<tr><td colspan="3">Brief description of existing system / procedure</td><td></td></tr>
<tr><td colspan="3">Change Classification: Simple Change / Complex Change
RISK (Sum Cn+Cm+F) = Score = 3 - Simple Change
OR
= Score > 3 - Complex Change
<table>
<tr><td>Consequence (Cn) of failure.
(e.g. Loss of containment, injury, pollution)</td><td>Minor
1</td><td>Severe
2</td></tr>
<tr><td>Complexity (Cm) of change.
(e.g. number of systems, people or processes involved)</td><td>Simple
1</td><td>Moderate
2</td></tr>
<tr><td>Familiarity (F) with system.
(e.g. change has been made before or on similar equipment)</td><td>Familiar
1</td><td>Novel
2</td></tr>
</table></td><td></td></tr>
<tr><td colspan="3">Draw backs/problems faced with existing system</td><td></td></tr>
<tr><td colspan="3">Impact of proposed modification on Quality of product or work system (Review of existing SOP/SMP to be enclosed with revision as applicable)</td><td></td></tr>
<tr><td colspan="3">Impact of proposed modification on Safety (Review of existing Risk Assessment needs to be enclosed as applicable also HAZOP study to be carried out, if applicable and enclosed)</td><td></td></tr>
<tr><td colspan="3">Impact of proposed modification on Environment (Review of existing EIA needs to be enclosed with revision as applicable)</td><td></td></tr>
<tr><td colspan="3">Impact of proposed modification on Energy (Review of existing Energy intensity needs to be enclosed with revision as applicable)</td><td></td></tr>
<tr><td colspan="3">Is there any statutory clearance required for the proposed change? If so, detailed requirement along with respective act/rule/law to be enclosed</td><td></td></tr>
<tr><td colspan="3">Are there any system /equipment going to be idle /obsolete due to this change? If so, detail plan how the old system/equipment is planned to dispose.</td><td></td></tr>
<tr><td colspan="3">Detailed design calculations of the proposed change if applicable.</td><td></td></tr>
<tr><td colspan="3">Cost of the proposed new system /equipment along with estimation/ offers to be enclosed</td><td></td></tr>
<tr><td colspan="3">Person responsible for training of all the concerned team members on proposed new system/procedures</td><td></td></tr>
<tr><td colspan="3">Cross Functional Team (CFT):</td><td>Name / Signature / Date</td></tr>
<tr><td colspan="3">MOC Initiator *</td><td></td></tr>
<tr><td colspan="3">Operations</td><td></td></tr>
<tr><td colspan="3">E&A</td><td></td></tr>
<tr><td colspan="3">Mechanical Maintenance</td><td></td></tr>
<tr><td colspan="3">Safety & Fire Services</td><td></td></tr>
<tr><td colspan="3">Other</td><td></td></tr>
</table>

Review and Approvals by Technical Review Committee: (Simple & Complex)	Date & Signature
Head Operations	
Head Electrical Maintenance	
Head Mech. Maint.	
Head Re-Engineering & Drawing	
Section Head Safety	
Others (Environment, EMD etc.as applicable)	
Approvals: ☐ **Change Approved** ☐ **Rejected**	
Complex Change	
Plant HOD	
Operation Head	
Approvals: ☐ **Change Approved** ☐ **Rejected**	
Change Executed and Completed (Confirmation by Executor)	
Verification of MoC by PSM Co-coordinator & Dept. Safety Professional	

*Please note involvement of at least any two discipline is mandatory

MoC Check Point for Simple Change:

Sl. No	Activity	Applicable (Y/N)	Action Details	Responsibility	Target Date
1	Is there any change in existing documentation (Equipment Specifications/P&IDs/SOP/HIRA/ HAZOP/Procedure/Drawings/Process Flow Diagram etc)?				
2	Is there any change in existing operating parameter/Operation & Maintenance practices/ Logic/ Alarms/facility/ESI etc?				
3	Is there any need for Training & Communication because of MOC Changes?				

MoC Check Points for Complex Changes:

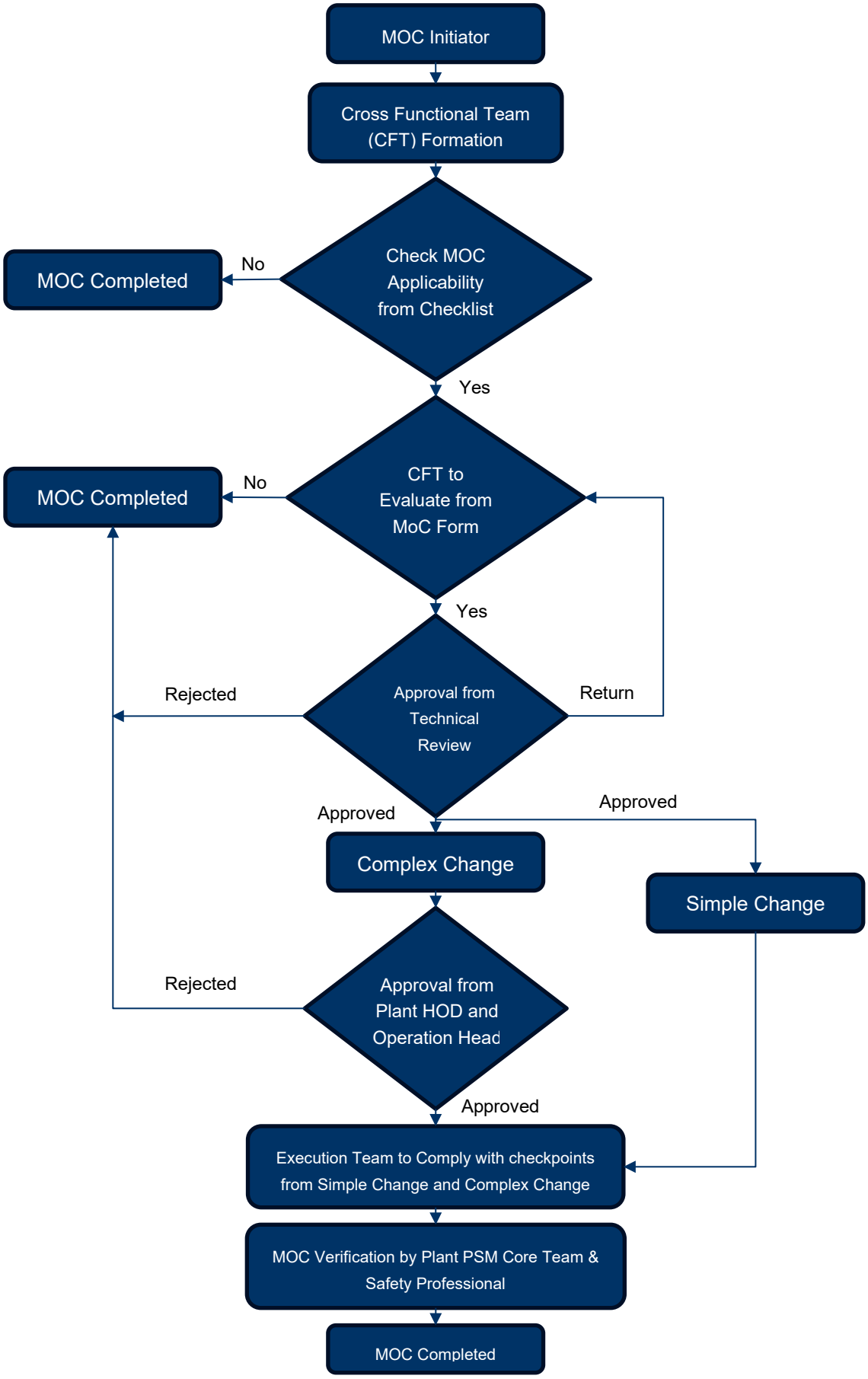
Sl. No.	Activity	Applicable (Y/N)	Action Details	Responsibility	Target Date
Checklist for Process Safety Information Updation	Is updation required for drawings? (P&IDs, Process Flow Diagrams, Equipment Layout, Plant layout etc.)				
	Is updation required for Process Design Basis, Equipment Design Basis, Instrument and Electrical Design basis etc. (Specify)				
	Is updation required for Procedures – Safe Operating Procedures, Emergency Preparedness Procedure etc.				
	Is it impacting compliance with regulatory norms (Factory Rules, Mines Rules, PESO, EIA, State Pollution Control Board etc.)				

Sl. No.	Activity	Applicable (Y/N)	Action Details	Responsibility	Target Date
	Is it impacting support/ foundation of installation				
Checklist for Effects on Plant, Equipment's, Structure, Machine foundations, Pipelines, cable routings etc.	Is additional Warning Sign, labelling on pipeline and Panels etc. required.				
	Is there deviation from Design limits of affected plant, equipment, structure				
	Is there change in Maintenance philosophy (frequency/method/criticality)				
	Is Updation required for Energy Source Identification (ESI) documents				
	Is there impact on Shutdown scheduling /additional resources during shutdown				
	Is there impact on functionality/performance on other system/equipment's				
	Is there additional impact on Vibration / Fatigue in equipment's / pipelines / structures				
	Is the existing Inspection and Quality Assurance Plan for equipment's, spares, civil and structural etc.				
	Is there impact on Corrosion, erosion (weather effects)				
	Does the change introduce additional Fire / Explosion hazard, or effect on existing fire protection system?				
	Is it impacting Compliance to TSL Technical Standards, Engineering, Design Standards, Safety Standards, Industry applicable Codes and Standards				
	Is Updation required in SAP				
	Is there impact on Relief / Flare system adequacy				
Checklist for Effects of the Change on Personnel.	Is it affecting response time for corrective actions, communication during emergencies				
	Is there any impact on Exposure to fumes/dust noise/trips and				

Sl. No.	Activity	Applicable (Y/N)	Action Details	Responsibility	Target Date
	falls/weather/extreme temperatures/Vibration / Toxic Chemicals				
	Is there any impact on Physical/Mental workload				
	Is additional Training / Competency required				
	Is there any impact on Access for Maintenance or operation/emergency escape route				
Checklist for Effects of the Change on Electrical Systems	Is there change on Indication of, Trips/Alarms/Emergency Shut Down initiation				
	Is there change in Fire and gas Detection/Protection systems				
	Is there change on Interfaces with any other systems; process, UPS, HVAC, communications facilities, ground protection				
	Is it impacting Electrical system conformation to applicable regulation- IEA etc.				
	Is Identification (Label) of voltage required				
	Is there impact on overload protection System adequate				
	Is Updation in Area Classification Drawing required				
	Is there any change to PLC Software (if yes submit precise details of equipment and system details below)				
Effect on Environment	If yes, need to attach detail sheet (Covers Spillage of Hazardous Material, release of inert/ toxic flammable gases)				

**** These annexures outline the minimum requirements; however, business units should make amendments to comply with any local or state regulations that are more stringent. Additionally, Business units to prepare these forms and get it approved from site PSM leader.*

14.6 ANNEXURE 6: MOC PROCESS FLOW CHART



14.7 ANNEXURE 7: CRITERIA FOR SELECTION OF PROCESS FOR PSRM

Department: Coke Plant			Process Name:											
Document No:			Rev No:							Effective Date:				
Objective of the job of the department/section	Section		Hazardous Substance / energy in process	Involving Hazardous Substance having/causing: -						Consequences			HHO	LHO
	Area	Process		Toxic	Explosive	Flammable	Corrosive	Thermally Instable	Pressure / Temperature	Significant Property damage (> 50 lakhs)	Potential for Fatality	Significant Environmental impact		

A) If a process/sub process has potential to result in uncontrolled release of energy in the form of , Toxic, Explosive, Flammable, corrosive, Thermal instable or Process / Temperature which could result in to the any of the consequences (mentioned din format) then that process / sub process is termed as HHO & would qualify for Total PSRM

B) If a process/sub process has potential to result in uncontrolled release of energy in the form of , Toxic, Explosive, Flammable, corrosive, Thermal instable or Process / Temperature which could not result in to the any of the consequences (mentioned din format) then that process / sub process is termed as LHO & would qualify only for base line PSRM i.e. only PSI to be collected

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14.8 ANNEXURE-8 PROCESS SAFETY MANAGEMENT SYSTEM METRICS

The organization should establish and maintain systems at all levels for managing and tracking data that regularly assess and analyze the status of the Process Safety Management (PSM) program using a set of key performance indicators. These data management systems should clearly outline responsibilities for data entry and updates, the schedule of reviews, and procedures for generating and validating data.

Within all aspects of process safety management systems, metrics play a crucial role in enhancing performance. **Table 5-1** provides various examples of Key Performance Indicators (KPIs) that can monitor these system elements. Besides selecting impactful KPIs, the organization should establish methodologies for interpreting each metric they decide to monitor. Furthermore, they should devise strategies for tracking and presenting data effectively to monitor the robustness of their process safety management systems and safety barriers at their facility.

Sr.	Element	Metric (KPI)	Interpretation
1.	Process Technology	**Percentage of Complete Process Safety Information**	Number of available records in the process safety information database compared to the total required records.
		Number of Process Safety Audit Findings	Count of audit findings related to process safety information, categorized by severity (e.g., critical, major, minor)
		Ratio of Updated Process Diagrams	Ratio of updated process flow diagrams, block flow diagrams, and process & instrumentation diagrams to the total number of diagrams
		Completeness of Safety Data Sheets	Percentage of safety data sheet files that are complete, current, and accurate based on random checks
2.	Process Hazard Analysis	**Number of Overdue PHAs**	Number or percentage of process hazard analysis studies that are overdue
		Number of Qualified PHA Personnel	Number of qualified PHA study leaders, scribes, and participants
		Distribution of Control Recommendations	Percentage of recommendations categorized by administrative controls, active engineered controls, passive engineered controls, and inherently safer alternatives
		Actual Losses vs. Risk Tolerance	Ratio of actual losses to the risk tolerance criteria
		Recommendations Per Study	Average number of recommendations per PHA study or per year

Sr.	Element	Metric (KPI)	Interpretation
		Percentage of Unresolved Recommendations	Percentage of recommendations unresolved by their due date
		Percentage of Repeat Recommendations	Percentage of recommendations that are repeats from previous studies
		Internal/External Risk Communications	Number or percentage of risk communication activities conducted
3	Operating Procedures	**Number of Updated Procedures**	Number of operating procedures updated, or staff hours spent updating procedures per year
		Completion of Task Analysis	Number of units that have completed task analysis to identify procedure needs
		Task Analysis Update Compliance	Percentage of task analyses that are updated according to the scheduled review cycle
		Incident Recommendations	Number of incident investigations that recommend changes to procedures
		Procedures Past Due	Number or percentage of procedures that are past due for review
04	Training	**Number of Qualified Personnel**	Number of qualified personnel in defined process safety management roles
		Training Compliance Rate	Percentage of workers whose training is overdue or percentage of workers who missed scheduled training sessions
05	Contractor Safety Management	**Contractor Performance Rating**	Percentage of contracted firms that would be considered for future contracts based on post-job evaluations
		Contractor Training Compliance	Percentage of required contractor training conducted on schedule
		Root-Cause Analysis of Contractor Incidents	Percentage of contractor-related incidents or near misses subjected to root-cause analysis
		Contractor Safety Meeting Attendance	Frequency of contractor safety meetings and percentage of attendance

Sr.	Element	Metric (KPI)	Interpretation
06	Pre-Startup Safety Review	**Number of Start-Up Incidents**	Number of incidents occurring during startup
		Number of Readiness Reviews	Number of readiness reviews performed
		Deferred Start-Ups	Number of startups deferred due to problems identified during readiness reviews
07	Asset integrity	**Equipment Inventory Coverage**	Number or percentage of equipment items included in the Asset integrity program
		Accuracy of ITPM Work Orders	Number of ITPM work orders related to equipment no longer present at the facility
		Overdue ITPM Tasks	Number or percentage of overdue ITPM tasks
		ITPM Task Failures	Number or percentage of ITPM tasks that uncover a failure
		Equipment Reliability	Metrics on equipment reliability or availability, such as mean time between failures (MTBF
08	Quality Assurance (QA)	**Percentage of QA Compliance**	Percentage of quality assurance checks and processes that comply with established standards
		Number of QA Non-Conformances	Number of quality assurance non-conformances identified during audits or inspections
		Percentage of Corrective Actions Implemented	Percentage of corrective actions from QA findings that have been implemented
09		**Number of Technology MOCs**	Number of MOCs related to technology changes performed each month

Sr.	Element	Metric (KPI)	Interpretation
	Management of Change Technology (MOC-T)	**Ratio of Undocumented Changes**	Ratio of identified undocumented technology changes to the number of MOCs
		Incorrect Technology MOC Reviews	Percentage of technology MOCs reviewed incorrectly
		Percentage of Technology MOCs Informed	Percentage of technology MOCs where workers were informed or trained
10	Management of Change Personnel (MOC-P)	**Number of Personnel MOCs**	Number of MOCs related to personnel changes performed each month
		Ratio of Undocumented Personnel Changes	Ratio of identified undocumented personnel changes to the number of MOCs
		Incorrect Personnel MOC Reviews	Percentage of personnel MOCs reviewed incorrectly
		Percentage of Personnel MOCs Informed	Percentage of personnel MOCs where workers were informed or trained
11	Management of Change Facilities (MOC-SF)	**Number of Facility MOCs**	Number of MOCs related to facility changes performed each month
		Ratio of Undocumented Facility Changes	Ratio of identified undocumented facility changes to the number of MOCs
		Incorrect Facility MOC Reviews	Percentage of facility MOCs reviewed incorrectly
		Percentage of Facility MOCs Informed	Percentage of facility MOCs where workers were informed or trained
12	Incident Reporting and Investigation	**Percentage of Repeat Causes**	Percentage of repeat causes identified in incident investigations
		Number of Qualified Investigators	Number of qualified incident investigators
		Incident Reporting Rate	Number of incidents reported per unit time
13		**Local Responder Engagement**	Number of meetings or contacts with local emergency responders regarding

Sr.	Element	Metric (KPI)	Interpretation
	Emergency Planning and Response (EP&R)		emergency response plans
		Trained ERT Members	Number of trained emergency response team (ERT) members on each shift
		ERP Review Status	Percentage of emergency response plans or annexes that are past due for periodic review
		Emergency Equipment Test Failures	Percentage of failed tests or inspections of emergency response equipment
		Drill Compliance	Fraction of emergency drills conducted as scheduled
14	Auditing	**Audit Completion Rate**	Percentage of audits completed according to the scheduled audit plan
		Unresolved Audit Recommendations	Number or percentage of unresolved audit recommendations
		Percentage of Repeat Audit Findings	Percentage of audit findings that are repeats from previous audits

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14.9 ANNEXURE 9: EXAMPLES OF INCIDENTS INVOLVING MULTIPLE GROUP COMPANIES

COMPANY PREMISES

1. A third-party truck loading a flammable product on Company Premises, experiences a leak and subsequent fire and property loss damages of $75,000 (direct costs). Although the truck is "Operated-by-Others", it is connected to the process. The incident would be a reportable PSI if property losses in direct costs were equal to or greater than $25K or some other PSI threshold was met or exceeded (e.g., a fatality).
2. Similar example as #1. The truck loaded with flammable product overturns in route out of the plant, resulting in a fire and loss of the truck. This would not be reported as a PSI since the truck is no longer connected to the plant.
3. A pipeline leaks and releases 2000 lb of flammable vapor above ground within 1 hour. A public road bisects the main facility and its marine docks. This pipeline originates in the facility and goes to the docks. The leak site happens to be off the site's property in the short segment of piping that runs over the public road. Although the leak technically occurs off-site, this is a reportable PSI since the facility owns and operates the entire segment of pipeline.

PSIs WITH MULTIPLE OUTCOMES

4. There is a 200 bbl spill of flammable liquid that results in significant flammable vapor being released, ignited and causing a fire. The fire damages other equipment resulting in a toxic gas release above the reporting threshold, along with multiple lost time injuries, including a fatality. This event should be reported as a single PSI, but with multiple outcomes. When applying the severity metric, the appropriate severity point assignment would be selected for the fire damage, the chemical release potential impact, the human health impact, and the community/environmental impact. The sum of these individual severity points will be used in calculating the overall severity rate metric.

LOSS OF CONTAINMENT

5. Ten barrels of gasoline (1400 kg, 3100 lbs.) leak from piping onto concrete and the gasoline doesn't reach soil or water. Site personnel estimate that the leak was "acute" (e.g., occurred within a 1-hour timeframe). This is a reportable PSI because there was an "acute" loss of primary containment (e.g., within "1 hour") of 1000 kg (2200 lbs) or more of" Flammable Liquid".
6. A faulty tank gauge results in the overfilling of a product tank containing "flammable liquids". Approximately 7000 kg (15500 lbs) of liquid overflows into the tank's diked area. This incident is a reportable PSI since it is an "acute" spill greater than 2200 lbs, regardless of secondary containment.
7. A maintenance contractor opens a process valve and gets sprayed with sulfuric acid resulting in a severe burn and lost time injury. This would be a reportable PSI. It is an unintended event involving a material and a loss of containment. For fatalities and days away from work injuries and illnesses, there is no release threshold amount.
8. An operator opens a quality control sample point to collect a routine sample of product and receives a bad hand laceration requiring stitches due to a broken glass bottle and misses the next day of work. This is not a reportable PSI because it is not related to a loss of containment.
9. A bleeder valve is left open after a plant turnaround. On startup, an estimated 10 bbls of fuel oil (1700 kg, 3750 lbs.) is released, at 100°F, onto the ground and into the plant's drainage system before the bleeder is found and closed. This would not be a PSI because it is less than the release criteria of 2000 kg or 4400 lbs of a "Combustible Liquid".
10. Operations is draining water off of a crude oil tank (operated at 120°F) into a drainage system designed for that purpose. The operator leaves the site and forgets to close the valve. 20 bbls of crude oil is released into the drainage system. This would be a PSI because the release of crude

oil, a “Combustible Liquid”, is unintended and it is greater then the release criteria of 2000 kg or 4400 lbs.

11. A pipe corrodes and leaks 10 Bbls (1700 kg, 3750 lbs.) of Heavy Cycle Oil (HCO) at the operations temperature of 550°F to the ground. The HCO has a flash point of 300°F. This would not be a PSI. Although the HCO is a high flash material released above its flash point, the release did not exceed the threshold quantity of 2000 kg (4400 lbs) or 14 bbls.

12. An operator purposely drains 20 bbls of combustible material into an oily water collection system within one hour as part of a vessel cleaning operation. The drainage is planned and controlled, and the collection system is designed for such service. This is not a reportable PSI since it is consistent with a specific exclusion. If the material had been unintentionally released or it had become uncontrolled and flowed to an open drain, sewer or other collection system, it would be a reportable PSI.

13. Hydrocarbon fumes migrate into the QA/QC laboratory located within the facility and results in a fire with $5000 damage. The source of the hydrocarbon fumes is the oily water sewer system. Although the fire was the result of an unplanned or uncontrolled loss of primary containment, this incident is not a PSI since the damage threshold of $25,000 was not exceeded.

14. A forklift truck delivering materials inside a process unit knocks off a bleeder valve leading to the release of isopentane and a subsequent vapor cloud explosion with asset damage greater than $25,000. This is a PSI since an unplanned or uncontrolled LOPC resulted in a fire or explosion causing greater than $25,000 damage.

15. There is a loss of burner flame in a fired heater resulting in a fuel rich environment and subsequent explosion in the fire box with greater than $25,000 in damages to the internals of the heater. There was no release outside of the fire box. This would be a reportable PSI since after the flameout the continuing flow of fuel gas is now an uncontrolled release. The intent is for combustion of the fuel gas at the burner and not for fuel gas to be contained in the fire box.

16. There is a tube rupture in a fired heater causing a fire (contained in the heater) resulting in greater than $25,000 in damages to the heater internals (beyond that of replacing the failed tube). The tube failure is a loss of primary containment of the process fluid and combined with the additional damages greater than $25,000 makes this a reportable PSI.

ACUTE RELEASES

17. There is a 10 bbl spill of gasoline (1400 kg, 3100 lbs.) that steadily leaked from piping onto soil over a two-week time period. Simple calculations show the spill rate was approximately 0.03 bbls per hour (9 lbs./hr). This is not a reportable PSI since the spill event was not an "acute" release (e.g., the 1000 kg (2200 lbs.) threshold exceeded in any 1-hour period).

18. Same example as above, except that the 10 bbl leak was estimated to have spilled at a steady rate over a period of 1 hour and 30 minutes. Simple calculations show that the spill rate was 6.7 bbls (933 kg or 2060 lbs.) per hour. The spill rate was slightly less that the reporting threshold of 1000 kg (2200 lbs.) within any "1 hour" period, and therefore is still not a reportable PSI.

19. While troubleshooting a High-than-expected natural gas flow rate, operating personnel find a safety valve on the natural gas line that did not reseat properly and was relieving to the atmospheric vent stack through a knockout drum. Upon further investigation, it is determined that a total of 1 Million lbs of natural gas was relieved at a steady rate over a 6 month period. This is not a reportable PSI as the release rate (~100 kg per hour) is not “acute”, (i.e. does not exceed the 500 kg TQ for flammable vapors in any 1-hour time period).

Note: This size release may be reportable under environmental regulations.

20. An operator discovers an approximate 10 bbl liquid spill of aromatic solvent (e.g. benzene, toluene) near a process exchanger that was not there during his last inspection round two hours earlier. Since the actual release duration is unknown, a best estimate should be used to determine if the TQ rate has been exceeded (it is preferred to err on the side of inclusion rather than exclusion).

This incident is a PSI because the solvents involved are Packing Group II materials and the threshold quantity of 7 bbl is exceeded if the time period is estimated to be less than one hour.

DOWNSTREAM DESTRUCTIVE DEVICES (e.g., flares, scrubbers, incinerators, quench drums)

21. The flare system is not functioning properly due to inactive pilots on the flare tip. During this time, a vapor load is sent to the flare due to an overpressure in a process unit. The volume of the vapor through the pressure relief device is greater than the threshold and it results in the formation of a flammable mixture at grade. This would be classified as a PSI since the relief valve discharge is greater than the threshold quantity and resulted in an unsafe release.

22. 100 bbl of naphtha liquid are inadvertently routed to the flare system through a pressure relief device. The flare knockout drum contains most of the release; however, there is minimal naphtha rainout from the flare. This is a PSI since the volume released from the pressure relief device to a downstream destructive device does exceed the threshold quantity and resulted in one of the four listed consequences (i.e. liquid carryover).

23. A pressure relief device release less than threshold quantity is routed to a scrubber which is overwhelmed by a flow rate greater than design and exposes personnel to toxic vapors resulting in a days away from work injury. This is a PSI since a loss of primary containment resulted in a days away from work injury. The rules for pressure relief device discharges are superseded by the actual harm caused.

24. A propane tank over-pressures through a pressure relief device to the flare system. The pilots on the flare system are not working properly, and the flare does not combust the vapors. The event transpires over a period of 45 minutes. The volume of propane release was estimated to be 1300 pounds and the release dissipated into the atmosphere above grade and above any working platforms. Even though the release exceeded the threshold quantity, this is not a PSI since the discharge was routed to a downstream destructive device with none of the listed consequences.

25. An upset causes a pressure relief device to open and release fuel gas to the facility flare system. The flare system works properly and combusts the vapor release which came from the pressure relief device. This is not a PSI since the pressure relief device release was routed to a downstream destructive device that functioned as intended (i.e. did not cause one of the four listed consequences).

SAFETY RELIEF DEVICE / SYSTEM

26. There is a unit upset and the relief valve opens to an atmospheric vent which has been designed per API Standard 521 for that scenario, resulting in a gas release to the atmosphere with no adverse consequences. This would not be a reportable PSI since vapors and gases released to atmosphere from safety valves, high-pressure rupture disks, and similar safety devices that are properly designed for that event per API Standard 521 or equivalent are excluded, as long as the release did not result in liquid carryover, discharge to a potentially unsafe location, an on-site shelter-in-place, or public protective measures (e.g. road closure) and and a PRD discharge quantity greater than the threshold quantity.

27. A chlorine vessel has a Pressure Relief Device (PRD) that was identified in a recent PHA to be undersized. In the process of making a transfer, the vessel overpressures. A release of 60 pounds of chlorine gas (TIH Zone B material) occurs through this PRD to a safe location over a period of 25 minutes. This would not be a Tier 1 or Tier 2 PSE, regardless of the HAZOP finding, so long as it did not result in a liquid carryover, on-site shelter-in-place, public protective measure or other indication of discharge to an unsafe location.

28. There is a unit upset and the relief valve fails to open, resulting in overpressure of the equipment and an "acute" release of flammable gas from a leaking flange. The amount released is above the 500 kg (within 1 hour) threshold. This is a reportable PSI. Releases from flanges are not excluded from PSI reporting.

TOXIC GAS, VAPOR OR AEROSOL

29. A leak on a high-pressure hydrochloric acid line results in a spill of 1900 lbs of hydrochloric acid. Flash calculations indicate that greater than 220 lbs. of hydrogen chloride would be released as a vapor. The 1900 lbs release of hydrochloric acid is not a reportable PSI since this liquid is categorized as a “Packing Group II” corrosive liquid, with a 2200 lbs reporting threshold. However, since the liquid flashed or was sprayed out as an aerosol, producing more than 220 lbs of hydrogen chloride as vapor the event would be reportable due to exceeding the 100 kg (~220 lbs) or more of Toxic Inhalation Hazard Zone C material within 1 hour.

30. A pipe containing CO2 and 10,000 vppm (1% by volume) H2S leaks and 7,000 kg (15,400 lbs) of the gas is released within a short time period (e.g., less than one hour). Calculations show that the release involved about 55 kg (120 lbs) of H2S. The release is a reportable PSI since the reporting threshold for Toxic Inhalation Hazard Zone B chemicals is any amount greater than 25 kg (55 lbs) of the toxic chemical (e.g., H2S).

31. Same as above, except that the H2S concentration in the pipe is 50 vppm, rather than 10,000 vppm. The incident would still be reportable as a PSI since the release of CO2 is greater than the 2000 kg (4400 lb) threshold.

DAYS AWAY FROM WORK INCIDENTS

32. An operator is walking, then slips and falls to the floor and suffers a lost time injury. The slip/fall is due to weather conditions, "chronic" oily floors and slippery shoes. This is not a reportable PSI. Personnel safety "slip/trip/fall" incidents that are not directly associated with evacuating from or responding to a loss of containment incident are specifically excluded from PSI reporting.

33. Same as above, except that the operator slipped and fell while responding to a small flammable liquid spill (e.g., less than 1000 kg in 1 hour). This would be PSI reportable since the operator was responding to a loss of containment incident. A PSI is reportable if the loss of primary containment occurs on Company Premises and results in a lost time incident or fatality. For fatalities and lost time incidents, there is no release threshold quantity requirement.

34. Same as above, except that the operator slipped and fell several hours after the incident had concluded. This would not be PSI reportable. The terms "evacuating from" and "responding to" in the reporting exclusion mean that the loss of containment and associated emergency response activities are on-going. Slips/trip/falls after the event have concluded (such as "after-the-fact" clean-up and remediation) are excluded from PSI reporting.

35. A scaffold builder suffers a lost time injury after falling from a scaffold ladder while evacuating from a loss of containment incident on nearby equipment. This is a reportable PSI.

36. An operator walks past an improperly designed steam trap. The steam trap releases, and the operator's ankle is burned by the steam, resulting in a lost time injury. This is a reportable PSI because even though the loss of containment was steam (vs. hydrocarbon or chemical), the physical state of the material was such that it caused a lost time injury.

Non-toxic and non-flammable materials are excluded from the threshold quantity criteria but are subject to the other consequence criteria.

37. An enclosure has been intentionally purged with nitrogen. A contractor bypasses safety controls, enters the enclosure and dies. This is a reportable fatality, but not a reportable PSI since there was no unplanned or uncontrolled loss of primary containment.

Note: This fatality may be reportable under safety regulations and may need to be recorded on a company’s injury and illness log.

38. Same as above, except that nitrogen inadvertently leaked into the enclosure. This would be a reportable PSI (and fatality) since there was a fatality associated with an unplanned loss of primary containment.

39. An operator responding to an H2S alarm collapses and has a “days away from work” injury. If the alarm was triggered by an actual unplanned or uncontrolled H2S LOPC, the event would be a

reportable PSI. If the alarm was a false alarm, the event would not be a reportable PSI because there was no actual release.

PIPELINES

40. An underground pipeline leaks and releases 1,000 bbls of diesel (combustible material) over 3 days (13.9 bbl/hr).. The spill results in contaminated soil that is subsequently remediated. This is not a reportable PSI since there were no safety consequences and the quantity did not exceed the "acute" threshold of 14 bbls or greater.

41. A pipeline leaks and releases 2000 lbs. of flammable vapor above ground within 1 hour. However, the release occurred in a remote location within the site. The release is PSI reportable, since "remoteness" is not a consideration, and it release exceeds the threshold quantity.

42. A DOT covered pipeline that is owned, operated, and maintained by Company A crosses through Company B's property. The DOT covered line has a 1500 lb release within an hour from primary containment of flammable gas and causes a fire resulting in greater than $25,000 damage to Company A's equipment. This is not a reportable PSI for Company B since the pipeline is not owned, operated or maintained by Company B. This would be a transportation incident for Company A.

FIRES or ENERGY RELEASES NOT ASSOCIATED WITH LOSS OF PRIMARY CONTAINMENT

As a general rule, a fire or energy release is reported as a PSI only if caused by a loss of primary containment or results in a chemical release in excess of the reporting quantities. Examples include:

43. An electrical fire impacts the operation of the process resulting in the release of 4000 lbs. of toluene. This event would be reported as a PSI since if the loss of primary containment exceeds the 2200 lb. reporting threshold for toluene.

44. An electrical fire, loss of electricity, or any other loss of utility which causes a plant shutdown and possibly incidental equipment damage greater than $25,000 (e.g., damage to reactors or equipment due to inadequate shutdown) but does not cause a loss of primary containment that results in one of the identified consequences would not be reported as a PSI. To be a reportable PSI, there should be a loss of primary containment.

45. A bearing fire, lube oil system fire, electric motor failure, or similar fire occurs which damages the equipment (> $25,000) but does not cause a loss of primary containment that results in one of the identified consequences would not be reported as a PSI since no chemical release greater than the threshold quantity or injuries occurred.

46. If in the examples #44 or #45, if either an injury or chemical release exceeding the threshold quantity had occurred these would have been reportable PSI events.

47. An internal deflagration in a vessel causes equipment damage > $25,000, but there was no loss of containment. While this is a serious process event and should be investigated as such, it does not meet the definition of a reportable PSI since there was no loss of primary containment.

48. The vent on a storage tank containing chemicals becomes plugged and vacuum caused by routine pump out collapses the tank resulting in equipment damages >$25,000. This event would not be reported as a PSI since there was no loss of primary containment.

49. If in the example #48, if a tank seam failed resulting in a spill of contents in excess of the TQ quantity for that material, it would have been reported as a PSI (even if the contents were captured in secondary containment dikes).

50. A scaffold board is placed near a high-pressure steam pipe and subsequently begins to burn, but is quickly extinguished with no further damage. The investigation finds that the board had been contaminated by some oil, but there is no indication of an oil leak in the area. This is not a reportable PSI since there was no unplanned or uncontrolled LOPC.

MARINE TRANSPORT VESSELS

51. A company operated Marine Transport Vessel has an onboard "acute" spill of combustible material greater than 14 bbls. The event is not PSI reportable since Marine Transport Vessel incidents are specifically excluded, except when the vessel is connected to the process for the purposes of feedstock or product transfer.

52. A third-party barge is being pushed by a tug and hits the company dock. A barge compartment is breached and releases 50 bbl of diesel to the water. The event is not a reportable PSI since the marine vessel was not connected to the process for the purposes of feedstock or product transfer.

TRUCK AND RAIL

53. A company railcar derails and spills more than 7 bbls of gasoline while in transit outside the facility. The incident is not PSI reportable since railcar was connected to the process for the purposes of feedstock or product transfer or being used for onsite storage.

54. A third-party truck/trailer overturns while in the Company Premises, resulting in an "acute" spill of gasoline greater than 7 bbls. The incident is not reported as a PSI reportable if the truck is no longer connected to the loading/unloading facilities. However, companies may choose to have transportation incident metrics, which would capture this event.

55. A contract truck hauler is unloading caustic, and the hose separates and generates an airborne aerosol and/or liquid caustic spill of 2500 kg. The event is a reportable PSI since the caustic TQ of 1000 kg was exceeded and the truck was still connected to the loading/unloading facility immediately prior to the incident.

56. Two chlorine railcars have been delivered to the facility. One is connected to the process and the other is staged at the unloading rack but is not connected to the process. While at the unloading rack but not connected to the loading rack, the second railcar develops a leak, and 6 lb is released in less than an hour. This is not a reportable PSI since truck and railcars are expressly excluded unless connected to the process or being used for onsite storage. Staging while waiting to unload is not considered storage.

OFFICE BUILDING

57. There is a boiler fire at the Main Office complex, and direct cost damages totaled $75,000. The incident is not PSI reportable since Office Building incidents are specifically excluded.

MAN-MACHINE INTERFACE INCIDENTS

58. An operations technician is injured while working around the finishing equipment in a polymers plant. The injury is caused by the mechanical, man-machine interface with the equipment. This would not be a reportable Process Safety Incident because there was no unplanned or uncontrolled loss of containment.

MIXTURES

59. A chemical manufacturer spills 10,000 lbs of a formulated product containing multiple chemicals downstream of a mixing operation. This material is marketed as specific product (e.g., a heating fluid, brake fluid, etc.). Since this material is shipped in this formulation, the company has previously evaluated the mixture per all of the UN Dangerous Goods definitions (or DOT regulations in the USA) and classified the mixture as a “Packing Group III” material. Since the spill exceeded the 2000 kg (4400 lb.) threshold quantity of a Packing Group III material, this spill would be reported as a PSI.

VACUUM TRUCK OPERATIONS

60. After collecting a load from an adjacent unit, a vacuum truck is parked at the wastewater treatment facility awaiting operator approval to discharge. While waiting the vacuum truck malfunctions and vents process material to the atmosphere. This is not a PSi since vacuum truck operations are excluded unless loading, discharging, or using the truck’s transfer pump.

61. A vacuum truck outfitted with a carbon canister on the vent is loading a spill of hydrocarbons. The carbon canister catches fire which escalates to the point of creating more than $45,000 in damage

to the vacuum truck. This is a PSI since the original spill of hydrocarbons constitutes the LOPC and the response to the LOPC results in fire damage greater than $25,000.

DIRECT COSTS

62. A pump seal fails, and the resultant loss of containment catches on fire. The fire is put out quickly with no personnel injuries. However, the fire resulted in the need to repair some damaged instrumentation and replace some insulation. The cost of the repairs, replacement, cleanup, and emergency response totaled $20,000. This is not a PSI. It should be noted the cost of replacing the seal is not included in the direct cost calculation—only the costs for repair and replacement of the equipment damaged by the fire, not the cost to repair the equipment failure that led to the fire.

OFFICIALLY DECLARED EVACUATION OR SHELTER-IN-PLACE

63. A small quantity of very odorous material enters a cooling water system via tube leak. The material is dispersed into the atmosphere at the cooling tower. An elementary school teacher decides not to conduct recess outside due to a noticeable odor even though officials deemed no shelter-in-place was necessary; therefore, this is not a PSI.

64. Less than 1 pound of Hydrogen Fluoride gas is released while unloading a truck at a refinery. The release is detected by a local analyzer and triggers a unit response alarm. An off-duty police officer living in a nearby home advises his neighbors to evacuate because “an alarm like that means there’s a problem at the refinery.” This is not an officially declared evacuation or shelter-in-place because in this situation the officer is acting as a private citizen suggesting a precautionary measure; therefore, this is not a PSI.

15. REFERENCES

References Document	Full Title, Brief Description and Web Links
1. Occupational Safety and Health Administration (OSHA)	OSHA is a part of the United States department of labor to ensure safe and healthful working conditions for workers by setting and enforcing standards by providing training, outreach, education and assistance. eCFR :: 29 CFR 1910.119 -- Process safety management of highly hazardous chemicals.
2. Occupational Safety and Health Administration (OSHA)	Compliance Guidelines and Recommendations for Process Safety Management (Nonmandatory). 1910.119 App C - Compliance Guidelines and Recommendations for Process Safety Management (Nonmandatory). | Occupational Safety and Health Administration (osha.gov)
3. JSW Steel, Dolvi Works PSM Standard	JSW Steel Internal PSM standard referred to understand existing structure and elaboration of elements expectation.

JSW Group

MANAGEMENT STANDARD: GUIDANCE NOTE ON PLANNING AND PREPARING TO CONDUCT PROCESS HAZARD ANALYSIS AND PT FORMS

GS-18-01

MANAGEMENT STANDARD GUIDANCE NOTE ON PLANNING AND PREPARING TO CONDUCT PROCESS HAZARD ANALYSIS AND PT FORMS

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1. PLANNING AND PREPARING TO CONDUCT A PHA

- Charter definition
- Team selection and training
- Team preparations (e.g., PHA timeline)
- Review of process technology and information
- Hazards Identification
- Identification techniques (checklists, chemical interaction matrix)
- Field tour
- Hazards Evaluation and Risk Assessment
- Methodology selection
- Line of defence identification
- Hazardous Event Identification and Consequence Analysis
- Interlock Evaluation
- Human Factors Analysis
- Human factors checklist
- Facility Siting Analysis
- Inherently Safer Process (ISP) Analysis
- Development and Management of Recommendations
- Risk evaluation
- Recommendation development and documentation
- Management response and follow-up
- Documentation of the PHA
- PHA report and closure forms
- Communicating results

1.1 CHARTER DEFINITION

The Site head shall approve and issue a charter detailing the study team's responsibilities, tasks, and objectives for baseline PHAs, cyclical revalidations, and special-focus PHAs. The PHA charter should be included as the first annexure to the PHA report, as specified in **Annexure-3**

1.2 TEAM SELECTION AND TRAINING

The Site head is responsible for selecting the PHA study team, arranging their training, and ensuring their availability for PHA meetings. The team should include:

- **In-depth Knowledge:** Basic science, technology, equipment design.
- **Operating Experience:** Hands-on process operation.
- **Maintenance Experience:** Hands-on process maintenance.
- **Hazards Evaluation Training:** Selection and application of evaluation methods.
- **Additional Expertise:** Mechanical integrity, quality assurance, control systems.

The team shall have one full-time leader and at least one qualified PHA resource. Team members should be full-time participants in all PHA steps, with ad hoc participation from specialists as needed. The preferred team size is four to five members, though larger teams may be needed for complex projects.

1.3 TRAINING REQUIREMENTS

1.3.1 PHA Team Leader Training

- **In-depth Training:** The PHA Team Leader shall have substantial training in selecting and applying hazard evaluation methodologies. They should have experience as a full-time participant in at least one prior PHA.
- **Ongoing Skills Maintenance:** The leader shall regularly refresh their skills and meet the training and experience qualifications**.**
- **Documentation:** Qualifications of the PHA Team Leader shall be documented and included in the team membership and qualifications section of the PHA report.

1.3.2 Full-Time Team Member Training

- **Overview Training:** All full-time team members shall receive an overview of the PHA procedure and the application of chosen hazard evaluation methodologies.
- **Documentation of Training:** This training shall be documented in the PHA report, including the date, trainer's qualifications, trained individuals, and covered topics.
- **Training Standards:** Training is deemed adequate if conducted by a qualified PHA Resource with current training materials.

1.3.3 Timing and Just-In-Time Training

- **Initial Training:** Overview training should occur at the start of the PHA process by a qualified PHA Resource or other qualified personnel.
- **Support Activity Training:** Training for specific PHA support activities (e.g., human factors, ISP, facility siting) should be provided just-in-time, at the start of each relevant activity.

1.4 TEAM PREPARATIONS

1.4.1 Reviewing and Accepting the Charter

Charter Review: The PHA Team Leader shall review the team charter with all members to ensure a clear understanding of expectations, boundaries of the study, completion timelines, special work, available resources, and resolution of priority conflicts.

1.4.2 Team Assignments and Study Schedule

Plan Development: The team shall develop a plan for conducting the study, including assignments and an overall timeline.

1.5 HAZARDS IDENTIFICATION TECHNIQUES

Hazards identification is a critical step in the Process Hazard Analysis (PHA) process, undertaken in the initial stages of the PHA to determine the inherent risks associated with a process. The identified hazards are typically linked to specific chemicals or conditions of use in the process, such as high pressure, high temperature, or corrosive environments. These hazards have the potential to lead to hazardous events like explosions, fires, energy releases, or the release of toxic materials, which can cause serious injuries, irreversible health effects, or significant environmental damage. The identified hazards are used to guide the PHA discussions and shall be included in the final PHA report and communicated to relevant personnel.

To effectively identify and rank hazards, the following techniques can be employed:

1.5.1.1 Review of Process Incident Reports

Examine reports of incidents that have occurred in the process under review and similar facilities. These reports can provide insights into past problems and potential hazards.

1.5.1.2 Review of Hazards Information

Analyse the Hazards Information section of the Process Technology package for the process or similar facilities. This section includes details on chemical properties and process conditions that could pose risks.

1.5.1.3 Review of MOC Documents

Assess the impact of changes made through the Management of Change (MOC) process on process safety. Consider whether interactions among these changes introduce new hazards.

1.5.1.4 Review of Previous PHA Reports

Review past PHA reports for the process under review and similar facilities. Previous findings can offer valuable information on known hazards and risk factors.

1.5.1.5 General Hazards Identification Checklist

Use a checklist to ensure all potential hazards are considered. This checklist can help in identifying both obvious and less apparent hazards.

1.5.1.6 Loss of Containment Checklist

Employ a checklist focused on scenarios where containment might fail, leading to hazardous releases

1.5.1.7 Chemical Interaction Matrix

Review the matrix to understand how different chemicals interact under various conditions

1.5.1.8 Experience and Expert Consultation

Engage with consultants or individuals with process experience or PHA expertise. Their insights can assist in identifying hazards that might not be immediately apparent.

1.6 FIELD TOUR

A field tour is essential for PHAs associated with existing facilities, including cyclical revalidations or new baseline PHAs, as well as major modifications within project or MOC activities. For new, green-field facilities, where a physical tour may not be feasible, alternative methods such as model reviews (e.g., Plant Design Management System) can serve as a virtual tour. Regardless of the method, results shall be documented in the PHA report.

1.6.1 Field Tour Process

1.6.1.1 Conducting the Tour

For existing facilities, the PHA team shall visit the site to gain a firsthand understanding of the process and facility layout. A team member with hands-on operating experience should guide the tour to provide practical insights.

1.6.1.2 Objectives of the Field Tour

- **Visualize the Process:** Gain a clear understanding of the process and its layout.
- **Identify Hazards:** Look for potential hazards and start compiling a list of hazards and hazardous events.
- **Verify Drawings:** Compare the physical layout and equipment with P&IDs (Piping and Instrumentation Diagrams) to ensure that the diagrams are accurate and up to date.

1.7 DOCUMENTATION

Document the results of the field tour or any alternative review methods used. Include observations, identified hazards, and discrepancies between physical observations and P&IDs in the PHA report.

1.8 HAZARDS EVALUATION

Hazard evaluation is a crucial component of the Process Hazard Analysis (PHA) and involves a systematic approach to identifying, assessing, and managing risks associated with process hazards. This section outlines the scope, requirements, and methodologies used in the hazard evaluation process.

The hazard evaluation and risk assessment are central to the PHA, involving a thorough examination of the process to:

- **Identify Hazardous Events:** Determine all potential ways that each hazardous event might occur.
- **Evaluate Likelihood:** Assess the probability of each hazardous event occurring, considering the frequency of initiating events and the effectiveness of existing safeguards.
- **Assess Risk:** Evaluate the risk of each hazardous event based on its potential consequences and the mitigated frequency of occurrence.
- **Develop Recommendations:** Propose practical measures to either eliminate hazards or reduce risk to an acceptable level.

This phase involves selecting and applying appropriate hazard evaluation methods, analysing existing lines of defence, and distinguishing between hazards, hazardous events, and their consequences.

Example Distinctions:

Hazard: Chlorine's toxicity or hot metal's thermal energy.

Hazardous Event: Loss of containment of chlorine or hot metal.

Consequences: Chlorine exposure leading to serious health effects or hot metal causing severe burns or equipment damage.

Safeguards: For chlorine, this might include safety interlocks and relief valves; for hot metal, visual inspections and thermography.

1.8.1 Requirements

The PHA team shall:

Select Appropriate Methods: Choose suitable hazard evaluation techniques for the process.

Identify Specific Hazards: Ensure all specific hazardous events are identified.

Analyse Lines of Defence: Evaluate significant lines of defence, including their reliability and availability.

Assess Risk: Consider both the frequency of initiating events and the effectiveness of safeguards in relation to potential consequences.

1.9 APPROACH

1.9.1 Hazard Evaluation Methodologies

Different methodologies are used for hazard evaluation, each offering a unique approach to analysing process hazards:

1.9.1.1 HAZOP (Hazard and Operability Study):

Overview: HAZOP identifies deviations from design intent by examining P&IDs with guide words (e.g., "more of," "less of"). It is effective for continuous chemical processes but has been adapted for batch, mechanical, electrical processes, and operating procedures.

Process: The team systematically reviews nodes (sections of P&IDs) and identifies potential deviations and their impacts. Please use **Annexture 2** for HAZOP node checklist.

1.9.1.2 “What If”/Checklist Methodology:

Overview: Combines “What if” questions with checklists to explore potential hazards and deviations. The “What if” approach is used first to generate questions, followed by checklists to stimulate additional questions.

Process:

“What If” Questions: Generate questions about deviations and potential failures.

Checklist Review: Use checklists to uncover additional questions and ensure comprehensive coverage.

Additional Reviews: Apply operating procedures and human factors considerations.

1.9.1.3 Structured “What If”/Checklist Methodology:

Overview: A structured version of the “What If”/Checklist method that combines elements of HAZOP and FMEA. It provides a rigorous approach while incorporating brainstorming techniques.

Process:

Process Variable Deviations: Ask questions about deviations in process parameters.

Equipment Failures: Consider failure modes for each piece of equipment.

Checklist Utilization: Use checklists for additional questions and procedural states.

Creative Thinking: Brainstorm potential hazards outside normal operations.

1.9.1.4 Failure Mode and Effect Analysis (FMEA):

Overview: A systematic approach focusing on component failures and their impacts. It traces the effects of failures through the system to understand their impact on process safety.

Process:

List Components: Identify components and their failure modes.

Local Effects: Assess immediate impacts of failures.

Global Effects: Evaluate how failures cascade through the system to determine overall impact.

1.10 METHODOLOGY SELECTION

For baseline and project Detailed PHAs, HAZOP (Hazard and Operability Study) is mandated as the primary hazard evaluation methodology. This method is essential for its structured approach to identifying deviations from design intent and assessing their implications. However, depending on the specifics of the process and regulatory requirements, multiple methodologies can be employed. Here’s a breakdown of how methodologies are selected based on different types of PHAs:

1.10.1 Baseline PHAs and Project Detailed PHAs

Shall use HAZOP as the primary method. This ensures a thorough, systematic evaluation of potential hazards and their impacts. Additional methodologies can be employed at the discretion of the PHA team, especially if local regulations mandate different approaches.

1.10.2 Project SPHAs (Screening PHAs)

Typically involve limited details, such as basic process chemistry and a process flow diagram. A high-level “What if” analysis or a basic HAZOP focusing on process parameter deviations is effective here. Supplementing with checklists tailored to general hazards or loss of containment can enhance the analysis.

1.10.3 Project PPHAs (Preliminary PHAs)

As more details become available, extending the methodology from the screening phase to a more detailed approach is appropriate. This might involve a more comprehensive application of HAZOP, or other methods as described in the relevant sections.

1.10.4 Idling, Mothballing, Abandoning in Place

For processes in these states, a checklist/ “What if” approach is often effective. This starts with purpose-built checklists followed by brainstorming sessions to ensure all potential hazards related to equipment de-inventory, decontamination, and safe abandonment are addressed.

Other analytical tools, such as Fault Tree Analysis (FTA), Event Tree Analysis (ETA), Layer of Protection Analysis (LOPA), cause-consequence analysis, and bow tie analysis, can be used to complement these methodologies. These tools provide more refined estimates of the likelihood and impact of hazardous events and can be integrated with the primary methodologies for a more robust analysis.

1.11 METHODOLOGY APPLICATION

1.11.1 During The Hazard Evaluation

Develop Hazardous Event Scenarios: The PHA team shall comprehensively develop each identified hazardous event scenario and conduct a risk analysis. This involves detailing the scenario from the initiating event through to the potential consequences, if safeguards fail.

1.11.2 Documenting Scenarios

Process Description: Begin with a brief overview of the process role or function, including relevant details such as line numbers, equipment names, and variables.

Scenario Development: Describe the scenario from the initiating event, through control system responses, operator actions, and eventual consequences if safeguards do not function.

List Safeguards: Document the safeguards expected to address the scenario, including equipment and interlock details.

Estimate Risk: Assess the risk based on the mitigated event frequency and unmitigated consequences. Conclude whether the risk is tolerable with existing safeguards or if additional recommendations are necessary.

No Significant Consequences: If a scenario is determined not to have significant safety or environmental consequences, document this conclusion clearly. You may still list safeguards and complete the risk assessment columns, if necessary, but the findings should state that no further action is required.

1.12 LINES OF DEFENCE IDENTIFICATION

Understanding and evaluating the integrity of existing lines of defence is essential for making final process hazard recommendations. This activity is integrated into HAZOP and FMEA methodologies and should also be considered when applying the “What if”/checklist method.

1.12.1 Criteria for Evaluating Lines of Defence

Independence: Determine if the line of defence operates independently or relies on other systems.

Dependability: Assess the reliability of the defence mechanism (e.g., relief valves, containment vessels). Consider if it requires human intervention.

Auditability: Verify if the line of defence allows for regular validation or testing.

Integrity: Ensure that the line of defence has been installed and maintained properly, with regular validation or testing.

1.13 HAZARDOUS EVENT IDENTIFICATION AND CONSEQUENCE ANALYSIS

The purpose of identifying hazardous events and conducting consequence analysis is to understand and evaluate the potential impacts of various hazardous scenarios that could arise from the process. The primary hazardous events typically considered include:

Fires: Various types such as flash fires, pool fires, and jet fires.

Explosions: Including confined or unconfined vapor cloud explosions, condensed phase explosions, and combustible solids explosions (e.g., dust).

Other Hazardous Releases of Energy: This can include unexpected releases of stored energy.

Unintended or Uncontrolled Chemical Reactions: Such as runaway polymerizations, spontaneous decompositions, and uncontrolled molecular rearrangements.

Loss of Containment: Of toxic or corrosive materials due to failures in engineering or administrative controls.

Consequence analysis involves evaluating the direct impact of these hazardous events. This includes both qualitative and quantitative assessments to estimate or calculate release amounts, evaluate consequences, and determine the resulting safety, health, and environmental effects.

1.13.1 Requirements

The PHA team shall identify and assess the consequences of a range of hazardous events, from minor to worst-case scenarios. Key considerations include:

Type of Event: Whether it is a fire, explosion, uncontrolled chemical reaction, hazardous energy release, or toxic material release.

Potential Release Quantities: Estimation of how much material could be released.

Consequences: Evaluating distances to different levels of concern, such as toxic concentrations or thermal effects.

Safety and Health Effects: Impact on site and community personnel, including potential injuries and chronic effects.

Environmental Impacts: Potential adverse effects on the environment.

1.13.2 Approach

Initial Consequence Analysis: Conducting an initial consequence analysis early in the PHA helps understand potential impacts and identify areas where additional information or resources may be needed. This analysis is revisited throughout the PHA process to update understanding based on new data or events.

Sequence for Conducting Consequence Analysis:

Review Facilities and Hazards: Examine process technology, previous incidents, and identified hazards to understand potential hazardous events.

Estimate Consequences: Determine the type of event, potential release quantities, affected areas, and possible safety, health, and environmental effects.

Identify Lines of Defence: Preliminary identification of major defences that could prevent or mitigate the consequences of identified hazardous events.

This initial understanding aids in evaluating risks associated with hazardous events and supports other parts of the PHA.

1.13.3 Identify Event Scenarios

The PHA team should consider scenarios where all engineering and administrative controls fail, leading to events such as toxic releases, explosions, and fires. Scenarios should range from minor to worst-case events. For example, with the storage of Coke Oven Gas, consider scenarios from small leaks to major releases. Evaluate the potential impact on locations, health effects, and severity of injuries.

1.13.4 Estimate Consequences

Qualitative Analysis: Qualitative estimates based on historical data or simple calculations are acceptable for understanding potential consequences when the hazards are well-understood. This involves making conservative assumptions to estimate release quantities and affected areas.

Quantitative Modelling: For more detailed understanding, especially for off-site impacts, use consequence modelling tools to calculate affected areas and potential impacts. This helps estimate the severity of injuries, property damage, and environmental harm.

Modelling Results: Clearly document the modelling results, including assumptions and inputs. If using external contractors, ensure their analyses are reviewed and approved by internal resources.

Specialized Expertise: Quantitative modelling should be conducted by trained professionals with expertise in consequence modelling, meteorology, and toxicity. Ensure proper training or professional accreditation for those conducting the modelling.

1.13.5 Consider Major Lines of Defence

Once the potential consequences of hazardous events have been estimated, the next step is to identify and evaluate the major lines of defence in place. This process helps the PHA team understand how existing safeguards contribute to preventing or mitigating the effects of hazardous events. Here's how to approach this:

1.13.5.1 Identify Major Lines of Defence

Major lines of defence are systems, equipment, procedures, or safety measures designed to prevent or mitigate hazardous events. These can include:

Engineering Controls: Such as safety valves, containment systems, and automatic shutdown systems.

Administrative Controls: Including operating procedures, maintenance schedules, and training programs.

Personal Protective Equipment (PPE): Protective gear for personnel.

Emergency Response Measures: Such as emergency shutdown systems and fire suppression systems.

1.13.6 Preliminary Evaluation of Effectiveness

Role of Safeguards: Consider how each line of defence might prevent or reduce the severity of the consequences identified in the consequence analysis.

Consequence Modelling: Use consequence modelling, if applicable, to evaluate how effectively certain safeguards reduce potential injuries or damage. This may involve simulating scenarios with and without certain safeguards to assess their impact.

1.13.7 Perspective and Integration

Initial Review: The initial review of lines of defence is meant to provide perspective on how well current safeguards might manage the identified risks. This helps in understanding the potential effectiveness of safeguards in mitigating consequences.

Documentation: Ensure that this review is documented, noting the major lines of defence and their expected roles in managing the identified hazards.

1.13.8 Detailed Analysis Later

Future Analysis: A more comprehensive analysis of the effectiveness of lines of defence is conducted later in the PHA process, during the detailed hazards evaluation. This detailed analysis will examine:

Reliability: How dependable each line of defence is under various conditions.

Independence: Whether the effectiveness of a line of defence depends on the operation of other systems.

Auditability: The ability to test or validate each defence regularly.

Integrity: The maintenance and operational status of each defence.

By considering major lines of defence at this stage, the PHA team can better understand how these safeguards integrate with the overall risk management strategy and identify areas where additional measures might be needed.

1.13.9 Interlock Evaluation

Interlocks are a critical category of lines of defence in process safety. Unlike other safeguards, interlocks are designed specifically as instrumented layers of protection to prevent or mitigate process hazards. This section details the requirements and approach for evaluating interlocks, focusing on their role in safeguarding against process-related hazardous events, in accordance with industry standards such as IEC 61511, ISA S84, and other recognized good engineering practices (RAGAGEP).

Note: This section excludes machinery safety interlocks (e.g., limit switches or light curtains). Such interlocks are documented separately as machine safety interlocks.

PHA teams shall:

1.13.9.1 Document Existing and Proposed Interlocks

Existing Interlocks: Record interlocks currently in use as safeguards in the hazard evaluation.

New Interlocks: Evaluate proposed interlocks and document them as recommendations or potential improvements.

1.13.9.2 Categorize Interlocks

Process or Safety: Identify each interlock as either a process or safety interlock. For safety interlocks, also document the Safety Integrity Level (SIL) or Probability of Failure on Demand (PFD).

Unique Identifiers: Use loop numbers, P&ID references, or other unique identifiers for documentation.

Note: Interlocks falling outside the "safety" or "process" categories (e.g., quality or environmental interlocks) should be categorized as "process" if not clearly safety related.

1.13.9.3 Evaluate Proposed Changes

Existing Interlocks: If no changes are proposed, no additional evaluation beyond the hazard evaluation worksheets is required.

New or Modified Interlocks: Shall be evaluated for their classification and integrity level requirements. Ensure participation of qualified personnel (e.g., Area Safety Interlock Guardian or Electrical and E&A engineer).

1.13.9.4 Approach

Identify Interlocks:

Existing and Proposed: List interlocks related to hazardous events, including both those currently in use and those proposed.

1.13.9.5 Determine Consequence Category

Use the risk matrix provided in **Annexure 1 to** assign a consequence severity rating assuming all controls fail.

Categories C-1 to C-4: No Safety Instrumented Function (SIF) required.

Category C-5 & C-6: Further evaluation using Layer of Protection Analysis (LOPA) is required to determine acceptability and target reliability (SIL) of the interlock.

1.13.9.6 Compare Reliability

Existing SIFs: Compare calculated SIL/PFD to target reliability. If below target, recommend measures to reduce risk, such as upgrading the design or increasing test frequency.

New SIFs: Communicate target SIL/PFD to design engineers. Ensure proper design and calculation to meet specified risk reduction.

Example:

A hazardous event with off-site consequences (C-4) has an existing electromechanical interlock. A LOPA is performed, determining a required PFD of 0.1 (SIL-1). If the calculated PFD meets or exceeds this, no further recommendations are necessary.

Document Evaluation:

Include the Following in Documentation:

Unique Identifier: SIF number or other identifiers.

Event Description: Hazardous event and consequences, with references to specific hazard evaluation questions.

Evaluation Method: (e.g., LOPA).

Process Variables/Conditions: Detected by the interlock, with associated equipment identifiers.

Final Control Actions: Required actions to prevent the hazardous event, with associated equipment numbers.

Target Class/SIL/PFD: Desired reliability metrics.

Manual Shutdown Method: Description of manual procedures in case of SIS or HMI failure.

Additional Information (if available):

Logic Functions: Time delays, voting, start-up bypasses, shutdown sequences.

Reset Actions: Typically, manual.

1.14 HUMAN FACTORS ANALYSIS

Human factors analysis examines how people interact with their work environment, including equipment, systems, and information, both in routine and emergency situations. The goal is to identify and mitigate potential human errors that could lead to hazardous events or impact the effectiveness of safeguards. This analysis encompasses both physical and cognitive aspects of human interaction with processes.

1.14.1 Requirements

Human factors shall be considered throughout the PHA process. This includes:

Field Tour: Observing how humans interact with equipment and systems.

Hazard Evaluation Methodology: Identifying potential human errors that could lead to hazardous events.

Lines of Defence: Evaluating how human factors affect the performance of safeguards and response actions.

1.14.2 Approach

1.14.2.1 Field Tour

Observations: During the field tour, leverage the experience of operators and maintenance personnel to identify human factors issues. Focus on Human-Machine Interfaces (HMIs), control room layout, and critical equipment.

Control Room Review: Assess the clarity and functionality of displays, alarms, and control systems. Evaluate the control room environment, including lighting, noise, and communications capabilities.

Emergency Equipment: Ensure the availability and accessibility of personal protective equipment and other emergency systems.

1.14.2.2 Hazardous Event Characterization

Operator Actions: Identify scenarios where operators' actions could initiate or influence hazardous events. Evaluate whether operators have clear and unambiguous instructions for these scenarios.

Standard Operating Procedures (SOPs): Review SOPs to ensure they are clear and designed to minimize human error. Consider scenarios where operator errors might occur and address them in procedural reviews.

1.14.2.3 Lines-of-Defence Analysis

Operator Involvement: Assess the role of operators as part of the lines of defence. Ensure that their tasks are manageable and that they have the capability to perform required actions effectively.

Alarms and Alerts: Evaluate whether alarms and alerts are designed to effectively communicate the need for operator action and whether operators can respond appropriately under stress.

1.14.2.4 Areas for Consideration

Ergonomics:

Accessibility: Ensure emergency controls and equipment are easily accessible and operable.

Physical Demands: Consider if emergency controls require excessive strength or dexterity.

Emergency Access:

Access to Controls: Verify that manual shutdowns and emergency stop buttons are quickly accessible and not obstructed during emergencies.

Human-Machine Interface (HMI):

Design Clarity: Ensure that panel boards and video displays are clearly marked and that controls are easily distinguishable.

Complexity: Avoid complex or confusing emergency activation procedures.

Familiarity and Anxiety:

Error Risk: Recognize that familiarity and anxiety can increase the likelihood of errors. Address these factors in training and procedure design.

Distractions

Alarm Proximity: Ensure that trivial alarms do not distract from critical ones. Manage information overload, especially in emergencies.

Training, Skill, and Performance:

Training Effectiveness: Evaluate the effectiveness of training programs for handling unusual or emergency situations.

Drills: Conduct regular drills to assess the practical application of emergency procedures.

Fatigue Management

Work Schedules: Assess whether work schedules or overtime contribute to fatigue that might impair performance.

Turnover

Personnel Turnover: Evaluate turnover rates and the quality of training for new personnel, especially in key operational and supervisory roles.

Operating Procedures

Procedure Accuracy: Review SOPs for accuracy and usability, especially those related to hazardous events. Ensure that emergency procedures are clear and accessible.

Maintenance Procedures

Procedure Adequacy: Review maintenance procedures for process safety-critical equipment to ensure they are accurate and clear.

1.15 FACILITY SITING ANALYSIS

The facility siting analysis aims to assess the risks posed to occupants of buildings on a site by process-related events originating outside those buildings. For sites with multiple process units, this analysis is generally incorporated into a site-wide facility siting study, which should be updated and revalidated every five years.

The analysis evaluates whether site buildings are appropriately designed and located to protect occupants and critical process functions from hazardous events. It involves an initial screening to identify significant hazards, occupancy status, and critical safety functions of buildings, followed by consequence or risk assessment if necessary.

1.15.1 Requirements

Facility siting issues shall be addressed in various types of PHAs, including those for new facilities, projects impacting existing facilities, Management of Change (MOC) activities, and cyclical updates. This analysis also applies to portable or temporary buildings. The analysis should follow company requirements and include:

- **Design, Function, and Occupancy:** Evaluate the design and function of site buildings and their occupancy status.
- **Consequence Screening:** Use spacing criteria or site-specific modelling to assess potential consequences.
- **Risk Screening:** Apply qualitative or quantitative risk assessments to evaluate potential risks.
- The specific scope of the facility siting analysis varies by the type of PHA:
- **New, Green-Field Plant:** For new facilities, facility siting should be addressed conceptually in Screening and Pre-authorization PHAs and in detail in Detailed PHAs. The analysis should cover the entire site and evaluate the facility siting requirements as they apply to the new plant.
- **New Unit or Major Modification on Existing Site:** For new units or major modifications, facility siting shall be addressed at both the conceptual level in Screening and Pre-authorization PHAs and in detail in Detailed PHAs. The Detailed PHA should document hazardous events from new or modified processes that could impact existing or new buildings, including occupancy and critical functions, and outline any necessary risk mitigation measures.
- **MOC Activity:** For MOC activities, the PHA shall evaluate the impact of proposed changes on facility siting, including:
  - Creation of new hazardous events with potential siting impacts.
  - Changes to existing events.
  - Addition or removal of buildings potentially impacted by process-related events.
  - Changes in building occupancy or critical functions.
  - Required risk mitigation measures.
- **Cyclical Baseline PHA or Revalidation:** For cyclical updates or revalidations, the analysis involves reviewing and updating facility siting information. This includes:
  - An updated list of hazardous events with potential siting impacts.
  - Changes to buildings (new or no longer in use).
  - Changes in building occupancy or critical functions.
  - Additional risk mitigation measures as needed.
  - Methodology for Facility Siting Analysis

1.15.2 Initial Screening

Hazard Identification: Identify and document potential hazardous events that could impact buildings.

Building Analysis: Assess building design, function, occupancy, and criticality.

Consequence Screening: Use predefined spacing criteria or perform site-specific modelling to estimate potential consequences.

Risk Assessment:

Qualitative Assessment: Conduct a qualitative assessment to identify and evaluate risks based on the potential consequences and the existing safeguards.

Quantitative Assessment: For higher risk scenarios, perform a quantitative risk assessment to determine the likelihood and impact of identified hazards on site buildings.

1.15.3 Mitigation Measures

Design Improvements: Recommend improvements to building design or location to reduce risk.

Safeguard Enhancements: Propose additional safeguards or modifications to existing safeguards to mitigate identified risks.

Emergency Planning: Develop or update emergency response plans and procedures to address potential risks effectively.

1.15.4 Documentation and Reporting

Detailed Documentation: Document the findings of the facility siting analysis, including identified hazards, assessed risks, and recommended mitigation measures.

Update PHAs: Ensure that the facility siting analysis is integrated into the overall PHA documentation and updated as necessary based on findings and changes.

1.16 INHERENTLY SAFER PROCESSES ANALYSIS

The purpose of inherently safer processes (ISP) analysis is to integrate safety into the design and operation of processes by eliminating or reducing hazards rather than just controlling them. This approach involves assessing the fundamental chemical characteristics, physical conditions, and equipment used in the process to identify ways to make the process inherently safer. ISP focuses on modifying the process to minimize hazards and risks from the outset.

For all project-level PHAs (including Screening PHAs, Preliminary PHAs, and Detailed PHAs) and baseline PHAs, the PHA team shall evaluate the incorporation of ISP technology in the process under review. This evaluation is also necessary during cyclical reviews to identify opportunities for applying ISP concepts to current or future process versions. Existing ISP features should be documented during cyclical revalidations. Identified opportunities for improving inherent safety may be classified as recommendations or potential improvement opportunities based on risk analysis. A summary of the ISP review shall be included in the PHA documentation (refer to Annexure-3).

The principal approaches to making processes inherently safer are outlined in process safety literature, such as the CCPS publications "Guidelines for Engineering Design for Process Safety" and "Inherently Safer Chemical Processes—A Life Cycle Approach." These approaches are categorized as follows:

1.16.1 Substitution or Elimination

Objective: Replace hazardous materials with less hazardous alternatives.

Example: Use a less toxic solvent in place of a highly toxic one.

1.16.2 Intensification or Minimization

Objective: Reduce the quantity of hazardous materials used or stored.

Example: Design the process to make and use a toxic intermediate on-site, minimizing its storage.

1.16.3 Attenuation (Moderation)

Objective: Use less hazardous conditions or forms of materials.

Example: Operate at lower pressures or temperatures or use less reactive forms of chemicals.

1.16.4 Simplification or Error Tolerance

Objective: Design processes and systems to minimize the likelihood of operating errors and make them forgive of errors.

Example: Design controls and systems that are intuitive and robust to human errors or unintended conditions.

1.16.5 Limitation of Effects

Objective: Design facilities to minimize the impact of a hazardous material release or energy.

Example: Construct vessels to withstand extreme pressures to avoid failure and eliminate the need for pressure-relief devices.

In some references, the approaches are simplified into four categories:

Minimization: Reducing the quantity of hazardous materials used.

Substitution: Replacing hazardous materials with less hazardous ones.

Moderation: Using less hazardous conditions or materials to reduce risks.

Simplification: Designing processes and systems to reduce the potential for errors and make them more tolerant of failures.

1.16.6 Implementation and Timing

Opportunities for inherently safer design can be identified throughout the process life cycle but are most effectively integrated during the research and development (R&D) stage. Implementing ISP concepts at the R&D stage is generally more cost-effective and less difficult compared to later stages in the process development path. However, project and cyclical PHAs provide ongoing opportunities to apply and refine ISP concepts.

1.16.7 Documentation and Reporting

Documenting ISP Opportunities:

Identify and describe ISP opportunities and features in the PHA documentation.

Classify these opportunities based on their potential impact on safety and their feasibility.

Incorporating ISP in PHA:

Ensure that ISP considerations are integrated into the overall PHA documentation.

Summarize the ISP analysis, including identified opportunities and their potential impact on process safety.

1.17 DEVELOPMENT AND MANAGEMENT OF PHA FINDINGS AND RECOMMENDATIONS

During a Process Hazard Analysis (PHA), the team generates findings that need to be classified and reported to leadership for follow-up action. These findings often stem from hazard evaluations and are categorized as follows:

Recommendations: Necessary changes or requirements to improve process safety and reduce the risk of specific hazardous events.

Potential Improvement Opportunities: Non-safety-related operational or process improvements that are not critical for risk reduction but could enhance overall performance.

Additional Findings: Items requiring mandatory follow-up but not directly related to specific risk reduction; these may involve compliance or operational issues.

1.18 RISK ANALYSIS OF PHA FINDINGS

The risk associated with hazardous events identified by the PHA team shall be evaluated. Risk is the product of the seriousness (consequence) and the likelihood (frequency) of an event occurring. It's crucial not to overreact to high-consequence events without considering their likelihood. Evaluations can be qualitative, semi-quantitative, or quantitative:

1.18.1 Qualitative Risk Assessment:

Method: Use hazard evaluation methodologies (e.g., HAZOP) to assess the probability and consequence of each event.

Process: A matrix combining consequence and frequency rankings helps determine the overall risk and guide whether a recommendation is needed.

1.18.2 Semi-Quantitative Risk Analysis:

Method: Tools like Layer of Protection Analysis (LOPA) provide an order-of-magnitude estimate of risk by evaluating initiating event frequencies and the reliability of protection layers.

Implementation: LOPA should be facilitated by qualified or trained resources, with results reviewed by a qualified individual.

1.18.3 Quantitative Risk Analysis (Optional):

Method: Involves detailed analysis techniques such as Fault Tree Analysis (FTA) or Event Tree Analysis (ETA) to estimate event frequencies and risks.

Usage: Generally reserved for high-consequence events and requires expert assistance due to complexity and potential for error.

1.19 DEVELOPING PHA RECOMMENDATIONS AND IMPROVEMENT OPPORTUNITIES

1.19.1 PHA Recommendations:

Criteria: Recommendations should directly address hazardous events and reduce risk to an acceptable level.

Requirements: Recommendations should be specific, actionable, and not merely suggestions to investigate further. They should avoid prescribing specific design solutions to allow for innovative approaches.

1.19.2 Potential Improvement Opportunities:

Criteria: These address non-critical issues discovered during the PHA, which do not necessitate immediate risk reduction.

Documentation: Improvement opportunities should be documented separately from recommendations and forwarded to management. They should not appear in the main recommendations section of the PHA report but should be tracked if accepted.

Additional Findings:

Issues discovered that require follow-up but are not directly related to risk reduction, such as compliance or documentation errors.

Documentation: Clearly label and list these findings separately from recommendations. They should be appended to the PHA report and tracked until resolved.

1.20 DOCUMENTING RECOMMENDATIONS

Clarity: Each recommendation should specify the hazardous event, risk assessment, and how the recommendation mitigates the risk.

Detail: Include references to specific findings, and ensure detailed information is provided to those responsible for implementing the recommendations.

Assignment: Break multi-part recommendations into manageable tasks and assign them to individual responsible parties.

1.21 PRESENTATION TO MANAGEMENT

Review: The PHA team leader and members should present the PHA report to leadership, including findings and recommendations.

Acceptance: Management signs off on the report to signify acceptance. If concerns arise, management may request further work before approval.

1.22 MANAGEMENT'S RESPONSE TO RECOMMENDATIONS

Response Letter: Management shall prepare a response detailing their acceptance, modification, or rejection of each recommendation.

Justification: If modifying or rejecting recommendations, management shall provide a rationale, including technical feasibility, necessity, and alternative measures.

1.23 FOLLOW-UP ON RECOMMENDATIONS

1.23.1 Completion Timing:

Considerations: Recommendations should be completed promptly, considering urgency, resource availability, and other relevant factors.

Interim Measures: Implement interim controls to mitigate risks until permanent solutions are in place.

1.23.2 Tracking Recommendations:

System: Use a formal tracking system to monitor progress and completion of recommendations.

Reporting: Publish monthly updates on open recommendations and ensure no recommendations are removed without proper documentation.

1.23.3 Closing Recommendations:

Completion: Document and verify the effectiveness of completed recommendations.

Modification: Justify any changes to recommendations, ensuring alternate solutions are as effective as the original.

Cancellation: Document the reasons for cancelling recommendations and ensure thorough justification.

1.23.4 Tracking Other Findings:

System: Track additional findings in the same manner as recommendations, ensuring proper documentation and follow-up.

1.24 DOCUMENTATION OF THE PHA

The final report documents the PHA team's work, findings, and conclusions for management review.

Content: The report should provide detailed explanations of hazards, hazardous events, lines of defence, and the consequences of losing those defences.

Retention: Maintain a permanent copy in a central file, including all relevant documentation.

Recipients: Determine the distribution of the report based on business and site leadership requirements, ensuring all relevant parties receive the report.

Format: Follow the mandatory report format outlined in Annexure-3 for consistency across PHAs.

Communication: Ensure all employees affected by the findings and recommendations are informed about the PHA outcomes and actions taken.

1.25 PROCESS EVALUATION

Design: Review process design, including equipment, safety systems, and operational procedures.

Operational Aspects: Evaluate process flow, temperatures, pressures, materials, alarms, interlocks, and safety systems.

1.26 HAZARD IDENTIFICATION

Systematic Examination: Identify potential hazards and their causes through systematic examination of process steps, equipment, and operating conditions.

Types of Hazards: Include chemical reactions, fire and explosion risks, toxic releases, overpressures, and equipment failures.

1.27 CONSEQUENCE ANALYSIS

Impact Assessment: Evaluate the potential consequences of identified hazards, including fire, explosion, toxic releases, and environmental damage.

Feasibility Study: Conduct feasibility studies on the consequences of explosions within JSW processes to understand potential impacts and ensure appropriate risk mitigation.

1.28 RISK EVALUATION AND CONTROL MEASURES

Risk Assessment: Assess the risk associated with each identified hazard, prioritizing them based on severity and likelihood.

Control Measures: Implement engineering controls, administrative controls, and procedural changes to mitigate risks.

1.29 PROCESS HAZARD ANALYSIS PROCEDURE

Define Scope and Criteria: Establish the scope, context, and criteria for risk management according to the Risk Management Group Standard (JSW/GHS/GS-17).

1.30 RISK ASSESSMENT:

Risk Identification: Identify risks associated with the process.

Risk Analysis and Evaluation: Analyse and evaluate risks to determine their significance.

1.31 DOCUMENTATION AND FOLLOW-UP

Report: Document PHA results, including findings, recommendations, and proposed control measures.

Follow-Up: Track and ensure the implementation of recommendations and changes.

PHA Review: Conduct a PHA review every five years to ensure the analysis aligns with current processes.

1.32 ROLES AND RESPONSIBILITIES

1.32.1 Line Management:

Responsibility: Ensure the implementation and compliance with the PHA procedure. Provide support and oversight for all PHA-related activities.

1.32.2 Site Management:

- Demonstrating leadership and commitment to the PHA program.
- Providing essential resources for PHAs.
- Evaluating program effectiveness through auditing.
- Ensuring timely completion of PHAs and implementation of recommendations.

1.32.3 Head of Operations & Maintenance (O&M):

- Select and charter the PHA study team with qualified personnel.
- Monitor the progress of the PHA study team.
- Provide sufficient resources and prioritize PHA activities.
- Respond to PHA recommendations and oversee their implementation.
- Approve changes to the PHA recommendations and ensure communication of results to affected personnel.
- Define and document the scope and boundaries of each PHA based on factors such as process type, complexity, location, hazards, and other relevant factors.

1.32.4 Site PHA Leadership:

Provided by a PSM Sub-committee or Site PSM Leader:

- Offer guidance for PHA activities on-site.
- Ensure adherence to PHA requirements and procedures.
- Maintain and audit the PHA program for quality and effectiveness.
- Track accepted recommendations and ensure timely completion.
- Maintain an updated PHA procedure consistent with company standards.

1.32.5 Process Hazard Analysis Study Team

- Conduct the PHA in accordance with the team's charter.
- Request additional resources as needed.
- Document findings and present the final report to the Head O&M.
- Ensure that recommendations are tracked and addressed.

1.33 POST-PHA ACTIONS

Implement Recommendations:

Action Plan: Create and execute an action plan to address recommendations.

Documentation: Document the reasons for non-implementation, completed items, and system changes.

Schedule: Develop a schedule for actions and communicate deadlines to personnel.

1.34 PHA REVIEW AND UPDATE

Update Documentation: Update PHA documents with changes related to MOC and process modifications.

Periodic Updates: Regularly review and revise PHAs to account for process, equipment, or industry standard changes.

1.35 TYPES OF REVIEWS

1.35.1 New Facilities Reviews

1.35.1.1 Project-Level Facilities

When designing new facilities, process safety shall be a top priority. The objective of the PHA for new facilities is to integrate safety measures into the design as early as possible. This involves identifying and mitigating potential hazards early and implementing safeguards to prevent serious injuries, asset damage, or environmental harm. The project team is responsible for ensuring that all safety measures incorporated during the PHA are documented and reviewed with the Original Equipment Manufacturer (OEM) for authorization.

1.35.1.2 Project Process Hazards Analysis

For new facilities developed through capital projects, several PHA activities are typically performed:

Screening PHA (SPHA): Conducted early in the project to identify potential acute hazards and unknowns. The SPHA aims to propose broad scope changes to mitigate identified hazards. This involves reviewing the project scope, referring to existing baseline PHAs, assembling Material Safety Data Sheets (MSDSs), and documenting potential hazards. The SPHA report determines if further PHAs, such as a PPHA or Detailed PHA, are required.

Preauthorization PHA (PPHA): Follows the SPHA and addresses any identified hazards needing control or unresolved follow-up items. It reviews the SPHA results, assesses changes in scope or design, confirms all hazards and events have been identified, and ensures capital and technical requirements meet hazard control needs.

Detailed PHA(s): Required if SPHA or PPHA identifies hazards needing control. Detailed PHA(s) should start once process diagrams and design details are available. This analysis includes a comprehensive review of earlier PHAs, identification of new hazards, evaluation of safeguard adequacy, and development of recommendations for further hazard control. The Detailed PHA report shall be documented as per guidelines and completed before facility start-up.

Final Project Safety Report (FPSR): Required for projects that undergo full PHA activities. The FPSR compiles all PHA reports and summarizes key findings and recommendations. It documents significant changes during the project and becomes part of the permanent PHA file for the facility.

1.36 FACILITIES AUTHORIZED THROUGH MANAGEMENT OF CHANGE (MOC) PROCESSES

1.36.1 MOC Process Overview

Site MOC processes, which may be named differently (e.g., MOC-technology, MOC-facilities), are collectively referred to as the “MOC process” for this standard. The principles applied to project-level new facilities also apply to smaller changes or projects within the site MOC process, though the Process Hazard Analysis (PHA) should be simplified based on the hazard level.

For smaller modifications, a simplified hazard pre-screening review, typically included as part of the face-sheet control document, may suffice if significant hazards are not involved. For modifications with higher hazards or process complexity, a more detailed analysis such as a Simplified PHA (SPHA), Preliminary PHA (PPHA), or a Detailed PHA may be required. The decision rationale for conducting or not conducting various PHA steps should be documented. PHA reports should adhere to site MOC practices and be filed accordingly.

1.36.2 Existing Facilities Reviews

1.36.2.1 Baseline Process Hazard Analysis

The baseline PHA is a comprehensive, systematic review of a process that establishes a foundation for future cyclic PHAs or revalidations. It shall be thorough and based on an up-to-date process technology package, as outlined in the Section 7.1 of JSW Process Safety Management Standard. The baseline PHA shall include all mandatory elements specified in Annexure-3.

1.36.2.2 Cyclic Process Hazard Analysis Schedule

Cyclic PHAs for High Hazard Processes (HHPs) shall occur every three years from the date the PHA team signs off on the initial baseline PHA or from the due date of the preceding cyclical review. For processes with frequent safety incidents, extreme hazards, or frequent significant changes, consider a shorter review frequency.

The cyclic PHA schedule shall be updated and include dates of the last and next scheduled reviews.

1.36.2.3 Re-validation Protocol for Cyclic PHAs

Cyclic PHAs may be updated through revalidation, at least every 3 years following the initial PHA

1.37 PHA Resolution System

1.37.1 Submission and Review

Submit Reports: Submit completed PHAs to relevant committees within one week.

Resolution Plan: Develop a resolution plan within two weeks after review.

1.37.2 Guidelines for Resolution Timeline

Documentation: Record and track review and resolution actions.

Implementation: Ensure timely implementation of recommendations.

1.38 Special Considerations

1.38.1 Selection of Methodology

Based on Equipment/Process: Select PHA methodologies based on the nature and complexity of the process or equipment.

1.38.2 Integration with MOC

Documentation Updates: Ensure PHA documents are updated with any MOC-related changes.

Periodic Updates:

Regular Reviews: Revisit and update PHAs periodically to align with current processes and standards

Annexure-1: Risk Matrix

Severity Rating / Consequences definition table

Category	Score	People (P)	Asset (A)	Work Environment (WE)
Very High	C5	**Multiple Fatality / Irreversible health effect** More than one Fatality Illnesses with irreversible health effects affecting multiple people.	**Massive damage** Costs > Rs 30 Crs	Extreme Health effects affecting more than one person with a chronic medical disability
High	C4	**Single Fatal / Irreversible health effect** Single fatality or Multiple LTI Illnesses with irreversible health effects such as corrosive burns, asbestosis, and silicosis.	**Major damage** Costs > Rs 10 Crs to 30 Crs	Major Health effects affecting one person with a chronic medical disability
Medium	C3	**Major injury or Reversible health effect** Single LTI (occupational injuries which prevent a	**Moderate damage** Costs > Rs 50 Lacs to 10 Crs	Serious Health effects leading to minor but permanent disability

Category	Score	People (P)	Asset (A)	Work Environment (WE)
		worker from joining the next scheduled shift) or Multiple First Aid Illnesses with reversible health effects such as food poisoning, dermatitis, Musculoskeletal disorders, Repetitive strain injury etc.		
Low	C2	**Reportable injury (MTC or RWC) or health effect** MTC (Any occupational injury involving one-time treatment / medicinal help from a medical professional) or RWC Illnesses that result in minor discomfort & irritation or transient effects that are reversible after exposure stops.	**Minor damage** Costs > Rs 10 Lacs to 50 Lacs	Minor Health effects leading to temporary discomfort
Very Low	C1	**No or Minor injury or health effect** No Treatment Case, First Aid Case or Local Offsite Treatment Essentially no ill health effects.	**Slight damage** Costs less than Rs 10 Lacs	Superficial Health effects

Probability Definition Table				
Category	**Score**	**Probability Description**	**Event Frequency/ Year (For guidance only)**	**Safeguard Combination**
Almost Certain	F1	**Possibility of repeated incident** **Happens several times per year in different unit of JSW group**	**F1** **≥10-1 to ≤1**	Single Administrative
Likely	F2	**Event has occurred at least once in JSW Entities or is likely to occur within the**	**F2** **≥10-3 to <10-2**	1. One active OR 2. Two Independent Administrative

Category	Score	People (P)	Asset (A)	Work Environment (WE)
		lifetime of similar companies.		
Possible	F3	**A similar event has occurred at least Once in JSW Entities.**	**F3** **≥10-4 to <10-3**	1. Passive OR 2. One active + One administrative OR 3. Three Independent Administrative
Un-likely	F4	**A similar event has occurred somewhere in our industry but not in JSW Entities.**	**F4** **≥10^-5 to 10^-4**	1. Two active OR 2. One passive + one administrative OR 3. Four Independent Administrative
Rare	F5	**A similar event has not yet occurred somewhere in our industry**	**F5** **≥ 10^-6 to 10^-5**	1. Two Active + One administrative OR 2. One passive + One active

	Severity / Consequences					
Probability / Likelihood		**C1**	**C2**	**C3**	**C4**	**C5**
	F1	R2	R1	R1	R1	R1
	F2	R3	R2	R1	R1	R1
	F3	R3	R2	R1	R1	R1
	F4	R3	R2	R2	R2	R1
	F5	R3	R3	R3	R3	R2

Risk Factor	Classification	Risk Level
R1	Extreme Risk	"Extreme High Risk"
		Hazard Within this range should be immediately managed to reduce risk at least tolerate but preferably acceptable.
	High Risk	"High Risk"
		Hazard within this range should be proactively managed to reduce risk to acceptable
R2	Moderate Risk	"Moderate Risk" or tolerable risk
		Identified hazard within this range should be actively managed with reasonable efforts to bring down risk level to acceptable

Risk Factor	Classification	Risk Level
R3	Low Risk	"Low Risk" and therefore no further action would be necessary. However, it would still be important to ensure that any existing controls are managed

Risk Factor	Classification	Risk Level
16 to 25	Extreme risk	“Extreme risk” Hazards within this range should be immediately managed to reduce risk to at least tolerable but preferably acceptable
9 to 15	High Risk	“High Risk” Hazards within this range should be proactively managed to reduce risk to acceptable
5 to 8	Moderate risk	“Moderate Risk” or tolerable risk Identified hazards within this range should be actively managed with reasonable efforts to bring down risk level to acceptable;
1 to 4	Low Risk	"Low Risk" and therefore no further action would be necessary. However, it would still be important to ensure that any existing controls are maintained.

Severity	Circumstances
Critical (15)	Fatality, severe and permanent disability or illness. Prosecution by enforcement authorities. More than 50k in damage.
Major (10)	Lost time injury. Temporary disability or fractures. Prohibition or improvement notice issued by enforcement authorities, 10k to 50k in damage.
Serious (6)	Medical treatment, Alternative duties, requirement to report incident to enforcement authorities. 1k to 10k in damage.
Minor (2)	First aid/ Nil treatment or irritation. Minor, short-term environmental impact. Up to 1k in damage.

	Severity rating					
Probability rating		1	2	3	4	5
	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5

Probability	Description
Likely (15)	Certain to happen, possibly frequently, every time or daily while performing the activity
Likely (12)	Not surprised, to be expected once in a while, i.e. 2-3 times a monthly
Possible (9)	Could occur, been known to happen, i.e. 2-3 times a half yearly
Unlikely (7)	Unlikely, although convincible, i.e. 2-3 times a yearly
Impossible (5)	So unlikely that possibility is close to zero, negligible or happened more than a year

ANNEXURE-2: HAZOP NODE

Date of MEETING & Venue:
Plant:
Drawings (P&ID) Number:
Node number:
Node design intent:
Node Standard Operating Condition:
Name of HAZOP Leader, Scribe, Participants:

Parameter	Guideword	Deviation	Cause	Severity / Consequence	Impact (P, A)	Valid Safeguards	Safeguard type (Active/ Passive/ Administrative)	Risk Level			Recommendations	Implementation Status	Risk Level (Post recommendations)			Remark
								C	F	R			C	F	R	
Flow	No															
	More of															
	Less OF															
	Reverse															
	Part of															
	As Well as															
	Other than															
Temperature	No															
	More of															
	Less OF															

	Reverse															
	Part of															
	As Well as															
	Other than															
Pressure	No															
	More of															
	Less OF															
	Reverse															
	Part of															
	As Well as															
	Other than															
Time	No															
	More of															
	Less OF															
	Reverse															
	Part of															
	As Well as															
	Other than															
Level	No															
	More of															

	Less OF															
	Reverse															
	Part of															
	As Well as															
	Other than															

HAZOP Methodology Guide Words



ANNEXURE-3: PHA REPORT

General

The current approach to baseline Process Hazards Analysis (PHAs) and the requirements for their revalidation highlight the necessity for a well-organized and comprehensive PHA format. This format must be structured in a way that facilitates easy revalidation.

To meet this need, the mandatory baseline PHA report format outlined here was developed. It aims to provide a clear and organized structure for Detailed PHAs at the project level and baseline PHAs. This structure is designed to be easily updated, extended, and revalidated as part of the cyclical PHA process, incorporating any new information from project or Management of Change (MOC) PHAs. The goal is to produce a document at the conclusion of each PHA cycle that serves as a reliable baseline PHA. Additionally, this format offers the added benefit of streamlining first- and second-party Process Safety Management (PSM) audits of the PHA element by allowing for easier verification of PHA compliance through review of the report documentation.

The key feature of this format is its sectioned structure, with each major element of the PHA documented in a separate, comprehensive section. Each section should ideally be created as an individual word-processing document or as a distinct section within a single, continuous document. Sections may also include other types of documents as necessary. In this format, the pages of each section are numbered independently of the rest of the report, enabling them to be updated and revalidated on a standalone basis. For hardcopies, the report may be organized in a binder.

Requirements

The requirements for using the PHA format are specified in Section 7.1.2.3.

The table of contents for the PHA format is presented on the following page. A detailed description of each section follows. Specific mandatory elements for each item must be included in the PHA report. However, where indicated, sites may adapt the content or usage of certain sections to meet specific site needs or regulatory requirements, provided that all mandatory items are appropriately addressed.

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Consequence Analysis	Section K
Consequences of the Failure of Engineering and Administrative Controls	Section L
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Field Tour	Section N
Hazard Evaluation Methodologies and Selection Rationale	Section O

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Interlock Evaluation	Section T
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Communications of PHA Results	Section V
Appendices Appendix 1 Appendix 2, etc.	Section W

Cover page

The cover page of the PHA report shall contain the PHA title and date. Other information (e.g., identifying number [if any], basic site information, and the type of PHA) may also be included at the discretion of the site.

Approvals and authorizations

The PHA report shall include an approvals and authorizations page(s), which shall include the membership signature page. The signature page shall clearly state that the facility is or is not safe to operate.

Contents

Baseline PHAs shall have a contents page in alignment with the general format shown previously.

Section A—Introduction and overview

The PHA report shall include an introduction and overview section. This section shall provide a brief description of the process under review and the scope and nature of the PHA. Otherwise, the specifics of any additional content are left to the discretion of the site. A short overview of the process segment or operation should be provided, followed by a summary of the PHA Charter including a description of the boundaries of the area under study. For cyclical revalidation PHAs, a brief summary of the history of prior PHAs may be included, indicating both prior PHA activities and the frequency of revalidations. For larger PHAs, it may be desirable to expand this section into an executive summary by including a brief summary of the team's findings and recommendations. This section could then be used as a stand-alone document for broader communication to site management beyond the approvers and authorizers of the report.

Section B—Recommendations and management response

The PHA report shall include a recommendations and management response section. This section shall provide complete documentation of the recommendations made by the team as a result of their PHA activities and provide a place for filing or inclusion of management's response to the recommendations. The detailed development supporting each recommendation shall be documented in a way that makes clear the thinking and logic employed by the team to generate the recommendations.

A suggested format is as follows:

Recommendation No. (or another identifier):	
Description	A detailed description of the specific action recommended by the PHA team.
Rationale	A detailed discussion of the team's rationale in making the recommendation and references to any supporting documentation found elsewhere in the report.
Risk Analysis	A summary of the qualitative (or quantitative) risk analysis for the potential event prompting the recommendation (e.g., risk analysis: frequency–F2, consequence–C4, risk ranking–II)
Reference	A pointer or reference to the specific portion of the hazard's evaluation (or other PHA activity) that prompted the recommendation (e.g., reference: "what if"/checklist hazards evaluation–distillation column, question 132)

There may be other categories of items generated during the PHA (e.g., Action Items and Potential Improvement Opportunities). If other categories of items besides recommendations are addressed in this section, they shall be clearly defined and clearly delineated so that there is no possibility of their being interpreted as PHA recommendations. Only PHA recommendations are listed in this section of the report. Under no circumstances shall potential improvement opportunities be collected as a list in this section, or any other section, of the PHA report. Collected lists of other categories of findings (e.g., Action Items) shall be placed in an annexure.

Section C—PHA team membership and qualifications

The PHA report shall contain a team membership and qualifications section. This section shall contain a detailed list of the full-time PHA team members. Any ad hoc members or other part time participants should also be listed. A suggested format would be to include the following:

- Name
- Official job title
- Affiliation (e.g., external company or internal organization)
- Area of expertise for the PHA (e.g., operator or process engineer)
- Number of years of total company or relevant industry experience
- Number of years of experience with the process or area under review
- Prior PHA training
- Prior PHA experience

The qualifications of individuals required by this procedure to meet certain training and/or other qualification criteria (e.g., the PHA resource, the LOPA resource) shall be documented in this section of the report. The information included in this section permits verification that the minimum essential requirements for a multi-disciplined PHA team composition, as detailed in Section 7.2.1.2 and certain aspects of the training requirements have been met.

1.38.2.2 *Section D—PHA meeting summary*

The PHA report shall contain a PHA meeting summary section. At a minimum, this section of the PHA report shall include a list of the PHA meetings held and the attendance at those meetings. For teams that like to take detailed meeting notes, they may be included as part of this section or as an annexure.

1.38.2.3 *Section E—Team training*

The PHA report shall contain a team training section. It shall include a description of the training provided to the PHA team throughout the course of the study. This section shall include documentation of the overview training in the PHA procedure and application of the hazard evaluation methods selected for the study as required.

Training provided to the team on any other specific aspects of the PHA (e.g., human factors, ISP, and LOPA) should also be documented in this section.

1.38.2.4 *Section F—Process/equipment description*

The PHA report shall contain a process/equipment description section. The boundaries of the studied area must be described in specific detail in this section. This section is intended to provide a detailed description of the process and process equipment, such that a reader unfamiliar with the process is able to clearly understand it. Where appropriate, a description of the process chemistry, the materials handled, and the unit operations should be included. Simplified process diagrams, drawings or photos may be included to enhance the reader's understanding.

1.38.2.5 *Section G—MOC (Technology) since the last PHA*

The PHA report shall contain MOC (technology) since the last PHA. For cyclical PHAs and/or revalidations, this section provides a place to list and summarize the MOCs reviewed as part of the PHA and discuss the significance of any of the process changes. For new projects, it may be marked as "not applicable," or it may be used to discuss any significant changes to the process technology that have occurred since the Screening or Pre-authorization PHAs.

1.38.2.6 *Section H—Process Technology assessment*

The PHA report must include a section dedicated to the assessment of process technology. Site leadership is responsible for ensuring that process technology information, as defined in the company's Process Safety Management Standard, is current, complete, and accurate. This information should be thoroughly assessed before the PHA review commences. This section should document the team's efforts in reviewing and either confirming the adequacy of the process technology information or identifying any deficiencies that require correction, with particular focus on the process design basis and equipment design basis components.

Any deviations from applicable codes and procedures, or any issues related to equipment design and installation compliance with Recognized and Generally Accepted Good Engineering Practices (RAGAGEP), that need to be addressed in the PHA, should be clearly documented in this section.

1.38.2.7 *Section I—Hazards of materials*

The PHA report must include a section detailing the hazards of materials used in the process. This section should list all materials encountered, including raw materials, intermediates, by-products, final products, utilities, and significant materials used in construction. For each material, provide the Material Safety Data Sheet (MSDS) or Chemical Abstracts Service (C.A.S.) numbers along with a summary of their hazards and properties.

Where applicable, include a copy of the chemical interaction matrix and a summary of the potential for uncontrolled chemical reactions. Special attention should be given to materials covered by the Company's Management of Highly Toxic Materials procedure, ensuring that the PHA team is aware of any specific needs or requirements for analyses involving those materials.

1.38.2.8 *Section J—Hazards, hazardous events, and lines of defence*

The PHA team must identify and understand the consequences of a broad range of potential hazardous events associated with the process. The consequence analysis should consider the following critical information: the type of resulting event, estimated potential release quantities, the consequences of the event, and the safety and health impacts on both site personnel and the surrounding community.

This section should provide an executive summary of the identified hazards, the most significant hazardous events that could arise from the process, and the primary safeguards in place to reduce or eliminate the likelihood of these events. Additionally, this section may document estimates of potential release quantities, the event's consequences, and the safety and health effects on site and community personnel, where applicable.

One effective way to document compliance with these requirements is by dividing the process into segments. For each segment, list the associated hazards, followed by the specific hazardous events of concern, including estimates of potential release quantities where appropriate. For each event, provide a qualitative description of the consequences (including safety and health effects on site and community personnel) and the safeguards or lines of defence, as illustrated in the following example.

Item	Description
Segment:	Transfer of hot metal
Hazard:	Extremely high temperature
Event A:	Spillage of hot metal from ladle
Consequences:	High potential for extremely serious burn injury/fatality to nearby personnel. A much greater potential of asset damage which is a function of spillage location (on water), size of spillage and spread. Spillage size could vary from a few tons to a total content of the ladle with a maximum spillage of about 170 tons. It is highly unlikely that any spillage could remain undetected.
Safeguards:	Mandatory visual inspection and preheating of the hot metal ladle

It should be noted that non-chemical hazards (i.e., thermal energy and kinetic energy) may exist in the process, and they should be addressed as part of this section.

Section K—Consequence analysis

The PHA report shall have a consequence analysis section. This section shall discuss the results of any quantitative consequence analyses and provide basic conclusions drawn from the consequence analyses. It is suggested that the qualitative discussion of the consequences of the identified events of concern be included in Section J of the report. Some description of consequences is also contained in the hazard evaluation worksheets. The intent of this section is to provide a summary and discussion of any quantitative consequence analysis done in support of the PHA. The results of modelling using PHAST, TRACE, FLACS, or any other software tools if used should be summarized for inclusion here. Pointers should be provided to the qualitative consequence analysis included in Section J and any detailed calculation reports, which may either be included in the back of this section of the report or placed in the Appendices.

Section L—Consequences of failure of engineering and administrative controls

This section is intended to serve as a reference point, directing readers to all sections of the PHA report where the consequences of the failure of engineering and administrative controls are discussed. This is designed to facilitate verification of compliance with specific regulatory requirements. This section may be adapted to document location-specific regulatory requirements or marked as not applicable, depending on the circumstances.

Section M—Review of process incidents

The PHA report shall contain a section for the review of process incidents. Each serious incident report reviewed in the PHA should be listed and summarized (e.g., date, title, and a description of what occurred). Any learnings or conclusions resulting from the review should be discussed, including a listing or discussions of the key factors identified from root cause failure analysis. For cyclical revalidations of existing processes, this incident summary should be expanded to include incidents occurring since the prior PHA, while preserving information on incidents gathered during previous PHAs. For project-level Detailed PHAs, this section should be used to document and discuss any historical incidents of relevance to the process, or processes associated with the project.

Section N—Field tour

The PHA report shall contain a section documenting the dates and findings of the field tour(s) conducted during the course of the PHA.

Section O—Hazard evaluation methodologies and selection rationale

The PHA report shall contain a section describing the specific hazard evaluation method(s) selected for use in the study and an explanation of the rationale behind the selection.

Section P—Hazard evaluation worksheets

The PHA report shall contain a section with the detailed notes and documentation used in the hazard evaluation methodology.

For cyclical PHA revalidations, hazards evaluations done in prior PHAs may be reviewed, updated, and/or extended for inclusion, in addition to any new studies conducted. A table summarizing any hazards evaluations done during the current and prior PHAs may be included to provide an historical perspective.

Section Q—Facility siting

The PHA report shall contain a section discussing and documenting any facility siting issues associated with the process under study. Dependent upon the specific type of PHA.

Ultimately, the information contained in this section is to be used to update the site-wide facility siting PHA, during its next revalidation cycle.

Section R—ISP Options

The PHA report shall contain a section to document the team’s consideration of ISP technology and any resultant recommendations. In addition to any practical recommendations for improving inherent safety in the existing process and any “blue sky” thoughts for future generations of the process technology, it is a good practice to document any existing features in the process, as well as any changes since the last PHA, that reflect application of ISP concepts.

Section S—Human factors

The PHA report shall contain a section on human factors. It shall document how the team has addressed human factors throughout the PHA, in most cases, these requirements may be fulfilled by conducting one or more human factors focused field tours and analysis using one or more appropriate human factors checklists.

Section T—Interlock evaluation

The PHA report must include an interlock evaluation section. Required documentation related to the types of safeguards should be incorporated into the hazard evaluation worksheets, as outlined in Section P. whenever an interlock is listed in the safeguards or recommendation fields of the hazard evaluation, the interlock’s category (e.g., process or safety) must be determined and documented. For Safety Instrumented Functions (SIF), the target Safety Integrity Level (SIL) of the interlock, and/or the Probability of Failure on Demand (PFD), must also be determined and documented.

This section should be used to document the analysis conducted by the team to meet the interlock evaluation requirements and the JSW PSM Standard. Layers of Protection Analysis (LOPA) worksheets should be included in this section unless they are already incorporated within the hazard evaluation worksheets.

Section U—References

The PHA report shall contain a references section. This section provides a place to list any references consulted or used by the PHA team during the course of their work. Examples could include relevant company or industry consensus codes and procedures, previous PHAs, and technical references.

Section V—Communication of PHA results

The PHA report shall contain a section for documentation of the communication of PHA results, “Line management shall help ensure that the findings of all PHAs, including the actions taken, are communicated to all employees whose work assignments are in the facility or who are affected by the recommendations or actions.” This section is intended to provide a place to document the plan to communicate the results of the PHA. The information provided, the method of communication, and the people receiving it should be clearly documented. Second, the results of the PHA and the consequence analysis should be communicated to the Site Emergency Response Committee (SERC).

Section W—Appendices

The PHA report shall contain an appendices section. This section shall include, at a minimum, a copy of the PHA Charter and the PHA completion checklist. This section should be used for any other supporting documents not included elsewhere in the PHA. Possible examples include appendices for copies of the MSDS for the primary materials involved in the process, supporting calculations, and copies of other checklists used during the PHA.

Additional Sections

Some situations may call for additional sections for information not addressed in the PHA report format. For example, local regulations may require explicit coverage of a topic not included in the procedure PHA report format. In such instances, it is permissible for the PHA team to add in additional sections

ANNEXURE-4: PHA CHECKLIST

PHA Completion Checklist

A.1 Preparation for PHA			
		Yes	No
1	A charter for the PHA was provided or developed and agreed to with area management.	O	O
2	Process technology package was examined and found to be adequate.	O	O
3	The team selected had adequate experience and expertise.	O	O
4	Adequate training was provided for team members in PHA techniques.	O	O
5	A field tour was conducted during this study.	O	O
A.2 Hazards identification			
6	Process hazards present in the process segment were identified and documented.	O	O
7	Serious potential incidents were reviewed.	O	O
8	Previous PHAs were reviewed.	O	O
9	Management of change (MOC) documents were reviewed.	O	O
A.3 Consequence analysis			
10	Hazardous events that could occur were defined.	O	O
11	A consequence analysis has been done prior to or as a part of the detailed PHA and used as a primary input for the rest of the study.	O	O
12	Consequences of hazardous events were reviewed.	O	O
13	Major lines of defense were identified.	O	O
14	Possible safety and health effects were evaluated.	O	O
15	Quantitative estimates of off-site consequences were made.	O	O
A.4 Hazards evaluation			
16	The PHA methodology was selected with consideration for the hazards identified and the consequences defined.	O	O
17	Lines of defense were evaluated for adequacy of control and consequences of control failure.	O	O
18	Facility siting issues were evaluated for all occupied buildings that could be affected by the hazardous events studied.	O	O
19	Human factors were evaluated.	O	O
A.5 Hazards control			
20	Inherently safer process changes were considered.	O	O

A.1 Preparation for PHA			
21	A qualitative or quantitative evaluation of risk was developed as abasis for preparing any recommendations.	O	O
22	A clear statement of each recommendation has been preparedcontaining degree of risk, connection with a defined hazardousevent, discussion of why additional prevention/mitigation is needed.	O	O
A.6 PHA report contents			
23	The report contains a membership signature page with a consensus statement indicating that the process is safe to operate in its present condition or requires modification, and the signatures of all full-time members	O	O
24	The PHA report includes a management response validating each recommendation and assigning follow-up responsibility and timing.	O	O
25	The report has a sketch or description that clearly indicates the process segment boundaries that were included in the review.	O	O
26	The PHA includes a detailed process description, including process chemistry	O	O
27	The PHA includes a list of hazards, the lines of defense, and effectsof failure of each line of defense.	O	O
28	The PHA report contains a clear list of recommendations that are specific and accomplishable.	O	O
29	The reasoning behind each recommendation is clearly explained inthe report.	O	O
30	Inherently safer process considerations used to develop recommendations are documented in the report.	O	O
31	A summary of the results of the consequence analysis is included inthe body of the report	O	O
32	A summary of the results of the facilities siting evaluation is included in the body of the report	O	O
33	A summary of the results of the human factors evaluation is included in the body of the report	O	O
35	The results of the PHA have been communicated to all affected employees.	O	O

PHA documentation –

Process Hazards Analysis charter PHA ID No.:_____

Purpose of effort

- Identify the process hazards of the study area. This includes a list of all the credible hazards of the process and the ways in which these hazards could occur. Also included is a list of the mitigating factors in place to prevent the hazard from occurring.
- Evaluate the hazards identified, determine the adequacy of safeguards, and make recommendations for any improvements needed.
- Create ownership and participation of the PHA across a wide cross section of the organization.

Desired outcome / products

- Publish a timeline to set goals for the PHA.
- Follow the guidelines of “Process Hazards Analysis Procedure”.
- Use the PHA completion checklist to ensure a thorough study.
- Document the PHA using the guidelines in “Process Hazards Analysis Procedure”.

Clients

(Persons or groups who receive the final product)

- President
- Head Operation and Maintenance
- Heads of Department
- Section Heads

Stakeholders

(Groups and individuals whose input is needed or who may be affected by the process)

- All members of the business team
- People in the neighbouring community
- People in adjacent work areas

Decision making

- Decision making should be by consensus. All team members should be active in the decision-making process during the study.
- Head of Department should approve the final report.

Roles and functions

(Individuals who fill the following roles and/or functions)

- PHA Team Leader:
- Operations member:
- Technical support member:
- Maintenance member:
- Process resource (if used). If no process resource is assigned, these duties are assumed by the PHA chairman:
- Scribe (may be a committee member or bring in an additional person):

- consultants, as needed:

Key issues/possible pitfalls

- **Conflicting priorities, such as vacations regular jobs, plant problems -** It is expected that organization provides resources to this PHA effort as a high priority. Supervision is expected to ensure that committee members are available for all meetings and have adequate time to accomplish assigned committee tasks outside of meetings.
- **PHA experience** - Some committee members may have received prior PHA training or have participated in prior PHA studies. Some may have less experience. More experienced members should train less experienced member.
- **Future PHA capability and skills -** The committee should avoid complete reliance on individual persons so that in-house PHA skills are concentrated in a small group of people. The PHA experience should include training to improve each member's capability to conduct or participate in future PHAs.

Road map

(Timelines, major check points, meeting schedules, workflow charts, etc.)

- This work should be started by_____ and completed by_____.
- The final presentation of results should be by_____.
- Key milestones:
  - Preparatory work and planning
  - Fieldwork
  - Meetings
  - Documentation
  - Final review
- The committee should prepare a more detailed timeline and publish these goals to management (see Annexure-4, PHA timeline - example).

Resources

- Area or site process analysis manual:.....
- Corporate Procedures (PSM):.....

Prior PHRs

PROCESS STUDY BOUNDARIES

COVER PAGE

Date of Review:		Issue Date: .....
		PHA Report No.:
Process Hazards Analysis of XXXXXXXX Area: Unit XXX		
Approvals		
Operation		Date
Maintenance		Date
Section Head		Date

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J. Hazard Evaluation Methodology Documentation

K. PHA Completion Checklist

L. References

M. Additional Tasks Documentation

MEMBERSHIP SIGNATURE PAGE

Process Hazards Analysis of Plant Area		
PHA Team signatures		
This report represents the consensus of the PHA team. Based on the informationanalyzed in this study, to the best of our ability we believe this process to be safe to operate in its present condition.		
PHA Leader		Date
Operation		Date
Maintenance		Date
E&A		Date

MANAGEMENT RESPONSE TO RECOMMENDATIONS

MANAGEMENT RESPONSE TO RECOMMENDATIONS
Business Name: Site Name: Date:
To: Process Hazards Analysis Team for PHA No. _____ _____, PHA Team leader _____, Operation _____, Maintenance _____, E&A PHA No. _____ Cyclic Process Hazards Analysis of _____ (descriptive title of area being reviewed)
Management recognizes the excellent effort and work done by your team and commendsyou for the contributions made in completing the process hazards analysis. Therecommendations and subsequent discussions indicate the personal commitment to safety that is the basis of continued business success. Our response to the recommendations in your report is given below. The management wantsto reiterate the point made by your team that the current facility is safe (or requires the following modifications) to operate. The recommendations made here are further upgrades toensure exemplary operation and to meet increasingly stringent safety, health, and environmental procedures.
LIST OF THE RECOMMENDATIONS:

PHA TIMELINE

PHA TIMELINE	
To: Section Head Operation Maintenance E&A From: PHA Team No.:_____ After our initial organizational meeting, the PHA committee has agreed on the following goal dates for completing our PHA.	
Action:	**Goal Date:**
• Start • Meeting schedule (for example, 2 times/week for 4 hours each) • Assemble required records (technology package, test authorizations, change of designs, serious incident reports, interlocks, relief device records, operation procedures, etc.) • Completion of hazard identification • Completion HAZOP studies • Complete consequence analysis • Complete Process hazard review • Complete draft PHA report • Issue draft report for comments • Issue completed report	

GENERAL HAZARD IDENTIFICATION CHECKLIST

Introduction

The objective of this checklist is to ask questions that assist in identifying hazards. The questions are general in nature and are likely to identify many items that do not fit the definition of process hazards.

The key value of the questions is to trigger thoughts and evaluation in a broad spectrum of areas. The process should not be looked at as a whole. To focus your attention, it should be divided into major items (e.g., reactor, compressor, dryer, stripper column, etc.).

Before proceeding, one should be aware of all the information available to be used, their interactions with each other, and the materials of construction at the appropriate temperatures and pressures. The chemical interaction matrix can help generate this awareness. Also, any other relevant PHAs and incident reports should be reviewed.

Consider any special circumstances presented by the location and its surroundings. For example, consider hazards such as earthquake, hurricane, flood potential, hazards from surrounding plants, airports.

1.38.2.9 *Procedure*

The following questions should be asked for each major item until the entire process area has been covered.

Fire

- Are flammable/combustible materials involved?
- Are these materials covered by all the appropriate fire codes (NFPA, API, electrical area classification)?
- Is there anything special about our circumstances that suggest the above are not completely adequate?
- Is there anything we need to know to help us answer these questions?
- If so, how can we obtain this information? All the fire hazards and their potential should be listed.

Explosion

Is any explosion potential present due to the following conditions?

Physical overpressure

- Is the overpressure mechanism conventional and well understood; will relief devices designed to conventional procedures provide adequate protection?
- Is the overpressure mechanism unusual or complex, so that the conventional safeguards may not be adequate? Is there anything we need to know to understand the hazard? If so, how do we get it?

Ignition of flammable mixtures inside process equipment or buildings

- Will conventional means of controlling proper ratios (e.g., burner management system), preventing air ingress (e.g., inerting), and eliminating ignition sources (e.g., area classification, anti-static precautions) be sufficient to prevent the explosion?
- Do we know all the data we need to define the boundary of explosive conditions? If not, how do we get it?

Ignition of flammable vapor clouds in air

- A large release of flammable material flowed by an ignition can result in significant injuries to personnel and damage to buildings. All the necessary data to properly define the boundaries of the hazard should be obtained.

Unusual reactions, decompositions, exotherms, polymerization.

- By definition, these require special attention to understand them and identify all potential causes. These conditions generally are process hazards needing special attention. Do we have all the information we need to define these hazards? If not, how do we obtain it?

Toxicity

Process hazards involve the release of toxic materials that pose a risk of fatality or irreversible health effects to employees or may cause nuisance to neighboring communities. If such risks are present, they must be identified as process hazards. It is essential to ensure that sufficient toxicity data is available to accurately assess the extent of the hazard and determine whether additional measures are necessary beyond relying on sound engineering design to contain the materials fully. Chronic toxic issues should be addressed, and in all cases, these matters should be handled by toxicologists, hygienists, or industrial health specialists.

Noise

Generally, noise does not present a process hazard, but asking these questions may trigger a new discovery. General noise concerns should be addressed outside the PHA effort.

Radiation

- **Nuclear -** Radioactive sources for sensors like level devices are not generally process hazards as long as the radiation source is contained. There are well-established procedures for dealing with these, and good design and operating procedures should deal adequately with this type of problem.
  - Is there any nuclear radiation that needs special and unusual precautions? If so, record it as a process hazard and determine what information we need to define the boundaries of the hazard.
  - Where can we obtain this information?
- **Electromagnetic**
  - Is there any EM radiation?
  - Is it covered by well-recognized precautions?
  - Consult the appropriate authority for these precautions and ensure they are integrated into the design.
  - Is there any EM radiation unique to this process that will not be covered by following well- recognized precautions? If so, record EM radiation as a process hazard and determine what information is needed to define the boundaries of the hazard and where can we get it?
- **Thermal -** Hot surfaces covered by OSHA regulations for protecting operations are not generally considered process hazards. Such surfaces should have operator protection as part of good design and safety.
  - Are there any thermal sources that present an unusual hazard to the operators, neighbours, equipment, etc. (e.g., flares)? If so, they should be recorded as process hazards, and it should be determined what information is needed to define the boundaries of the hazard?

Pollution

Many pollution concerns are not process hazards and should be addressed by good design procedures and managed through the normal environmental efforts outside the PHA effort.

- **Appearance**
  - Are there any regulations or building codes specifying aesthetics, limiting heights, colour, or other visual effects?
  - Do these have any process hazards potential?
  - Other visual effects, such as vapor clouds, bright flares, etc., might alarm the neighbours and should be considered as process hazards and dealt with accordingly.

- **Discharges:** Anything that may be leaked, spilled, or discharged, either accidentally or deliberately, whether continuously, routinely, or episodically, needs to be considered as a process hazard. This includes relief valve discharges, scrubber vents, drains, glands and flange leaks, seal flushes, etc. This also includes spent catalysts, column packing, empty drums, washings, material cleaned from tubes, pipes, heat exchangers, etc., or anything that is not consumed in the process and, therefore, has to be disposed of.

  The continuing growth of legislation in this area means that, although there may not appear to be a hazard from some of these discharges, they may well be regulated and require permitting or reporting. Each such hazard, therefore, should be considered by the appropriate consultant to determine if it requires special treatment and, if so, what that is.
- **Dusts:** Dusts, whether product or raw materials like ore or coke, can cause considerable annoyance to neighbours if they are pervasive. What is the hazard potential for releasing these materials?
- **Smells:** Are there any noxious odours that are a hazard to employees or neighbours?

Financial Loss

Although not a process hazard in the normally accepted sense, it is appropriate to question whether any deviation or failure of any part of the major item under consideration could cause major financial losses due to quality problems, down time, or equipment unavailability. Any such sensitive equipment should be recorded for special attention, probably outside the PHA effort.

Process Hazard Evaluation Checklist

Checklist-generated questions

One of the process hazard evaluation methodologies consists of more question formulation through the use of checklists. A copy of the simplified checklist and the [a]loss of containment checklist[o] are provided in Attachments A and B for possible consideration by the PHA team. The team should also consider other checklists, as appropriate. The checklist should be reviewed, point by point, to see if any additional questions are stimulated. All additional questions generated in this fashion should be recorded by the scribe as noted above. The formulation meeting is completed when all selected checklists have been reviewed.

Question(s) assignment

The final stage of the question-formulation meeting is assigning questions to the PHA team members. The team members then develop written responses to the questions outside the meeting. A fully developed response includes a restatement of the question, an identification of the potential hazardous event, a list of existing safety layers, and a discussion of any recommendations.

Question/response meeting(s)

The objective of the question-response meeting(s) is to build consensus around the answer to each question. The PHA team members meet to review, discuss, and finalize the final response to each question. Typically, the working activities during the question response meeting are as follows:

- The prepared response is accepted by the PHA team as submitted. The prepared response is accepted following a short discussion and/or minor modification.
- Acceptance is deferred until the next meeting, pending additional investigation, study, etc. outside the meeting. Meeting time should not be used to develop question responses.

The question-response meeting(s) are complete when the PHA team has reached a consensus agreement on each response to each question.

Simplified checklist for hazards analysis

Introduction

The following simplified checklist was derived from what if questions and covers important aspects of a process facility. The words or phrases in the list should serve to stimulate questions concerning the subject.

The phrase materials of construction should lead to such questions as:

- Have suitable materials been used in vessels, piping, instruments, instrument connections, agitators, dip tubes, valves, valve packing, vessel supports, flange bolts, expansion joints, etc.?
- What is the basis for selecting these materials?
- Are corrosion tests needed or desirable?
- Where plastic pipe linings or equipment is used, are the temperatures and pressures low enough or adequately controlled?

Other checklists that can be effectively used in lieu of the simplified checklist include:

- Loss of containment checklist (Attachment B of this Appendix)
- Other checklists, such as those in Appendix B of [a]Guidelines for Hazard Evaluation Procedures, by AIChE and CCPS.

Attachment A - Simplified process hazards analysis checklist

Attachment A: Simplified process hazards analysis checklist	
For use in stimulating questions during a [a]what if[o]/checklist review	
Storage of raw materials, products, intermediates	
Storage tanks	Design, separation, inerting
Dikes	Capacity, drainage
Emergency valves	Remote control-hazardous materials
Inspections	Flash arresters, relief devices
Procedures	Contamination prevention, analysis
Specifications	Chemical, physical, quality, stability
Limitations	Temperature, time, quantity
Materials handling	
Pumps	Relief, reverse rotation, identification
Ducts	Explosion relief, fire protection, support
Conveyors, mills	Stop devices, coasting, guards
Procedures	Spills, leaks, decontamination
Process equipment, facilities and procedures	
Procedures	Purging, start-up, normal, test authorizations, shutdown,emergency
Conformance	Job audits, shortcuts, suggestions
Loss of utilities	Electrical, heating, coolant, air, inerts, agitation
Vessels	Design, materials, codes, access
Identification	Vessels, piping, switches, valves
Relief devices	Reactors, exchangers, glassware
Review of incidents	Plant, company, industry
Inspections, tests	Vessels, relief devices, corrosion
Electrical	Area classification
Operating ranges sequence	Normal temperatures, pressures, flows, ratios, concentrations, densities, levels, time, sequence
Ignition sources	Peroxides, acetylides, friction, fouling, compressors,static electricity, valves, heaters
Compatibility	Heating media, lubricants, flushes, packing

Safety margins	Upper and lower operating limits, maximum coolingcapacity, contamination, runaway reactions
Personal protection	
Protection	Barricades, personal, shower, escape aids
Ventilation	General, local, air intakes, rate
Exposures	Other processes, public environment
Utilities	Isolation: air, water, inerts, steam
Hazards manual	Toxicity, flammability, reactivity, corrosion, symptoms,first aid
Environment	Sampling, vapors, dusts, noise, radiation
Controls and emergency devices	
Controls	Ranges, redundancy, fail-safe
Calibration, inspection	Frequency, adequacy
Alarms	Adequacy, limits, fire, fume
Interlocks	Tests, bypass procedures
Relief devices	Adequacy, vent size, discharge, drain, support
Emergencies	Dump, drown, inhibit, dilute
Process isolation	Block valves, fire-safe valves, purging
Instruments	Air quality, time lag, reset windup
Waste disposal	
Ditches	Flame traps, reactions, exposures, solids
Vents	Discharge, dispersion, radiation, mists
Characteristics	Sludges, residues, fouling materials

Attachment B - Loss of containment checklist

These questions should be used to stimulate the identification of potential hazards. Each question should be answered fully, not with a simple yes or no. Some questions may not be applicable to the review of a given pro duction operation.

Loss of containment causes in the chemical industry - checklist

This checklist catalogues plant inventory discharged to the environment due to loss of containment.

Note: This checklist does not presume to be an exhaustive list of causes

Loss of Containment Checklist
1. Containment lost via an open-end route to atmosphere a. Due to genuine process relief or dumping requirements b. Due to mal operation of equipment in service; for example, spurious c. relief valve operation or rupture disk failure Due to operator error; for example, drain or vent valve left open, misrouting of materials, tank overfilled, unit opened up under pressure, etc.
2. Containment failure under design operating conditions due to imperfections in the equipment • Imperfections arising prior to commissioning, not detected before start-up (due to poor inspection or testing procedures) • Equipment inadequately designed for proposed duty; for example, wrong materials specified, pressure ratings of vessels or piping inadequate, temperature ratings inadequate • Defects arising during manufacture; for example, wrong materials used, poor workmanship, poor quality control • Equipment damage or deterioration in transit or during storage • Defects arising during construction; for example, welding defects, misalignment, wrong gaskets fitted Imperfections due to deterioration of the equipment in service, not detected before the effect became evident (due to inadequate monitoring procedures in those cases where deterioration is gradual). • Normal wear and tear on pump or agitator seals, valve packing, and flange gaskets • Internal and/or external corrosion, including stress corrosion cracking • Erosion or thinning. • Metal fatigue or vibration effects. • Previous periods of gross mal-operation; for example, furnace operation at above the design tube skin temperature (creep). • Hydrogen embrittlement • Imperfections arising from routine maintenance or minor modifications not carried out correctly; for example, poor workmanship or the wrong materials.
3. Containment failure under design operating conditions due to external agencies a. Impact damage by cranes, road vehicles, excavators, or other machinery associated with the process b. Damage by confined explosions due to accumulation and ignition of flammable mixtures arising from small process leaks; for example, flammable gas buildup in analyser houses, in enclosed drains, around submerged tanks c. Settling of structural supports due to geological or climatic factors or failure of structural supports due to corrosion d. Damage to tank trucks and containers during transport of materials on- or off-site

4. Containment Failure Due to Deviations in Plant Conditions Beyond Design Limits

a. Over pressurizing of Equipment

Due to a Connected Pressure Source

- Gas Pressure Source
  - Gas breakthrough into downstream low-pressure equipment due to failure of a pressure or level controller, or erroneous opening of an isolation valve.
  - Pressurized backflow into low-pressure equipment, e.g., caused by compressor failure.
- Liquid Pressure Source
  - Pumping into blocked-in gas spaces.
  - Hydraulic over pressurizing due to a downstream blockage.
  - Excessive surge or hammer, e.g., caused by sudden valve closure on a liquid transfer line.

Due to Rising Process Temperature

- Loss of Cooling
  - Loss of coolant flow, e.g., to a reactor cooler or distillation column condenser.
  - Elevated coolant temperature, e.g., due to loss of cooling water fans.
  - Fouling of coolers, condensers, or heat exchangers.
- Excessive Heat Input (Thermal)
  - Heater control faults, e.g., in steam or hot-oil heated systems.
  - Ingress of hot extraneous materials, e.g., slop-over.
- Excessive Heat Generation (Chemical)
  - Reactor runaway, e.g., due to loss of reaction diluent, high feed rate, high molar ratio, accumulation of unreacted reactants due to inadequate mixing, or temporary loss of reaction leading to a runaway.
  - Exothermic reactions due to the ingress of catalytic impurities, e.g., backflow from an ethylene oxide consumer unit into a feed tank.
  - Exothermic reactions due to mixing of incompatible materials, e.g., H2SO4 with NaOH.
  - Exothermic decomposition of thermally unstable or explosive materials, such as peroxides, e.g., due to temperature rise, over-concentration, or deposition on hot surfaces.

Due to Internal Explosions Arising from Formation and Ignition of Flammable Gas Mixtures, Mists, or Dusts

- Ingress of air, e.g., due to inadequate purging of equipment at plant start-up or loss of nitrogen purge on flare headers, storage tanks, centrifuge systems, and dryers.
- Loss of a critical inert diluent, e.g., loss of nitrogen padding on an ethylene oxide storage tank or loss of nitrogen to the makeup section of a nitrogen/air solids conveying system.
- Failure of explosion suppressants.
- Flammable excursions in oxidation processes, e.g., due to high air or oxygen rates or loss of conversion.
- Due to Physically or Mechanically Induced Forces or Stresses
- Expansion upon change of state, e.g., freezing of water in pipe runs.
- Thermal expansion of blocked-in liquids, e.g., in heat exchangers or long pipe runs.

- Ingress of extraneous phases, e.g., gas compressor failure due to liquid carry-through to machine suction, or condensate hammer in steam lines.

b. Under pressurizing of Equipment (for Equipment Not Capable of Withstanding Vacuum)

i. By Direct Connection to an Ejector Set or to Equipment Normally Running Under Vacuum

- Equipment malfunction, e.g., loss of liquid seal due to failure of a level controller, causing vacuum to be applied upstream.
- Operator error, e.g., leaving an isolation valve open.

ii. Due to Movement or Transfer of Liquids

- Pumping out of tanks or vessels.
- Emptying or draining of elevated blocked-in equipment under gravity.

iii. Due to Cooling of Gases or Vapours

- Condensation of condensable vapours, e.g., a vessel blocked-in after steaming.
- Cooling of non-condensable gases or vapours, e.g., storage tank cooled by heavy rainfall in summer.

iv. Due to Solubility Effects

- Dissolution of gases in liquids.

c. High Metal Temperature (Causing Loss of Strength)

i. Fire Under Equipment

- Caused by spillage or pump leak.

ii. Flame Impingement

- Local overheating, e.g., on furnaces due to misalignment or maladjustment of burners.

iii. Overheating by Electric Heaters

- Due to failure of high-temperature cut-out.

iv. Inadequate Flow of Fluid Through Heated Equipment

- Furnace tube failure due to loss of hot oil flow.

v. Imbalanced Flow Rates or Temperatures in a Heat Exchanger

- Higher flow rate or temperature of the hotter stream, or lower flow rate or temperature of the colder stream.

d. Low Metal Temperature (Causing Cold Embrittlement and Overstressing)

i. Overcooling by Refrigeration Units

- Due to control faults or addition of the wrong refrigerant.

ii. Incomplete Vaporization and/or Inadequate Heating of Refrigerated Material

- Before transfer into equipment not rated for low temperatures, e.g., due to control faults on a liquid ethylene vaporization unit.

iii. Loss of System Pressure

- In units handling liquids with a low boiling point.

e. Wrong Process Materials or Abnormal Impurities (Causing Accelerated Corrosion, Chemical Attack of Seals or Gaskets, Stress Corrosion Cracking, Embrittlement)

i. Variations in Stream Composition

- Outside design limits.

ii. Abnormal Impurities Introduced with Raw Materials or Wrong Raw Materials

iii. By-products of Abnormal Chemical Reactions

iv. Oxygen, Chlorides, or Other Impurities

- Remaining in equipment at start-up due to inadequate evacuation or decontamination.

v. Impurities Entering the Process During Operation

- From the atmosphere, service connections, or tube leaks.

Human Factors Checklist

HUMAN FACTORS CHECKLIST			
Division :			**Date :**
Selected Process :			
Item No.	**Question**	**Summary of Discussion**	**Comments or Action Item**
1	**Management System**		
1.1	Are safety rules understood by all? Are personnel held accountableto them? Have personnel been fully apprised of safety priorities and disciplinary practices for failure to follow procedures?		
1.2	Does the area have a means to identify situations where error is likely to occur? How promptly does the organization respond if one is found?		
1.3	Are differences between the actual worker practices and the written policies and procedures tolerated? Do verbal, informal (e.g., [a]black book[o]), or unwritten practices exist that supersede writtenprocedures?		
2	**Procedures**		
2.1	Are there procedures available for the tasks involved, including, for example, start-up, shutdown, idle, normal operation, andemergency situations?		
2.2	Are the procedures kept up-to-date? Are they routinely checked, compared with user actions, and revised as appropriate?		
2.3	If different recipes or configurations are used on the same equipment, do the procedures clearly state when and how to apply the instructions? Are there checks to ensure the correct procedure is being applied for the recipe and or configuration?		
2.4	Do the manuals have the most recent revision level of the procedures? Are the procedures maintained as controlled documents where unauthorized copies are prevented?		
3	**Training**		
3.1	Do personnel understand: a. The potential hazards of the process? b. What the lines of defense are against them? c. What the key safety devices, interlocks, mitigation equipment, and administrative controls are? d. Why these controls exist and how they are supposed to work?		
3.2	Are personnel entering an area trained on both generic and area specific safety rules and critical emergency response procedures?		
3.3.	Is there an effective monitoring or mentoring program for operators undergoing on-the-job training?		
4	**Task design and organization**		
4.1	Are operators' job descriptions well defined (e.g., do overlaps orgaps in responsibility exist, having the potential to result in important tasks being left undone due to confusion regarding responsibility)?		
4.2	Where several different tasks are assigned to one person, can these run unattended for a limited time so that attention can be given to any single one?		

HUMAN FACTORS CHECKLIST			
4.3	Does the job environment involve long hours of continuous mental or physical inactivity, or social isolation (e.g., lack of help if needed, urge to wander off to seek company/assistance, dulling of senses by long periods of uneventful vigil)?		
4.4	For systems that require constant monitoring (e.g., a panel board, DCS, standby for vessel entry, heat permit work), is there an enforced policy to ensure coverage of the system at all times it is in operation?		
5	**Ergonomics**		
5.1	Are critical equipment controls (e.g., shutdown switches, valves) placed in such a way that they can be reached successfully in an emergency? (For example, does one have to wade through the spill or a fire to reach the emergency stop?)		
5.2	Does successful use of emergency equipment require physical skills or training beyond the capability of some of the people likely to respond?		
5.3	Do any tasks require the prolonged wearing of excessive or burden-some personal protective equipment, such that it may interfere with an individual's ability to safely complete an operation in an adequate amount of time, either due to physical constraints orinterference with the ability to stay mentally focused?		
5.4	Is enough space provided around equipment to perform the desired maintenance tasks? (For example, is it difficult to tighten one bolt on a particular flange because the surrounding area is too congested?)		
5.5	Does the layout of different but similar-looking equipment lend itself to misidentification? (Two examples are working on unit A instead of ªBº and hooking a tank truck unload line to the wrong station.)		
5.6	Are such things as key piping, valves, vessels, and field warning lights labeled clearly and unambiguously? Is it clear who is responsible for maintaining the labeling?		
6	**Control systems**		
6.1	Are there nuisance alarms that distract workers or make it likely an important alarm is ignored?		
6.2	Are the control schemes properly documented and understood by the users?		
6.4	Are the criteria clear and unambiguous for taking over manualcontrol from automatic? Is it understood when a system can be placed into automatic or supervisory control?		
6.5	Is there an effective means to detect instrument failure? What errors might be likely if key instruments give false readings?		
6.6	Are instruments calibrated or checked regularly?		
6.7	Are automatic interlock bypasses or alarm inhibits designed into the control system? If so, what controls are in place to avoid abuse?		

Inherently safer process considerations checklist

To use: This checklist may be used to guide the discussions of process design teams, PHA teams, incident investigation teams, and any other individuals or groups working on process improvements. It is intended to promote blue-sky or out of the-box thinking, and to generate ideas that might be usable in an existing facility and/or a plant of the future concept.

Users of this checklist may find it helpful to rephrase questions in order to prompt maximum creativity; for example, how might it be possible to...? This approach can lead users to consider alternative means for reducing the hazard level inherent in the process.

The topics for this checklist have been taken from the CCPS “Guidelines for Engineering Design for Process Safety” and the CCPS concept book “Inherently Safer Chemical Processes - A Life Cycle Approach”. Every effort was made to ensure that this checklist is comprehensive; therefore, there may be some redundancy or overlap in questions among the different sections.

Not to use: This checklist should not be used in a rote yes/no manner, nor is it necessary to answer every question. The idea is to consider what might be possible, and then determine what is feasible. The checklist should be reviewed periodically throughout the life cycle of the process; as technology changes, what was once impossible becomes possible, and what was once infeasible becomes feasible.

Intensification (or minimization)

Sl. No.	Description
1	Do the following strategies reduce inventories of hazardous raw materials, intermediates, and/or finished products? • Improved production scheduling • Just-in-time deliveries • Direct coupling of process elements • In situ generation and consumption
2	Do the following actions minimize in-process inventory? • Eliminating or reducing the size of in-process storage vessels • Designing processing equipment handling hazardous materials for the smallestfeasible inventory • Locating process equipment to minimize the length of hazardous material piping runs • Reducing piping diameters
3	Can other types of unit operations or equipment reduce material inventories? For example, • Wiped film stills in place of continuous still pots • Centrifugal extractors in place of extraction columns • Flash dryers in place of tray dryers • Continuous reactors in place of batch • Plug flow reactors in place of continuous flow stirred tank reactors

Sl. No.	Description
	• Continuous in-line mixers in place of mixing vessels
4	Can thermodynamic or kinetic efficiencies of reactors be improved by design upgrades (e.g., improved mixing or heat transfer) to reduce hazardous material volume?
5	Can equipment sets be combined (e.g., replacing reactive distillation with a separate reactor and multi-column fractionation train; installing internal reboilers or heat exchangers) to reduce overall system volume?
6	Can pipeline inventories be reduced by feeding hazardous materials as a gas instead of a liquid (e.g., chlorine)?
7	Can process conditions be changed to avoid handling flammable liquids above their flash points?
8	Can process conditions be changed to reduce production of hazardous wastes or by-products?

Substitution/elimination

- Is it possible to completely eliminate hazardous raw materials, process intermediates, or by-products by using an alternative process or chemistry?
- Is it possible to completely eliminate in-process solvents by changing chemistry or processing conditions?
- Is it possible to substitute less hazardous raw materials? For example:
  - Noncombustible rather than flammable
  - Less volatile
  - Less reactive
  - More stable
  - Less toxic
- Is it possible to use utilities with lower hazards (e.g., low pressure steam instead of combustible heat transfer fluid)?
- Is it possible to substitute less hazardous final product solvents?
- For equipment containing materials that become unstable at elevated temperatures or freeze at low temperatures, is it possible to use heating and cooling media that limit the maximum and minimum temperature attainable?

Attenuation (or moderation)

- Is it possible to keep the supply pressure of raw materials lower than the working pressure of the vessels to which they are fed?
- Is it possible to make reaction conditions (e.g., pressure or temperature) less severe by using a catalyst or by using a better catalyst?
- Can the process be operated at less severe conditions using any other route? For example:
  - Improved thermodynamic or kinetic efficiencies of reactors by design upgrades (e.g., improved mixing or heat transfer) to reduce operating temperatures and/or pressures
  - Changes in phase of the reaction (e.g., liquid/liquid, gas/liquid, or gas/gas)
  - Changes to the order in which raw materials are added

- Is it possible to dilute hazardous raw materials to reduce the hazard potential? For example, by using the following:
  - Aqueous ammonia instead of anhydrous
  - Aqueous HCl instead of anhydrous
  - Sulfuric acid instead of oleum
  - Dilute nitric acid instead of concentrated fuming nitric acid
  - Wet benzoyl peroxide instead of dry

Simplification/error tolerance

- Is it possible to separate a single, procedurally complex, multipurpose vessel into several simpler processing steps and processing vessels, thereby reducing the potential for hazardous interactions when the complexity of the number of raw materials, utilities, and auxiliary equipment is reduced for specific vessels?
- Can equipment be designed so that it is difficult to create a potentially hazardous situation due to an operating or maintenance error? For example:
  - Simplifying displays
  - Designing temperature-limited heat transfer equipment
  - Lowering corrosion potential by use of resistant materials of construction
  - Lowering operating pressure to limit release rates
  - Using higher processing temperatures (to eliminate cryogenic effects such as embrittlement failures)
  - Using passive vs. active controls (e.g., stronger piping and vessels)
  - Using buried or shielded tanks
  - Using fail-safe controls if utilities are lost
  - Limiting the degree of E&A redundancy required
  - Using refrigerated storage vs. pressurized storage
  - Spreading electrical feed over independent or emergency sources
  - Reducing wall area to minimize corrosion/fire exposure
  - Reducing the number of connections and paths
  - Minimizing the number of flanges in hazardous processes
  - Valving/piping/hose designed to prevent connection error
  - Using fewer bends in piping
  - Increasing wall strength
  - Using fewer seams and joints
  - Providing extra corrosion/erosion allowance
  - Reducing vibration
  - Using double-walled pipes, tanks, and other containers
  - Minimizing the use of open-ended valves
  - Eliminating open-ended, quick-opening valves in hazardous service
  - Improving valve seating reliability
  - Eliminating unnecessary expansion joints, hoses, and rupture disks
  - Eliminating unnecessary sight glasses/glass roto meters
- Can procedures be designed so that it is difficult to create a potentially hazardous situation due to an operating or maintenance error? For example:
  - Simplifying procedures

  - Reducing excessive reliance on human action to control the process
- Can equipment be eliminated or arranged to simplify material handling?
  - Using gravity instead of pumps to transfer liquids
  - Siting to minimize hazardous transport or transfer
  - Reducing congestion (i.e., easier to access and maintain)
  - Reducing knock-on effects from adjacent facilities
  - Removing hazardous components early in the process rather than spreading them throughout the process
  - Shortening flow paths
- Can reactors be modified to eliminate auxiliary equipment (e.g., by creating a self- regulatory mechanism by using natural convection rather than forced convection for emergency cooling)?
- Can distributed control system (DCS) modules be simplified or reconfigured such that failure of one module does not disable many critical control loops?

PHA closure forms

When a recommendation is completed, there must be an official closure document placed in the permanent PHA file and retained for the life of the process.

Key information that should be included on the document is who did the work, what was actually done, and an authorizing signature.

There are four types of recommendation closure or modification forms.

- Completion (as originally stated)
- Modifying a recommendation
- Changing the recommendation due date
- Canceling a recommendation previously accepted

The documents should be understandable without referring back to the original PHA report. Each form should contain the following basic information:

- PHA report number
- Specific recommendation number
- Year the PHA report was issued
- PHA report title
- Area or unit of the plant involved
- Text of the recommendation
- Signature of person responsible for follow-up
- Date of signature
- Signature of designated member of management
- Date of signature

2. PT FORMS

These PT forms are integral components of Process Safety Management (PSM), with annexures prepared as separate documents. They cover various forms, including: HHO & LHO, chemical, physical, and thermal properties; occupational health and toxicity data; fire and explosion properties; interactions between chemicals, materials of construction, and auxiliary materials; reaction thermal data; conditions for side reactions and heat accumulation; thermal stability; and a summary of thermal hazards. Additionally, they include the process

description, PFD, chemical reactions, P&ID, mass and energy balances (optional), utility requirements (optional), and protocols such as BPR, SOP, emergency shutdown, and process interruption. Further documentation encompasses SOC deviations, inventory, process/equipment changes, process incidents, equipment list, equipment datasheets, hazardous area classification, instrumentation details, site and block layouts, safety appliances, and a PSI documentation checklist.

**** These annexures outline the minimum requirements; however, business units should make amendments to comply with any local or state regulations that are more stringent. Additionally, Business units to prepare these forms and get it approved from site PSM leader.*

Annexure-5: HHP & LHO list & PSM critical substance identification

HHP & LHO		
Sl. No.	**HHP**	**Basis for HHP**

Sl. No.	LHO

Annexure-6: Chemical, Physical & Thermal properties

Property	Record	Remark
SAP no		
Chemical Data • CAS no • Other Names • MW, g/mol • Mol Formula • pH (1% Soln in water) • Pyrophoric • Reactivity with water • Air Sensitivity • Light Sensitivity • Storage stability • Reactivity groups		
Physical Data • State • Appearance/Colour • Odour • Density g/cc • Bulk Density • Relative Vapour Density • Sol.(g/cc) in H2O • Sol.(g/cc) solvent • Viscosity (centipoise) • Electrical Conductivity / Bulk resistivity		
Thermal data • Sp Heat (Kcal/m3) • Melt. Pt • Boil. Pt • Vap. Press • Latent Heats of evpn • Latent Heats of melting • Thml Expn (%vol)		
Tox & Hygiene Data • Toxicity • Reprotox • Carcinogen • Mutagen • Teratogen		

• Short Term Effect • Long Term Effect • TLV • TWA • STEL • PEL • IDLH (NIOSH) • LC 50 • LD 50		
Ecotoxicity • Biol. Degrad. • Flammability • Flash Point (deg C) • Auto Ignition (deg C) • Burning Class • LEL% • UEL% • LOC% • Powder Data • Particle Size Distribution (micron & %) • MIE • Dust Expl Class • MEC min expl concn • Dry Class • Milling Class • Shock Sensitivity • Fric. Sensitivity		
Others • NFPA – Flammability • NFPA - Reactivity • NFPA - Health Hazard • NFPA - Other Hazard		

Annexure-7: Chemical interaction matrix

Name of Chemical (Example given in this sheet of chemical Row and Column should be same)	Benzol	Wash oil	Nitrogen gas	Circulating water	Chilled water	COG	Sealing oil	Coal Tar	LYE	Sulphur	MAS/Sour Vapour	Ammonia Liquor
Benzol												
Wash oil												
Nitrogen gas												
Circulating water												
Chilled water												
COG												
Sealing oil												
Coal Tar												
LYE												
Sulphur												
MAS/Sour Vapour												
Ammonia Liquor												

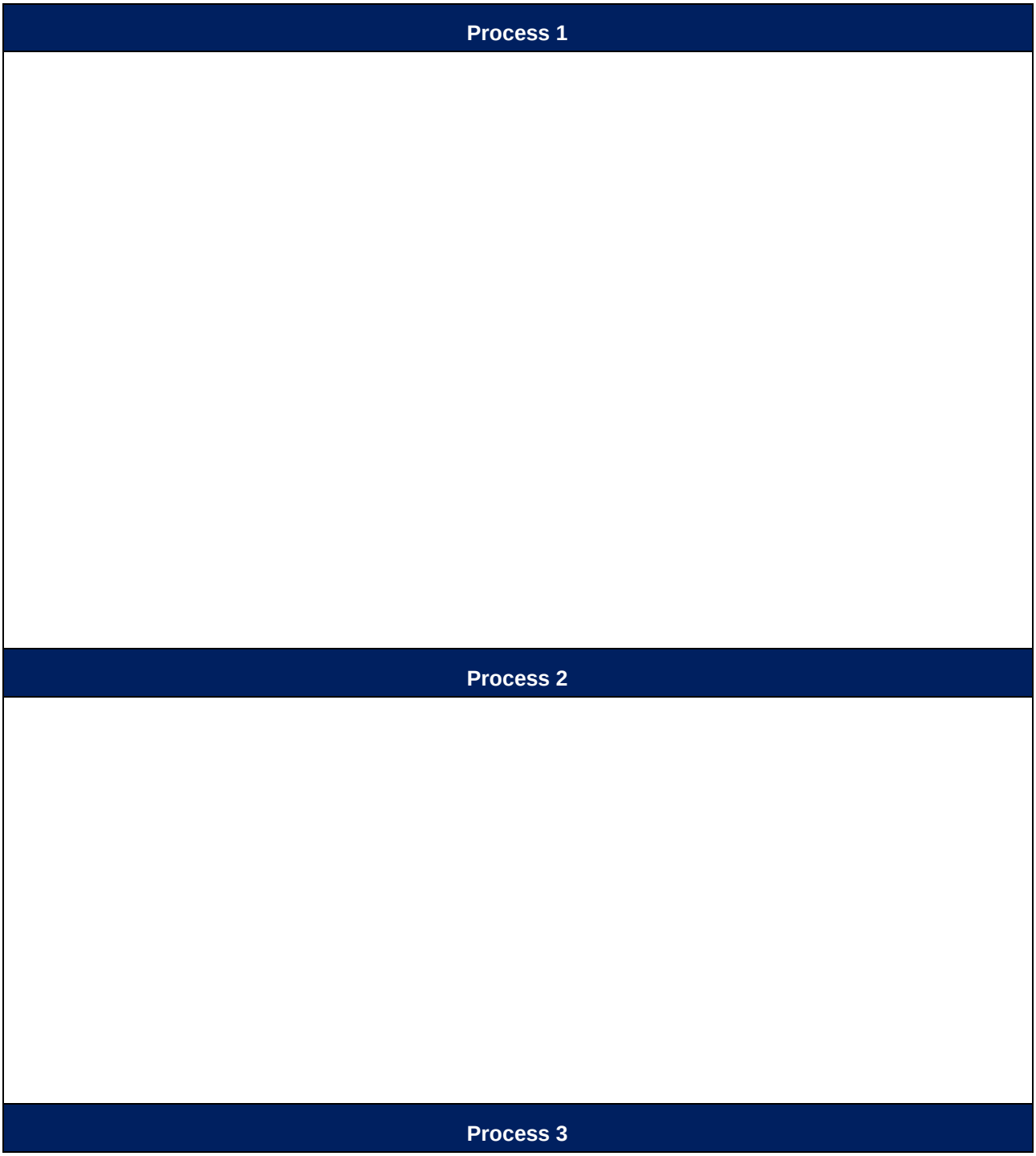
No interaction	-
Hazardous	+
Desired	(+)

Annexure-8: Interaction between chemical & material of construction

Interaction Between Chemical & Material of Construction		
Material/Chemical	Chemical 1	Chemical 2
Mild steel		
Stainless steel SS304		
Titanium		

No interaction	**-**
Hazardous	**+**
Desired	**(+)**

Annexure-9: Process Flow Diagram (PFD)



Annexure-10: Reactions

Reactions
Overall Reactions: H2S+1.5O2 →SO2+H2O; △H= -518.4 KJ/kg H2S (exothermic Reaction) 2H2S + SO2 →3/X SX + 2H2O (X=1- 8); △H= -146.7 KJ/kg H2S (at 260℃)
General Reaction: 3H 2 S+1.5 O 2 = (3/X)SX+3H2O + 664KJ CO2+H2S＝COS+H2O COS + H2O＝H2S + CO2 2H2S+CO2＝CS2+2H2O CS2 + 2H2O＝2H2S+CO2 NH3＝1.5H2+0.5N2

Annexure-11: P&IDs

Sl No	P&ID / Drawing No	Rev	Revision Date	Title	Status
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Annexure-12: Mass balance

Input		Operation / Equipment	OUTPUT (wastes)	
Raw Materials	Qty (MT/hr)		Material	Qty (MT/hr)

Annexure-13: Energy balance

Input		Operation / Equipment	Output (wastes)	
Raw Materials	Qty (MT/hr)		Material	Qty (MT/hr)

Energy Balance Calculation

Annexure-14: Utility requirements

Name of the Unit

Power Supply	Voltage	Equipment's

Sl no	Utility	Pressure (Mpa)			Temp (°C)			Normal Flow	Peak Flow
		Min	Nor	Max	Min	Nor	Max	(kg or m3 per h)	(kg or m3 per h)

Annexure-15: SOP - Control Room & Manager Room Copy

SOPs - Control Room & Manager Room Copy		
1. Section Name		
Sl no	Title	SOP Number

Annexure-16: Standard Operating Conditions – Deviations

1. Section Name									
S. N	Tag. No.	Description	Unit	SOC	SOL	Effect - below range	Effect - above range	Remarks	INDICATION

Annexure-17: Inventory

INVENTORY		
Chemical Name	**UoM (MT)**	**Quantity**
	MT	
	MT	
	MT	
	MT	
	M^3	
	Liters	

Annexure-18: Management of Change

Change Management Tracking sheet																	
Sr. No	Description	Plant	Initiator	Start Date	Closing Date	Category of Change (Tech. / Facility)	Type of Change (Temporary / Permeant)	Kind of Change (Capex / Revenue)	PHA / Risk Assessment point	PSSR			P & ID Updated	Operating Procedure Updated	Training Imparted	MoC Status (Open / closed)	Remarks
										Nos. of Observation	Nos. of Observation	% Compliance					

Annexure-19: Process Incidents

Plant	Date	Time	Description of Incident	Corrective and preventive Action

Annexure-20: Equipment's' List (Static & Rotary)

1.Section Name												
Equipment's' List (Static)												
Sl No	P&ID	Tag No (as in P&ID)	Title of Eqpt	Capacity	Size	MoC	PSM Critical (Yes/No)	PSM - Basis	PM (Freq)	Supplier / Make	Vendor Manual Location	Dwg Ref No/ Types	Remarks
Equipment's' List (Rotary)													
Sl No	P&ID	Tag No (as in P&ID)	Title of Eqpt	Capacity	Size	MoC	PSM Critical (Yes/No)	PSM - Basis	PM (Freq)	Supplier / Make	Vendor Manual Location	Dwg Ref No/ Types	Remarks

Annexure-21: PSM Critical Equipment List

PSM Critical Equipment List								
Plant								
Section								
PID / SOP No.								
PSM Critical Substance								
Sr. No.	**Equipment containing PSM critical substance**	**Tag Id No.**	**Pipeline (> 50 mm) containing PSM critical substance**	**Tag Id No.**	**Instruments for preventing / Mitigating Process safety Incidents**	**Tag Id No.**	**Prescriptive Equipment's**	**Tag Id No.**

Annexure-22: Hazardous Area Classification

1. Name of Unit	Zone/Class	Remark

Annexure-23: Instrument Details

1. Section Name														
Sl no	Tag No (as in P&ID)	Service / location	Unit	Range	MoC	Type	PSM Critical? (yes/no)	PM (freq)	Calbn (freq)	Lo Alarm	LL Alarm	Hi Alarm,	HH Alarm	Interlocks – Process / Effect of air / power

Annexure-24: Site layout

Site Number	Layout

Annexure-25: Block layout

Block Number	Layout

Annexure-26: Safety Appliances

1. Name of Unit				
GAS DETECTOR STATUS				
No.	TAG No.	GAS	LOCATION	DCS Range
Safety Shower				
Type	Sprinkler Location	Status		
Manual Call Points/ Assembly Point				
Sr. No.	Location	Status		
Other Safety Equipment's				
S.NO	Type	Location	Status	

Annexure-27: PSM Checklist

1. Name of Unit							
Form No	**Description**	**Custodian**	**Detail Provided**	**Document Enclosed**	**Doc Location Reference given**	**Doc / detail - not Provided**	**Remark**
0	HHP & LHO						
1a	Chemical, Physical & Thermal Properties						
1b	OH & Toxicity						
1c	Explosion Characteristics						
1d	Interaction between Chemicals						
1e	Interaction between Chemicals & MoC, aux matls						
1f	Thermal Data of reaction						
1g	Side reactions, Heat Accumulation Conditions						
1h	Thermal Stability						
1i	Summary of Thermal Hazards						
2a	Process Description, PFD						
2b	Chemical Reactions						
2c	P&ID						
2d	Mass Balance						

2e	Energy Balance (optional)						
2f	Utility Requirements (optional)						
2g	BPR, SOP, Emergency Shutdown, Interruption of Process						
2h	SOC						
2i	Inventory						
2j	Process Changes						
2k	Process Incidents						
3a	Equipment List						
3b	Eqpt Datasheet						
3c	Hazardous Area Classification						
3c	Inst Details						
4a	Site Layout						
4b	Block Layout						
4c	Safety Appliances						
4d	PSI documentation checklist						