OISD STD (OISD-192 & OISD-207)

[ANNEXURE –XV TO SPECIAL CONDITIONS OF CONTRACT]

OIL INDUSTRY SAFETY DIRECTORATE

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SAFETY PRACTICES DURING CONSTRUCTION
OISD-GDN-192

ENGINEERS INDIA LIMITED

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FOR RESTRICTED CIRULATION ONLY

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PREAMBLE

Indian petroleum industry is the energy lifeline of the nation and its continuous performance is essential for sovereignty and prosperity of the country. As the industry essentially deals with inherently inflammable substances throughout its value chain – upstream, midstream and downstream – Safety is of paramount importance to this industry as only safe performance at all times can ensure optimum ROI of these national assets and resources including sustainability.

While statutory organizations were in place all along to oversee safety aspects of Indian petroleum industry, Oil Industry Safety Directorate (OISD) was set up in 1986 by Ministry of Petroleum and Natural Gas, Government of India as a knowledge centre for formulation of constantly updated world-scale standards for design, layout and operation of various equipment, facility and activities involved in this industry. Moreover, OISD was also given responsibility of monitoring implementation status of these standards through safety audits.

In more than three decades of its existence, OISD has developed a rigorous, multi-layer, iterative and participative process of development of standards – starting with research by in-house experts and iterating through seeking & validating inputs from all stake-holders – operators, designers, national level knowledge authorities and public at large – with a feedback loop of constant updation based on ground level experience obtained through audits, incident analysis and environment scanning.

The participative process followed in standard formulation has resulted in excellent level of compliance by the industry culminating in a safer environment in the industry. OISD – except in the Upstream Petroleum Sector – is still a regulatory (and not a statutory) body but that has not affected implementation of the OISD standards. It also goes to prove the old adage that self-regulation is the best regulation. The quality and relevance of OISD standards had been further endorsed by their adoption in various statutory rules of the land.

Petroleum industry in India is significantly globalized at present in terms of technology content requiring its operation to keep pace with the relevant world scale standards & practices. This matches the OISD philosophy of continuous improvement keeping pace with the global developments in its target environment. To this end, OISD keeps track of changes through participation as member in large number of International and national level Knowledge Organizations – both in the field of standard development and implementation & monitoring in addition to updation of internal knowledge base through continuous research and application surveillance, thereby ensuring that this OISD Standard, along with all other extant ones, remains relevant, updated and effective on a real time basis in the applicable areas.

Together we strive to achieve NIL incidents in the entire Hydrocarbon Value Chain. This, besides other issues, calls for total engagement from all levels of the stake holder organizations, which we, at OISD, fervently look forward to.

Jai Hind!!!

Executive Director
Oil Industry Safety Directorate

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FOREWORD

The Oil Industry in India is over 100 years old. As such, various practices have been in vogue because of collaboration/ association with different foreign companies and governments. Standardization in design philosophies, operating and maintenance practices remained a grey area. This coupled with feedback from some serious accidents that occurred in the past in India and abroad, emphasized the need for the industry to review the existing state-of-the-art in designing, operating and maintaining of Oil and Gas installations.

With this in view, the Ministry of Petroleum and Natural Gas in 1986 constituted a Safety Council assisted by the Oil Industry Safety Directorate (OISD) staffed from within the industry in formulating and implementing a series of self-regulatory measures aimed at removing obsolescence, standardizing and upgrading the existing standards to ensure safe operations. Accordingly, OISD constituted a number of functional committees of experts nominated from the industry to draw up standards and guidelines on various subjects.

The present guideline on "Safety Practices During Construction" has been prepared by the functional committee based on, existing standards, guidelines & recommended practices of OISD, the recommendations arising out of recent major accidents and their analysis, the accumulated knowledge and experience of industry members in India and updation of National and International codes and practices.

The figures and photographs used in the document, if any, are representative in nature.

We, at OISD, are confident that the provisions of this standard, when implemented in totality, would go a long way in ensuring safe operation of the target group of locations.

Needless to mention, this standard, as always would be reviewed based on field level experience, incident analysis and environment scanning. Suggestions from all stake holders may be forwarded to OISD.

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NOTE

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Though every effort has been made to assure the accuracy and reliability of the data contained in these documents, OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from their use.

These documents are intended only to supplement and not to replace the prevailing statutory requirements of PESO, DGMS, Factory Inspectorate or any other Government body which must be followed as applicable.

Wherever Acts/ Rules/ Regulation and National/ International Standards are mentioned in the standard, the same relates to in-vogue version of such documents.

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In addition to the above, several other experts from Industry contributed in the preparation, review and finalisation of this Guideline.

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SAFETY PRACTICES DURING CONSTRUCTION

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SAFETY PRACTICES DURING CONSTRUCTION

1.0 INTRODUCTION

Safety in Construction Management deserves utmost attention especially in the hydrocarbon industry, such as Exploration, Refineries, Pipelines and Marketing installations, Gas Processing units etc. Construction is widely recognised as one of the accident prone activities. Most of the accidents are caused by inadequate planning, failure during the construction process and/or because of design deficiencies. Besides property loss, accidents also result in injuries and fatalities to the personnel, damage to environment which needs to be prevented.

The reasons for accidents during construction activities are related to unique nature of the industry, human behaviour, difficult work-site conditions, extended odd duty hours, lack of training & awareness and inadequate safety management. Unsafe working methods, lack of proper JSA (Job Safety Analysis) and use of improper / inadequate PPEs, equipment failure and improper housekeeping also tend to increase the accident rate in construction.

Ensuring good quality of materials, equipment and competent supervision along with compliance of standard engineering practices shall go a long way to in built safety into the system.

The objective of this document is to provide practical guidance on technical and educational framework for health, safety and environment in construction with a view to:

(a) prevent accidents and harmful effects on the health of workers arising from employment in construction;
(b) ensure appropriate safety during implementation of construction;
(c) provide safety practice guidelines for appropriate measures of planning, control and enforcement.
(d) protect environment.

2.0 SCOPE

This document specifies broad guidelines on HEALTH, SAFETY AND ENVIRONMENT practices to be adhered to during construction activities including green field projects in oil industry. However, before commencing any job, specific hazards and its effects should be assessed and necessary corrective/preventive actions should be taken by all concerned. The document is intended only to supplement and not to replace or supersede the prevailing statutory requirements, which shall also be followed as applicable. For Personal Protective Equipment, OISD-STD-155 (Part I&II) shall be referred to. The scope of this document does not include the design aspects and quality checks during construction.

3.0 DEFINITIONS

Definitions of various terminology are given below:

- **Adequate, appropriate or suitable** are used to describe qualitatively or quantitatively the means or method used to protect the men, machinery, material, property and enviroment.

- **By hand:** The work is done without the help of a mechanised tool.

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- **Competent Authority:** A stautory agency having the power to issue regulations, orders or other instructions having the force of law.
- **Competent person:** A person possessing adequate qualifications, such as suitable training and sufficient knowledge, experience and skill for the safe performance of the specific work. The competent authorities may define appropriate criteria for the designation of such persons and may determine the duties to be assigned to them.
- **Construction site:**

  A worksite involving new construction, modification or maintenance of existing facility, shutdown related activity, demolition, housekeeping etc.
- **Environment:**

  Environment includes water, air and land and the interrelationship which exists among and between water, air and land and human beings, other living creatures, plants, microorganisms and property.
- **Execution agency:**

  Any entity / person, having contractual obligation with the owner and who employs one or more workers on a construction site.
- **Hazard:** A condition or a set of conditions which has potential of causing injury to person, damage to property or environment.
- **Health:** Soundness of body covering Physical, Emotional, Psychological and Intellectual conditions of a worker which assists the attainment of the objectives.
- **Means of access or egress:** Passageways, corridors, stairs, platforms, ladders and any other means for entering or leaving the workplace or for escaping in case of danger.
- **Owner:** Any entity / person for whom construction job is carried out.

  It shall also include owner's designated representative/ consultant/ nominee/ agent, authorised from time to time to act for and on its behalf for supervising/ coordinating the activities of the execution agency.
- **Scaffold:** Any fixed, suspended or mobile temporary structure supporting workers and material or to gain access to any such structure and which is not a lifting appliance.
- **Safety :** Prevention & protection from exposure to Hazard.
- **Worker:** Any person engaged in construction activity.
- **Workplace:** Owner's designated premises where workers need to be present by virtue of their involvement in the construction activity.

4.0 GENERAL DUTIES

4.1 GENERAL DUTIES OF EXECUTION AGENCIES

4.1.1 Execution agency should:

i) provide means and organisation to comply with the Health, safety and environment protection measures required at the workplace.

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ii) provide and maintain workplaces, plant, equipment, tools and machinery and organise construction work so that, there is no risk of accident or injury to health of workers. In particular, construction work should be planned, prepared and undertaken so that:

(a) dangers liable to arise at the workplace, are prevented;
(b) excessively or unnecessarily strenuous work positions and movements are avoided;

- organisation of work takes into account the safety and health of workers and also environment protection;
- materials and products used are suitable from Health safety and environment protection point of view;

(c) working methods are adopted to safeguard workers against the harmful effects of chemical, physical and biological agents.

iii) establish committees with representatives of workers and management or make other arrangement for the participation of workers in ensuring safe working conditions.

iv) arrange for periodic safety inspections by competent persons of all buildings, plant, equipment, tools, machinery, workplaces and review of systems of work, regulations, standards or codes of practice. The competent person should examine and ascertain the safety of construction machinery and equipment.

v) provide such supervision to ensure that workers perform their work with due regard to safety and health of theirs as well as that of others.

vi) employ only those workers who are qualified, trained and suited by their age, physique, state of health and skill.

vii) satisfy themselves that all workers are informed and instructed in the hazards connected with their work and environment and trained in the precautions necessary to avoid accidents and injury to health.

viii) ensure that buildings, plant, equipment, tools, machinery or workplaces in which a dangerous defect has been found should not be used until the defect has been rectified.

ix) organise for and remain always prepared to take immediate steps to stop the operation and evacuate workers as appropriate, where there is an imminent danger to the safety of workers.

x) establish a checking system by which it can be ascertained that all the members of a shift, including operators of mobile equipment, have returned to the camp or base at the close of work on dispersed sites and where small groups of workers operate in isolation.

- provide appropriate first aid, training and welfare facilities to workers as per various statutes like the Factories Act 1948, Building & Construction Workers Regulation (BOCWR), etc. and, whenever collective measures are not feasible or are insufficient, provide and maintain personal protective equipment and clothing in line with the requirement as per OISD-STD-155 (Part I & II) on Personnel Protective

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Equipment. They should also provide access to workers to occupational health services.

- educate workers about their right and the duty at any workplace to participate in ensuring safe working conditions to the extent of their control over the equipment and methods of work and to express views on working procedures adopted as may affect health, safety and environment.

xi) ensure that except in an emergency, workers unless duly authorised, should not interfere with, remove, alter or displace any safety device or other appliance furnished for their protection or the protection of others, or interfere with any method or process adopted with a view to avoiding accidents and injury to health.

xii) ensure that workers do not operate or interfere with plant and equipment that they have not been duly authorised to operate, maintain or use.

xiii) ensure that workers do not sleep, rest or cook etc in dangerous places such as scaffolds, railway tracks, garages, confined spaces or in the vicinity of fires, dangerous or toxic substances, machines or vehicles and heavy equipment etc.

xiv) obtain the necessary clearance/permits as required and specified by owner.

Arrangement for drinking water, toilet facilities, a creche and transport arrangement etc. to be provided as per statutory requirement.

xv) deploy a safety officer at site as per the requirement of Factory Act 1948/ Building & Construction Workers Regulation (BOCWR)/ Criticality of the job.

xvi) ensure that all employees/workmen undergo medical examination as required under the law or under the contract provision and keep a record of the same.

xvii) obtain the police verification of the workers/ supervisors arranged by him and the same is to be submitted to the owner.

xviii) not permit any employee/workmen/visitor to enter the work area under the influence of alcohol or any drugs.

4.2 GENERAL DUTIES OF OWNERS

4.2.1 Owners should:

i) co-ordinate or nominate a competent person to co-ordinate all activities relating to HEALTH, SAFETY AND ENVIRONMENT on their construction projects;

ii) inform all contractors on the work site / project of special risks to HEALTH, SAFETY AND ENVIRONMENT;

iii) ensure that executing agency is aware of the owner's requirements and the executing agency's responsibilities with respect to HEALTH, SAFETY AND ENVIRONMENT practices before starting the job.

5.0 SAFETY PRACTICES AT WORK PLACES

5.1. GENERAL PROVISIONS

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5.1.1 All openings and other areas likely to pose danger to workers should be clearly indicated and accident prevention measures taken as required. The working area should be clearly de-marketed to keep the workers in that area only.

5.1.2 Workers & Supervisors should use the safety helmet and other requisite Personal Protective Equipment according to job & site requirement as per OISD-STD-155 (Part I & II). They should be trained to use personal protective equipment including their limitations.

5.1.3 Never use-solvents, alkalis and other oils to clean the skin.

5.1.4 Lift the load with back straight and knees bent. The contractor shall ensure at his construction site, no worker lifts by hand or carries overhead or over his back or shoulders any material, article, tool or pipelines exceeding in weight as per The Factory Act 1948 / Rule 38 of Building & Construction Workers Regulation (BOCWR), unless aided by another worker or device.

5.1.5 Ensure the usage of correct and tested tools and tackles. Don't allow the make shift tools and tackles. Also the tools should be suitable for a particular job and rated accordingly.

5.1.6 No loose clothing should be allowed while at construction site.

5.1.7 Start work only after proper authorization viz Work permit etc.

5.1.8 Job safety analysis to be done for all critical works.

5.1.9 Hydra should not be used for transportation of hook loaded materials.

5.1.10 Rope ladders should not be used at construction sites.

5.2 MEANS OF ACCESS AND EGRESS

Adequate and safe means of access (atleast two, differently located) to and egress from all workplaces should be provided. Same should be displayed and maintained. Escape routes should be marked prominently in workers friendly language. The escape routes should not be blocked at any point of time and same to be made understand to the workers.

5.3 HOUSEKEEPING

5.3.1 General Housekeeping shall be carried out by the contractor and he will ensure;

i) proper storage of materials and equipment;

ii) removal of scrap, inflammable material, waste and debris at appropriate intervals including slippery materials. (construction sand on road, oil/ lubricants, resins, etc.).

iii) to provide containers for segregation of disposal of debris at required places and regular cleaning of the same.

5.3.2 Removal of loose materials, which are not required for use, to be ensured. Accumulation of these at the site can obstruct means of access to and egress from workplaces and passageways.

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5.3.3 Workplaces and passageways, that are slippery owing to oil, grease or other causes, should be cleaned up or strewn with sand, sawdust, ash etc.

5.3.4 All surplus earth and debris are removed/disposed off from the working areas to officially designated dumpsites. The debris like plastics, packing material, rubber items should not be allowed to burn. Trucks carrying sand, earth and any pulverized materials etc. in order to avoid dust or odour impact, shall be covered while moving.

5.4 PRECAUTIONS AGAINST THE FALL OF MATERIALS & PERSONS AND COLLAPSE OF STRUCTURES

5.4.1 Precautions should be taken such as the provision of fencing, look-out men or barriers to protect any person against injury by the fall of materials, or tools or equipment being raised or lowered.

5.4.2 Where necessary to prevent danger, guys, stays or supports should be used or other effective precautions should be taken to prevent the collapse of structures or parts of structures that are being erected, maintained, repaired, dismantled or demolished.

5.4.3 All openings through which workers are liable to fall should be kept effectively covered or fenced and displayed prominently.

5.4.4 SOP of crane operation should be adhered to. The crane jacks/legs should be parked on compacted surface to avoid tilting.

5.5 PREVENTION OF UNAUTHORISED ENTRY

5.5.1 Construction sites located in built-up areas and alongside vehicular and pedestrian traffic routes should be fenced to prevent the entry of unauthorised persons.

5.5.2 Visitors should not be allowed access to site(s) unless accompanied by or authorised by a competent person. All authorized visitors should report at the site office. Contractor shall provide visitor's helmet (helmet with visitor sticker) and other PPEs like Safety Shoe, reflective jacket, respiratory protection etc. as per requirement of the site. All the workers to have photo IDs including the staff of vehicles used in the job.

5.6 FIRE PREVENTION AND FIRE FIGHTING

5.6.1 All necessary measures should be taken by the executing agency and owner to:

i) avoid the risk of fire;
ii) control quickly and efficiently any outbreak of fire;
iii) bring out a quick and safe evacuation of persons.
iv) Inform unit/fire station control room, where construction work is carried out within existing operating area.
v) DMP should be in place for the same.

5.6.2 Combustible materials such as packing materials, sawdust, greasy/oily waste and scrap wood or plastics should not be allowed to accumulate in workplaces but should be kept in closed metal containers in a safe place. To be disposed periodically away from site at designated place and assigned manner.

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5.6.3 Places where workers are employed on works prone to danger of fire should be provided with:

i) suitable and sufficient fire-extinguishing equipment, which should be easily visible and accessible;
ii) an adequate water supply at sufficient pressure meeting the requirements of various OISD standards.
iii) required PPEs.

5.6.4 To guard against danger at places having combustible material, workers should be trained in the action to be taken in the event of fire, including the use of means of escape.

5.6.5 At sites having combustible material, suitable visual sign boards should be provided to indicate clearly the direction of escape in case of fire.

5.6.6 Means of escape should be kept clear at all times. Escape routes should be frequently inspected and if possible marked in fluorescent colours particularly in high structures and where access is restricted.

5.7 LIGHTING

5.7.1 Where natural lighting is not adequate, working light fittings or portable hand-lamps should be provided at workplace on the construction site where a worker will do a job.

5.7.2 Emergency lighting should be provided for personnel safety during night time to facilitate standby lighting source, if normal system fails.

5.7.2 Artificial lighting should not produce glare or disturbing shadows.

5.7.3 Lamps should be protected by guards against accidental breakage.

5.7.4 The cables of portable electrical lighting equipment should be of adequate size & characteristics for the power requirements and of adequate mechanical strength to withstand severe conditions in construction operations.

5.7.5 For temporary lighting connection, mostly neutral and phases are connected and insulation tapes are provided. It is better to stagger the neutral and phase connection so that even if the tape gets removed from the joints, there will be no short circuit/ spark between neutral and phase due to staggering of neutral and phase.

5.7.6 All the temporary lighting/ machine connections are to be provided from a three core cable for better safety.

5.8 PLANT, MACHINERY, EQUIPMENT AND HAND TOOLS

5.8.1 General Provisions

i) Plant, machinery and equipment including hand tools, both manual and power driven, should:
   a) be of proper design and construction, taking into account health, Safety and ergonomic principles.
   b) be maintained in good working order;
   c) be used only for work for which they have been designed.
   d) be operated only by workers who have been authorised and given appropriate training.

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e) be provided with protective guards, shields or other devices as required.

ii) Adequate instructions for safe use should be provided.

iii) Standard operating procedures should be established and used for all plant, machinery and equipment.

iv) Operators of plant, machinery and equipment should not be distracted while work is in progress.

v) Plant, machinery and equipment should be switched off when not in use and isolated before any adjustment, clearing or maintenance is done.

vi) Where trailing cables or hose pipes are used they should be kept as short as practicable and not allowed to create a hazard.

vii) All moving parts of machinery and equipment should be enclosed or adequately guarded.

viii) Every power-driven machine and equipment should be provided with adequate means, immediately accessible and readily identifiable to the operator, of stopping it quickly and preventing it from being started again inadvertently.

ix) Operators of plant, machinery, equipment and tools should be provided with PPEs, including where necessary, suitable ear protection.

5.8.2 Hand tools

i) Hand tools should be repaired by competent persons.

ii) Heads of hammers and other shock tools should be dressed or ground to a suitable radius on the edge as soon as they begin to mushroom or crack.

iii) When not in use and while being carried or transported, sharp tools should be kept in sheaths, shields, chests or other suitable containers.

iv) Only insulated or non-conducting tools should be used on or near live electrical installations.

v) Only non-sparking tools should be used near or in the presence of flammable or explosive dusts or vapours.

5.8.3 Pneumatic Tools

i) Operating triggers on portable pneumatic tools should be:
   a) so placed as to minimise the risk of accidental starting of the machine.
   b) so arranged as to close the air inlet valve automatically when the pressure of the operator's hand is removed.

ii) Hose and hose connections for compressed air supply to portable pneumatic tools should be:

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a) designed and tested for the pressure and service for which they are intended;
b) fastened securely on the pipe outlet and equipped with the safety chain, as appropriate.

iii) Pneumatic shock tools should be equipped with safety clips or retainers to prevent dies and tools from being accidentally expelled from the barrel.

iv) Pneumatic tools should be disconnected from power and the pressure in hose lines released before any adjustment or repair is made.

5.8.4 Electrical Tools

i) Low voltage portable electrical tools should generally be used.
ii) All electrical tools should be earthed, unless they are "all insulated" or "double insulated" tools which do not require earthing.

iii) All electrical tools should get inspected and maintained on a regular basis by a competent electrician and complete records kept.

iv) No temporary connected appliance shoud be left connected in the socket. Its plug should be immediately removed after use.

5.8.5 Engines

i) Engines should:

a) be installed so that they can be started safely and the maximum safe speed cannot be exceeded.
b) have controls for limiting speed.
c) have devices to stop them from a safe place in an emergency.
d) have their batteries top covered with insulating material.
e) have radiator fan covers in place.

ii) IC engines should not be run in confined spaces unless adequate exhaust ventilation is provided or the exhaust should be installed outside the confined place at suitable height.

iii) When IC engines are being fuelled:

a) the engine should be shut off.
b) care should be taken to avoid spilling fuel.
c) no person should smoke or have an naked light in the vicinity.
d) a fire extinguisher should be kept readily available.

iv) Secondary fuel reservoir should be placed outside the engine room.

6.0 CONSTRUCTION ACTIVITIES

The various common activities in construction are as under:

- Excavation
- Scaffolding, Platforms & Ladders
- Structural Work, Laying of Reinforcement & Concreting
- Road Work (Laying of roads)
- Cutting /Welding
- Working in Confined Space

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- Proof/Pressure Testing
- Working at Heights
- Handling & Lifting Equipment
- Vehicle Movement
- Electrical
- Offshore
- Demolition
- Radiography
- Shot blasting/ spray painting
- Work above water

Work permit system as per requirement of OISD-STD-105 shall be followed for various construction activities. As regards the activities at work places including grass root project sites if not covered under OISD-STD-105, owner shall develop a suitable methodology for execution of various construction activities under work permit system for safe execution of the works.

The safe practices to be followed during the implementation of above construction activities are given below:

6.1 EXCAVATION

6.1.1 All excavation work should be planned and the method of excavation and the type of support work required should be decided considering the following:

i) the stability of the ground including the chances of seepage of water;
ii) the excavation will not affect adjoining buildings, structures or roadways;
iii) to prevent hazard, the Hydrocarbon lines, water, electrical and other above ground & underground public utilities should be shut off, re-routed or disconnected, if necessary; If such a presence is envisaged, clearance to be taken from respective competent authority/ person.
iv) the position of culvert/bridges, temporary roads and spoil heaps should be determined;
v) a signed rough sketch of the excavation site to be prepared and made the workers understand

6.1.2 Before digging begins on site, all excavation work should be planned and the method of excavation and the type of support work required should be decided based on good engineering practices and recorded.

6.1.3 All excavation work should be supervised by a competent person.

6.1.4 Sites of excavations should be thoroughly inspected:

i) daily, prior to each shift and after interruption in work of more than one day;
ii) after every blasting operation;
iii) after an unexpected fall of ground;
iv) after substantial damage to supports;
v) after a heavy rain, frost or snow;
vi) when boulder formations are encountered.
vii) for cracks in the nearby buildings or area as the excavation progresses and the same to be reviewed.

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6.1.5 Safe angle of repose while excavating trenches exceeding 1.5m depth upto 3.0m should be maintained. Based on site conditions, provide proper slope, usually 45^0,and suitable bench of 0.5m width at every 1.5m depth of excavation in all soils except hard rock or provide proper shoring and strutting to prevent cave-in or slides.

6.1.6 As far as possible, excavated earth should not be placed within one meter of the edge of the trench or depth of trench whichever is greater.

6.1.7 Don't allow vehicles to operate too close to excavated area. Maintain atleast 2m distance from edge of excavation or depth of trench whichever is greater. No load, plant or equipment should be placed or moved near the edge of any excavation where it is likely to cause its collapse and thereby endanger any person unless precautions such as the provision of shoring or piling are taken to prevent the sides from collapsing.

6.1.8 Adequately anchored stop blocks and barriers should be provided to prevent vehicles being driven into the excavation. Heavy vehicles should not be allowed near the excavation unless the support work has been specially designed to permit it.

6.1.9 If an excavation is likely to affect the stability of a structure on which persons are working, precautions should be taken to protect the structure from collapse.

6.1.10 Barricade at 1m height (with red & white band/self glowing caution board) should be provided for excavations beyond 1.0 m depth. Provide two entries/exits for such excavation through proper means. Lighting arrangements to be made to avoid any accidental fall in the excavated portion even when work is not in progress.

6.1.11 Necessary precautions should be taken for underground utility lines like cables, sewers etc. and necessary approvals/clearances from the concerned authorities shall be obtained before commencement of the excavation job.

6.1.12 Water shall be pumped/ bailed out, if any accumulates in the trench. Necessary precautions should be taken to prevent entry of surface water in trenches.

6.1.13 During / after rains, the soil becomes loose. Take additional precaution against collapse of side wall. During rains excavation should be avoided.

6.1.14 In hazardous areas, air should be tested to ascertain its quality. No one should be allowed entry till it is suitable for breathing.

6.1.15 In case of mechanised excavation, precaution shall be taken to not to allow anybody to come within one meter of extreme reach of the mechanical shovel. This area of reach of mechanical shovel should be marked / barricaded suitably. The mechanised excavator shall be operated by a well-trained experienced operator. When not in operation, the machine shall be kept on firm leveled ground with mechanical shovel resting on ground. Wheel or belt shall be suitably jammed to prevent any accidental movement of the machine. Suitable precautions as per manufacturer guidelines should be taken for dozers, graders and other heavy machines.

6.1.16 In case of blasting, follow strictly IS:4081-1986 & Indian Explosive Act and rules for storage, handling and carrying of explosive materials and execution of blasting operation.

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6.2 SCAFFOLDING, PLATFORMS & LADDERS

System of tagging shall be followed to indicate status of `Fit-for-Purpose' certification by a competent person for the scaffoldings. Green Tag shall indicate `Fit-for-Purpose' whereas Red Tag shall indicate `Unfit-for-purpose'. Accordingly only Red Tag shall be displayed during Erection & Dismantling.

All personnel engaged in erecting, using, dismantling scaffolds shall use full body safety harness with double lanyard with shock absorber connected with personal fall arrestor which should be secured to a properly designed anchor.

6.2.1 Scaffold related guidelines

General Requirements

Categories and Classification

Most scaffolds fall into one of the four primary categories:

- Tube and coupler scaffold
- System scaffolds e.g. Cup lock, Ring lock, H frame scaffold
- Suspension(or Suspended) scaffold
- Mobile scaffold
- Special scaffold

Scaffolds are classified according to their intended use as:

- Light duty
- Medium duty (General Purpose)
- Heavy duty

Type of Scaffolding	Load duty	Light		Medium	Heavy/Special		
	Maximum Safe load in Kg/m^2	75	150	225	300	450	600
Tubular with clamps	Max. bay length (distance between two verticals) in Meter	2.7	2.2	1.8	1.4	1.0	0.8
Cup / Ring lock		2.5	2.0	1.5	1.25	1.0	NA

Conditions where special scaffolding procedure is required:

1. Height of the scaffolding is more than 30 meters.

2. Scaffolding is special in nature/ type: cantilever more than 1 .5 meters, bridge more than 4 meters, scaffolding for machine/ equipment maintenance requiring frequent modifications, offshore scaffold, hanging scaffold; wooden scaffold (for specific use e.g. cooling tower), etc.

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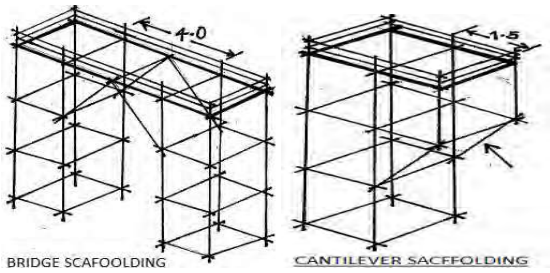

For all such cases, but not limited to, in addition to checklist, a plant specific procedure cum checklist based on additional risk is to be prepared & validated by a competent person (example: procedure for erection/ dismantling shall be prepared and followed. If need felt, help from Engineering Cell/Third Party may be taken for checking proposed scaffold in respect of design and load carrying capacity etc.).

Specifications of Scaffolds

Applicable to all Scaffolds

1. All elevated structures/ working platform areas should be guarded on all sides.

2. Railings and toe boards should be provided on the platform.

3. Scaffolds shall be designed to support at least 4 times the anticipated weight of Men, material and wind force.

4. Make certain that all scaffolds are in plumb and level at all times.

5. Scaffolds shall be secured from tipping when the scaffold height exceeds four times its minimum base dimension.

6. Scaffolds must be constructed at least **3** planks wide unless location makes this physically impossible.

7. Landing platform should be provided at every 9 meter of height or less.

8. The members of scaffolds should extend at least 6" on either ends but not more than 12". They should be fastened on both ends and laid tight by clamps.

9. All scaffoldings having height to base ratio more than 4 shall be secured firmly with permanent structure in X and Y direction at least every 6 meters.

10. Scaffold which spread to 20 meter or more should have two accesses preferably opposite side.

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11. Plastic Checklist holder with red marked to be used as a "Not Fit-for-Purpose" warning signboard and Green colour combined checklist to be used as "Fit-for-Purpose" signboard.

12. Keep distance of at least 150mm between high temp Pipelines or equipment and scaffolding.

13. Safe distance from overhead electrical lines to be maintained as per Site electrical safety procedures.

Applicable to Tube-and-coupler scaffold

1. Tube and coupler scaffolds over 30 meter in height must be Designed by a competent professional engineer (who by extensive knowledge, training, and experience have successfully demonstrated his ability to carry out scaffold design and load calculations).
2. Maximum height of first horizontal member (Ledger) of scaffolds from the Ground shall be 2.2 meters. Lower lift can be considered for heavy loads depending upon the scaffold design. When scaffold is more than 6 meter height for carrying heavy load, kicker lift should be provided at a height of 150mm from ground.

3. The top rail shall be at height of 900-1200 mm and Mid rails must be installed approximately halfway between the top rail and the platform surface. Toe boards (150mm) should be securely attached to the working platform. Toe boards are generally applicable to working platform and not for landing platforms.

4. The bay length & width depends on the height and the load to be carried by the scaffold.

5. Bracings shall be fitted up to full height of scaffold.

6. Standards should be joined having overlap of min 600 mm using three equally spaced swivel clamps or end to end using sleeve/pin type coupler.

7. Ledgers should be joined having overlap of min 600 mm using three equally spaced swivel clamps or end to end using sleeve coupler.

8. Base plate 150 x 150 x 6mm shall be used to support all vertical pipes of Scaffolds.

9. Sole plate shall be used at all unpaved area to support base late.

10. Scaffolding platform Grating shall be tied with clamp at both ends, and scaffolding platform Grating shall not overhang more than 150 mm and shall be at least 150 mm away from hot surface.

11. Every scaffold shall be provided with certified ladder and extending its free end shall be above platform by 1000 mm/ four rungs.

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Applicable to Mobile scaffolds

1. Attach castors with plain stems to the panel or adjustment screw by pins or other suitable means.
2. Apply castor brakes/lock at all times when scaffolding is not being moved.
3. Do not ride rolling scaffoldings.
4. Remove all material and equipment from platform before moving scaffolding.
5. Do not try to move rolling scaffolding without sufficient help. Watch out for holes protrusions in the floor and for overhead obstructions.
6. Do not use brackets on rolling scaffoldings without first considering the overturning effect.

Design Criteria

- All types of scaffolds shall be strong enough of carrying and transmitting all types of loads to the ground. All scaffolds shall be adequately secured, stiffened, both longitudinally and transversely.
- Scaffolding determines as per the requirement and use of scaffold such as:
    - Purpose of scaffolding
    - Loading on scaffold platform
    - Required height
    - Sufficient work place
    - Surrounding environment

Storage and inspection of materials

- All scaffolding material shall be stored at designated location to protect them from adverse environment conditions such as corrosion, weather.
- Storage racks/ Locations/ areas shall be clearly identified.
- Storage facility of scaffold material shall be properly constructed for its stability and load bearing capability.
- Steel pipes and scaffolding platform Grating shall be stacked horizontally according to length. Fittings, Couplers shall be stored in separate bins.

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- Defective material shall be removed from site.
- Scaffolding material such as tubular, planks, clamps etc. shall be inspected annually for contractor owned material by contractor. The visual inspection shall cover 100% scaffold materials.

Transportation and handling of scaffolding material

- Make sure that scaffold pipe shifting done in vehicle of appropriate length.
- Special safety care to be taken while shifting or lifting pipes manually.
- Rope and pulley should be used to lift pipe from height.

Safety requirements

A risk assessment to access scaffold hazards through inspection and work method statement for relevant work activities shall be made before erecting, dismantling, moving, or modifying scaffold. Examples of hazards to be considered include the following:

- Working at/from heights.
- The presence of nearby electrical lines or process equipment (e.g. hot line, vents, drains, etc.). Necessary safety distances shall be maintained as specified in site level electrical safety procedure.
- Possible emergency scenario, escape routes and responses.
- The condition and loading of working surfaces /platform /scaffold pipes and other components or loose material such as clamps/ bolts on the working platforms.
- The presence and activity of other people and equipment in the vicinity of the work.
- The weather (Heavy rain, high wind velocity-more than 20 knots, etc).
- Erection during dark hours.
- Scaffold collapse.
- Manual task (Manual Material Handling).
- Access and egress during normal and emergency condition.

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- The effect of heavy equipment movement in close vicinity such as within 4 meters to be considered for direct hit and sagging of land in case of unpaved area.

This assessment is a part of the work permit process but should also be extended to the specific job planning of the crew performing the work. Appropriate actions shall be taken to mitigate the hazards identified during the assessment.

Fall protection when erecting, dismantling, and modifying scaffolds shall be under the direction of a competent person (Scaffold Supervisor). Scaffold erectors (Scaffolder) shall use personal fall-protection systems that provide continuous fall protection while erecting, dismantling or modifying scaffolds unless the determination is made by a competent person that fall protection is not feasible or it creates a greater hazard. Fall protection can be accomplished through the use of adequate anchorages that are independent of the scaffold or by using scaffold systems and components that are approved by the manufacturer as adequate anchorages. Employees/workmen shall use appropriate fall-arrest equipment.

The footing for supported scaffolds shall be sound, rigid, and capable of supporting the maximum intended load, including the weight of the scaffold.

Scaffold platform grating shall be fastened on both ends and laid tight by scaffold clamps/couplers.

Manufacturer's guidelines for proprietary scaffolds (e.g. Cup lock, ring lock, H frame, Insulating modular scaffolds) shall be followed unless a competent person approves the variance and provided the variance complies with applicable regulations and generally accepted scaffold engineering practices.

Proprietary/special scaffold manufacturer's guidelines for erection and inspection should be available with users, and with plant maintenance engineer for reference.

The following safe practices with respect to scaffolds shall be followed:

- There shall be firm foundation for all scaffoldings. All scaffolding shall be made of sound material. Scaffolding material shall be inspected and used, only if found in good condition. Avoid using equipment whose strength is not known.

- Provide adequate Base for scaffolding posts. Metal base plate is used under all upright or standard scaffoldings. Correct type of couplers shall be used for all connections. Use right angle couplers for joining vertical to horizontal members and swivel type couplers for joining bracing with ledgers. For joining vertical load bearing members (standards), "joint pin" type couplers can also be used. The couplers shall be of a structural

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metal, such as drop-forged steel, malleable iron, or structural grade aluminum (use of gray cast iron is prohibited).

- Plumb and level scaffoldings as erection proceeds, so that braces will fit without forcing. Fasten all braces securely.
- Where scaffoldings are erected above walkways or work areas, the space between toe board and railing should be screened (e.g. Safety net, Metal sheets).
- Whenever work is being done over men who are working on scaffolding, overhead protection should be provided on the scaffolding.
- Restrain free-standing scaffolding towers from tipping by guying or other means.
- A safe and convenient means of access shall be provided to the platform level. Means of access may be a portable ladder, fixed ladder, ramp or runway or stairway. The ladder shall be so installed that there supporting member (pipe) is just below ladder rung. This is to avoid tripping hazard, especially while using the ladder.
- During erection, the ladder shall be installed as early as practicable, but not later than first two horizontal members (Ledgers). This is to facilitate Scaffolder while erecting the scaffold.
- During erection/ dismantling, scaffolder shall use 'T' steps to minimize risk of accidental fall/ slip.
- Ladder should be provided with tie rods/studs at top and bottom rungs and secured to scaffolding with ladder clamps, at least 2 locations for a ladder of length up to 4 m & at 3 locations for more than 4 m long ladder.
- The horizontal member/ ledger on which ladder is to be fixed, must be clamped to two subsequent standard using fixed clamps.
- Do not cantilever or extend putlogs / trusses as side brackets, without thoroughly considering the loads to be applied.
- Do not climb scaffold using cross braces.
- Do not use ladders or makeshift devices on top of scaffoldings to increase the height.
- Have at least 12" overlap and 6" extension beyond centerline of support or cleat at both ends to prevent sliding.
- Do not allow unsupported ends of planking to extend an unsafe distance beyond supports.
- Planks shall be non-greasy and free from defects.

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- Access to working platform shall be suitably protected against inadvertent fall by providing swing members/ swing gate or chains.
- When scaffolding is no longer required, request for dismantling of scaffold shall be sent to scaffolding supervisor through work permit.
- Scaffold shall be removed from top bracings. Ties, rackers etc. should not be removed from section lower than the one which is being dismantled.
- Do not throw or allow falling to ground any scaffold member, board or fittings.
- Dismantled scaffold material shall be neatly stacked, away from the site until whole of scaffold has been dismantled.

6.2.2 Metal as material of construction

i) A scaffold should be provided and maintained or other equally safe and suitable provision should be made where work cannot safely be done on or from the ground or from part of a building or other permanent structure.

ii) Scaffolds should be provided with safe means of access, such as stairs, ladders or ramps. Ladders should be secured against inadvertent movement.

iii) Every scaffold should be constructed, erected, properly secured/ tied and maintained so as to prevent collapse or accidental displacement during erection, while in use, in idle state or dismantling.

iv) Every scaffold and part thereof should be constructed :

(a) in such a way so as not to cause hazards for workers during erection and dismantling;
(b) in such a way so as guard rails and other protective devices, platforms, ladders, stairs or ramps can be easily put together;
(c) with sound material and of requisite size and strength for the purpose for which it is to be used and maintained in a proper condition.

v) Boards and planks used for scaffolds should be protected against splitting.

vi) Materials used in the construction of scaffolds should be stored under good conditions and apart from any material unsuitable for scaffolds.

vii) Couplers should not cause deformation in tubes. Couplers should be made of drop forged steel or equivalent material.

viii) Tubes should be free from cracks, splits and excessive corrosion and be straight to the eye, and tube ends cut cleanly square with the tube axis.

ix) Scaffolds should be designed for their maximum load as per relevant codes.

x) Scaffolds should be adequately braced.

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xi) Scaffolds which are not designed to be independent should be rigidly connected to the building at designated vertical and horizontal places.

xii) A scaffold should never extend above the highest anchorage to an extent which might endanger its stability and strength.

xiii) Loose bricks, drainpipes, chimney-pots or other unsuitable material should not be used for the construction or support of any part of a scaffold.

xiv) Scaffolds should be inspected and certified:

(a) before being taken into use;
(b) at periodic intervals thereafter as prescribed for different types of scaffolds;
(c) after any alteration, interruption in use, exposure to weather or seismic conditions or any other occurrence likely to have affected their strength or stability.

xv) Inspection should more particularly ascertain that:

(a) the scaffold is of suitable type and adequate for the job;
(b) materials used in its construction are sound and of sufficient strength;
(c) it is of sound construction and stable;
(d) that the required safeguards are in position.

xvi) A scaffold should not be erected, substantially altered or dismantled except by or under the supervision.

xvii) If out-rigger scaffolding is to be used, it should be specifically designed and inspected before putting in use.

6.2.3 Lifting appliances on scaffolds (CHAIN PULLEY BLOCKS, PULLERS)

i) When a lifting appliance is to be used on a scaffold:

(a) the parts of the scaffold should be carefully inspected to determine the additional strengthening and other safety measures required;
(b) any movement of the scaffold members should be prevented;
(c) if practicable, the uprights should be rigidly connected to a solid part of the building at the place where the lifting appliance is erected.

6.2.4 Prefabricated scaffolds

i) In the case of prefabricated scaffold systems, the instructions provided by the manufacturers or suppliers should be strictly adhered to. Prefabricated scaffolds should have adequate arrangements for fixing bracing.

ii) Frames of different types should not be intermingled in a single scaffold.

iii) Scaffolding shall be erected on firm and level ground. In case of loose or uneven terrain, care should be taken to see that the scaffolding is on firm footing by leveling / compacting or other means.

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iv) All members of metal scaffolding shall be checked periodically to screen out defective / rusted members. All joints should be properly lubricated for easy tightening.

v) Entry to scaffolding should be restricted.

vi) Erection, alteration and removal shall be done under supervision of experienced personnel.

vii) Use of barrels, boxes, loose bricks etc., for supporting scaffolds shall not be permitted.

viii) Each supporting member of platform shall be securely fastened and braced.

ix) Where planks are butt-joined, two parallel putlogs shall be used, not more than 100mm apart, to give support to each plank.

x) Platform plank shall not project beyond its end support to a distance exceeding 4 times the thickness of plank, unless it is effectively secured to prevent tipping. Cantilever planks should be avoided. If it is unavoidable overhang should be effectively secured to prevent tipping.

xi) The platform edges shall be provided with 150mm high toe board to eliminate hazards of tools or other objects falling from platform.

xii) Erect ladders in the "four up-one out position"

xiii) Ladder shall be properly secured with the structure.

xiv) Use non-slip devices, such as, rubber shoes or pointed steel ferules at the ladder foot, rubber wheels at ladder top, fixing wooden battens, cleats etc.

xv) When ladder is used for climbing over a platform, the ladder must be of sufficient length, to extend at least one meter above the platform, when erected against the platform in "four up-one out position."

xvi) Portable ladders shall be used for heights not more than 4mt. Above 4mt flights, fixed ladders shall be provided with at least 600 mm landings at every 6mt or less.

xvii) The width of ladder shall not be less than 300mm and rungs shall be spaced not more than 300mm.

xviii) Every platform and means of access shall be kept free from obstruction.

xix) If grease, mud, gravel, mortar etc., fall on platform or scaffolds, these shall be removed immediately to avoid slippage.

xx) Workers shall not be allowed to work on scaffolds during storms or high wind. After heavy rain or storms, scaffolds shall be inspected before reuse.

xxi) Don't overload the scaffolding. Remove excess material and scrap immediately.

xxii) Dismantling of scaffolds shall be done in a pre-planned sequential manner.

6.2.5 Suspended scaffolds/ boatwain's chair

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In addition to the requirements for scaffolds in general as regards soundness, stability and protection against the risk of falls, suspended scaffolds should meet the following specific requirements.

(a) platforms should be designed and built with dimensions that are compatible with the stability of the structure as a whole, especially the length;
(b) the number or anchorage should be compatible with the dimensions of the platform;
(c) the safety of workers should be safeguarded by an extra rope having a point of attachment independent of the anchorage arrangements of the scaffold;
(d) the anchorage and other elements of support of the scaffold should be designed and built in such a way as to ensure sufficient strength;
(e) the ropes, winches, pulleys or pulley blocks should be designed, assembled, used and maintained according to the requirements established for lifting gear adapted to the lifting of persons according to national laws and regulations;
(f) before use, the whole structure should be checked by a competent person.

6.2.6 Bamboo Scaffolding

i) It should not be used in oil & gas installations and in the areas where hot work is to be done.

ii) For construction and maintenance of low rise residential and office buildings, situated outside explosive licensed area, bamboo scaffold, if unavoidable, should conform to provisions given in IS-3696 (Part 1)-1987.

6.3 STRUCTURAL WORK, LAYING OF REINFORCEMENT & CONCRETING

6.3.1 General provisions

i) The erection or dismantling of buildings, structures, civil engineering works, formwork, falsework and shoring should be carried out by trained workers only under the supervision of a competent person.

ii) Precautions should be taken to guard against danger to workers arising from any temporary state of weakness or instability of a structure.

iii) Formwork, falsework and shoring should be so designed, constructed and maintained that it will safely support all loads that may be imposed on it. Conformity with design during job execution shall be certified by the competent person and the relevant records shall be maintained.

iv) Formwork should be so designed and erected that working platforms, means of access, bracing and means of handling and stabilising are easily fixed to the formwork structure.

v) Proper methodology based on the design of the building / structure to be developed and approved by competent person before resorting to dismantling / modifications.

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vi) All works / facilities should be certified for structural stabilities by a competent person and on statutory requirement completed before putting to use.

6.3.2 Erection and dismantling of steel and prefabricated structures

i) The safety of workers employed on the erection and dismantling of steel and prefabricated structures should be ensured by appropriate means, such as provision and use of:

(a) ladders, gangways or fixed platforms;
(b) platforms, buckets, boatswain's chairs or other appropriate means suspended from lifting appliances;
(c) safety harnesses and lifelines supported on properly designed anchor, catch nets or catch platforms;
(d) Mechanical / Power-operated mobile working platforms;
(e) Proper Personal Protective Equipment.

ii) Steel and prefabricated structures should be so designed and made that they can be safely transported and erected. Route survey to be carried out from works to construction site route considering the load bearing capacity of the bridges, height of the bridges en-route and maximum width and length permissible without causing any hazard to public, the route and the equipment.

iii) In addition to the need for the stability of the part when erected, the design should explicitly take following into account:

(a) the conditions and methods of attachment in the operations of transport, storing and temporary support during erection or dismantling as applicable;
(b) Methods for the provision of safeguards such as railings and working platforms, and, when necessary, for mounting them easily on the structural steel or prefabricated parts.

iv) The hooks and other devices built in or provided on the structural steel or prefabricated parts that are required for lifting and transporting them should be so shaped, dimensioned and positioned as:

(a) to withstand with a sufficient margin the stresses to which they are subjected;
(b) Not to set up stresses in the part that could cause failures, or stresses in the structure itself not provided for in the plans, and be designed to permit easy release from the lifting appliance. Lifting points for floor and staircase units should be located (recessed if necessary) so that they do not protrude above the surface;
(c) To avoid imbalance or distortion of the lifted load.

v) Storeplaces should be so constructed that:

(a) there is no risk of structural steel or prefabricated parts falling or overturning;
(b) storage conditions generally ensure stability and avoid damage having regard to the method of storage and atmospheric conditions;
(c) racks are designed and secured on firm ground so that units cannot move accidentally.

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vi) While they are being stored, transported, raised or set down, structural steel or prefabricated parts should not be subjected to stresses prejudicial to their stability.

vii) Every lifting appliance should:

(a) be suitable for the operations and not be capable of accidental disconnection;
(b) be approved or tested as per statutory requirement.

viii) Lifting hooks should have safety latch (self closing type).

ix) Lifting hooks, Tongs, clamps and other appliances for lifting structural steel and prefabricated parts should:

(a) be of such shape and dimensions as to ensure a secure grip without damaging the part;
(b) be marked with the maximum permissible load in the most unfavourable lifting conditions.
(c) be periodically inspected and certified to ensure further usage as per requirement of factory act / Building & Construction Workers Regulation (BOCWR).

x) Structural steel or prefabricated parts should be lifted only after rigging plan approved by competent person to prevent them from spinning, slipping or dropping accidentally.

xi) When necessary to prevent danger, before they are raised from the ground, structural steel or prefabricated parts should be provided with safety devices such as railings and working platforms to prevent falls of persons.

xii) While structural steel or prefabricated parts are being erected, the workers should be provided with appliances such as guiding ropes for guiding them as they are being lifted and set down, so as to avoid crushing of hands and to facilitate the operations. Use of such appliances should be ensured.

xiii) A raised structural steel or prefabricated part should be so secured and wall units so propped that their stability cannot be affected, even by external factors such as wind and passing loads before its release from the lifting appliance.

xiv) At work places, instruction should be given to the workers on the methods, arrangements and means required for the storage, transport, lifting and erection of structural steel or prefabricated parts, and, before erection starts, a meeting of all those responsible should be held to discuss and confirm the requirements for safe erection.

xv) During transportation within the construction area, attachments such as slings and straps mounted on structural steel or prefabricated parts should be securely fastened to the parts. Vehicle loading should be such that the vehicle and the load remain stable at all positions during transportation and unloading.

xvi) Structural steel or prefabricated parts should be so transported that the conditions do not affect the stability of the parts or the means of transport result in jolting, vibration or stresses due to blows, or loads of material or persons.

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xvii) When the method of erection does not permit the provision of other means of protection against fall of persons, the workplaces should be protected by guardrails, and if appropriate by toe-boards.

xviii) When adverse weather conditions such as snow, hailstorm, rain and wind or reduced visibility, etc. entail risks of accidents, the rigging work should be interrupted after taking necessary safety precautions.

xix) If necessary, to prevent danger, structural steel parts should be equipped with attachments for suspended scaffolds, lifelines or safety harnesses and other means of protection.

xx) The risks of falling, to which workers moving on high or sloping girders are exposed, should be limited by all means of adequate collective protection or, where this is impossible, by the use of a safety harness that is well secured to a properly designed support.

xxi) Structural steel parts that are to be erected at a height should as far as practicable be assembled on the ground.

xxii) When structural steel or prefabricated parts are being erected, a sufficiently extended area underneath the workplace should be barricaded or guarded

xxiii) Steel trusses that are being erected should be adequately shored, braced or guyed until they are permanently secured in position.

xxiv) Load-bearing structural member should not be dangerously weakened by cutting, holing or other means.

xxv) Structural members should not be forced into place by the hoisting machine while any worker is in such a position that he could be injured by the operation.

xxvi) Open-web steel joists that are hoisted singly should be directly placed in position and secured against dislodgment.

xxvii) All structures should be designed for either permanent anchors or provision for erection of anchors as and when required to support life line during any Maintenance work etc. during life of the structure. The point of provision of anchor should be indicated through suitable signage for ease of use as and when required.

6.3.3 Reinforcement

i) Ensure that workers use Personnel Protective equipment like safety helmet with chin straps, safety shoes, gloves, full body safety harness, safety goggles, etc.

ii) Don't place the hand below the rods for checking clear distance. Use measuring devices.

iii) Don't wear loose clothes while checking the rods.

iv) Don't stand unnecessarily on cantilever rods.

v) To carry out welding/cutting of rods, safety procedures/precautions as mentioned in Item No. 6.5 to be followed.

vi) For supplying of rods at heights, proper staging and/or bundling to be provided.

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vii) Ensure barricading and staging for supplying and fixing of rods at height.

viii) For short distance carrying of materials on shoulders, suitable pads to be provided.

ix) While transporting material by trucks/trailers, the rods shall not protrude in front of or by the sides of driver's cabin. In case such protrusion cannot be avoided behind the deck, then it should not extend 1/3rd of deck length or 1.5 Meters whichever is less and tied with red flags/lights.

x) Reinforcement rods, cut pieces etc. should be properly stored at identified locations and the scrap should be disposed off promptly on regular basis.

6.3.4 Concreting

i) Ensure stability of shuttering work before allowing concreting.

ii) Barricade the concreting area while pouring at height/depths.

iii) Keep vibrator hoses, pumping concrete accessories in healthy conditions and mechanically locked.

iv) Pipelines in concrete pumping system shall not be attached to temporary structures such as scaffolds and formwork support as the forces and movements may affect their integrity.

v) Check safety cages & guards around moving motors/parts etc. provided in concreting mixers.

vi) Use Personal Protective Equipment like gloves, safety shoes, full body safety harness, safety goggles, etc. while dealing with concrete and wear respirators for dealing with cement.

vii) Earthing of electrical mixers, vibrators, etc. should be done and verified.

viii) Cleaning of rotating drums of concrete mixers shall be done from outside. Lockout devices shall be provided where workers need to enter the drum for cleaning / inspection.

ix) Where concrete mixers are driven by internal combustion engine, exhaust points shall be located away from the worker's workstation so as to eliminate their exposure to obnoxious fumes.

x) Don't allow unauthorised person to stand under the concreting area.

xi) Ensure adequate lighting arrangements for carrying out concrete work during night.

xii) Don't allow the same workers to pour concrete round the clock. Insist on shift pattern.

xiii) During pouring, shuttering and its supports should be continuously watched for defects.

xiv) Never look into the drum mounted on truck (such as in case of Ready Mix Concrete).

6.4 ROAD WORK

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6.4.1 Site shall be barricaded and provided with warning signs, including night warning lamps at appropriate locations for traffic diversion. This should be done sufficiently advance as a warning to the approaching drivers for the impending dander ahead.

6.4.2 Filled and empty bitumen drums shall be stacked separately at designated places.

6.4.3 Mixing aggregate with bitumen shall preferably be done with the help of bitumen batch mixing plant, unless operationally non-feasible.

6.4.4 Road rollers, Bitumen sprayers, Pavement finishers shall be driven by experienced drivers with valid driving license.

6.4.5 Workers handling hot bitumen sprayers or spreading bitumen aggregate mix or mixing bitumen with aggregate shall be provided with PVC hand gloves and rubber shoes with legging up to knee joints.

6.4.6 At the end of day's work, surplus hot bitumen in tar boiler shall be properly covered by a metal sheet, to prevent anything falling in it,

6.4.7 If bitumen accidentally falls on ground, it shall be immediately covered by sprinkling sand, to prevent anybody stepping on it. Then it shall be removed with the help of spade.

6.4.8 For cement concrete roads, besides site barricading and installation of warning signs for traffic diversion, safe practices mentioned in the chapter on "Concreting", shall also be applicable.

6.4.9 Any excavation for road work should be done only after surveying underground utilities and after taking suitable precautions. The underground utilities to be rerouted as required after approval of competent person / authority.

6.4.10 All the raw material for road construction/ maintenance to be stored on designated place which should be away from the running road. The running road should not be used for storing the sand, hot bitumen, etc..

6.4.11 Precaution should be taken that no construction material/ slab/ pre-fabricated object can come on the running road accidently or due to slipping. In such case, an erection plan should be designed and got approved from the competent authority.

6.5 CUTTING / WELDING

6.5.1 Common hazards involved in welding/cutting are sparks, molten metal, flying particles, harmful light rays, electric shocks , depletion in O_2 concentration due to generation of toxic gases, etc. Following precautions should be taken: -

i) A dry chemical powder (DCP) type fire extinguisher shall be made available in the work area.

ii) Adequate ventilation shall be ensured by opening manholes and fixing a shield or forced circulation of air etc, while doing a job in confined space.

iii) Ensure that only approved and well-maintained apparatus, such as torches, manifolds, regulators or pressure reducing valves, and acetylene generators, be used. Also their regular calibration where ever necessary.

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iv) All panels and covers shall be kept in place, when operating an electric Arc welding machine. 30mA rating ELCB shall be ensured in the power receptacle of the welding machine.

v) The work piece should be connected directly to Power supply, and not indirectly through pipelines/ structures/ equipment etc.

vi) The welding receptacles shall be rated for 63 A suitable for 415V, 3-Phase system with a scraping earth. Receptacles shall have necessary mechanical interlocks and earthing facilities.

vii) All cables, including welding and ground cables shall be checked for any worn out or cracked insulation before starting the job and such cables shall not be used. Ground cable should be separate without any loose joints.

viii) Cable coiling shall be maintained at minimum level, if not avoidable. Criss-crossing of welding/electrical power supply cables & gas cutting hoses shall be avoided. Care to be taken against damage of gas cutting hoses.

ix) An energised electrode shall not be left unattended.

x) The power source shall be turned off at the end of job.

xi) All gas cylinders shall be properly secured in upright position.

xii) Acetylene cylinder shall be turned and kept in such a way that the valve outlet points away from oxygen cylinder.

xiii) Acetylene cylinder key for opening valve shall be kept on valve stem, while cylinder is in use, so that the acetylene cylinder could be quickly turned off in case of emergency. Use flash back arrestors to prevent back-fire in acetylene/oxygen cylinder.

xiv) When not in use, valves of all cylinders shall be kept closed.

xv) All types of cylinders, whether full or empty, shall be stored at cool, dry place under shed.

xvi) Forced opening of any cylinder valve should not be attempted.

xvii) Lighted gas torch shall never be left unattended.

xviii) Store acetylene and oxygen cylinders separately.

xix) Store full and empty cylinders separately.

xx) Avoid cylinders coming into contact with heat.

xxi) Cylinders that are heavy or difficult to carry by hand may be rolled on their bottom edge but never dragged.

xxii) If cylinders have to be moved, be sure that the cylinder valves are shut off.

xxiii) Before changing torches, shut off the gas at the pressure reducing regulators and not by crimping the hose.

xxiv) Do not use matches to light torches, use a friction lighter. Gas torch should be ignited with the lighter only. It should not be ignited by touching other hot surfaces.

xxv) Move out any leaking cylinder immediately and cap it. No hot work should be permitted in the vicinity of such leaked cylinders.

xxvi) Use trolleys for oxygen & acetylene cylinder and chain them.

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xxvii) Always use Red hose for acetylene and other fuel gases and Black for oxygen, and ensure that both are in equal length.

xxviii) Ensure that hoses are free from burns, cuts and cracks and properly clamped.

xxix) Avoid dragging hoses over sharp edges and objects

xxx) Do not wrap hoses around cylinders when in use or stored.

xxxi) Protect hoses from flying sparks, hot slag, and other hot objects. Protect cylinders by covering welding blanket while hot work in the vicinity.

xxxii) Lubricants shall not be used on Ox-fuel gas equipment.

xxxiii) During cutting/welding, use required PPEs like hand gloves, full body clothing of fire retardant / suitable material, safety shoes, full body safety harness, mask, goggles / face shields, welding screen of required DIN glass as per approved Weld Preparation Scheme.

xxxiv) Hot work permit to be taken if working in hazardous area.

6.6 WORKING IN CONFINED SPACES

6.6.1 Following safety practices for working in confined space like towers, columns, tanks and other vessels should be followed in addition to the safety guidelines for specific jobs like scaffolding, cutting/welding etc.

i) Shut down, positively isolate, depressurise and purge the vessel as per laid down procedures.

ii) Entry inside the vessel to carry out any job shall be done after issuance of valid permit only in line with the requirement of OISD-STD-105.

iii) Ensure proper and accessible means of exit before entry inside a confined space.

iv) The number of persons allowed inside the vessel should be limited to avoid overcrowding. Record of entering person shall be maintained with in and out time.

v) When the work is going on in the confined space, there should always be two men standby at the nearby manway / manhole equipped with communication arrangement to contact seniors and to evacuate the worker inside confined space in case of emergency.

vi) Before entering inside the vessels underground or located at lower elevation, probability of dense vapours accumulating nearby should also be considered in addition to inside the vessel and corrective action should be ensured.

vii) Ensure requisite O_2 level before entry in the confined space and monitor level periodically or other wise use required respiratory devices.

viii) Check for no Hydrocarbon or toxic substances before entry and monitor level periodically or use requisite Personal Protective Equipment.

ix) Ensure adequate ventilation or use respiratory devices.

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x) Depending upon need, necessary respirator system, gas masks and suit shall be worn by everyone entering confined space. In case of sewer, OWS or in the confined area where there is a possibility of toxic or inert gas, required respiratory device, shall be used by everyone while entering.

xi) Barricade the confined spaces during hoisting, radiography, blasting, pressure testing etc.

xii) Use 24V flameproof lamp fittings only for illumination.

xiii) Use tools with air motors or electric tools with maximum voltage of 24V.

xiv) House keeping shall be well maintained.

xv) Required PPEs like Safety helmet, safety shoes and full body harness shall be worn by everyone entering the confined space.

xvi) Don't wear loose clothing while working in a confined space.

xvii) In case of the vessels which are likely to contain pyropheric substances (like Iron Sulphide), special care need to be taken before opening the vessel. Attempt should be made to remove the pyropheric substances. Otherwise, these should be always kept wet by suitable means.

xviii) The cutting torches should also be kept outside the vessel immediately after the cutting.

xix) The gas cylinders used for cutting/welding shall be kept outside. Care to be taken for the integrity of gas hoses and welding cables while work is in progress.

xx) All cables, hoses, welding equipment etc., shall be removed from confined space at end of each work day, even if the work is to be resumed in the same space the next day.

xxi) To the extent possible sludge shall be cleared and removed from outside before entering.

xxii) No naked light or flame or hot work such as welding, cutting and soldering should be permitted inside a confined space or area unless it has been made completely free of the flammable atmosphere, tested and found safe by a competent person. Only non-sparking tools and flameproof hand lamps protected with guard and safety torches should be used inside such confined space or area for initial inspection, cleaning or other work required to be done for making the area safe.

xxiii) Communication should be always maintained between the worker and the attendant.

xxiv) Inside the confined space spray painting should be avoided. If absolutely essential it should be done after ensuring adequate precautions including exhaust of paint vapours and continuous monitoring of concentration of oxygen and toxic gases.

xxv) Before issuing the vessel entry permit, it should be ensured that all the incoming and outgoing lines to and from the vessel are positively isolated. Where this is not applicable like dampers in HRSG system, Sufficient time is to be allowed to observe the leakage of hot gases from the dampers/ passing valves before taking any decision on vessel entry permit.

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6.7 PROOF/PRESSURE TESTING

6.7.1 Review test procedure before allowing testing with water or air or any other fluid. Testing should be done only after proper Job Safety Analysis (JSA) and its approval.

6.7.2 Provide relief valves of adequate size while testing with air or other gases.

6.7.3 Ensure compliance of necessary precautions, step wise loading, tightening of fasteners, grouting etc. before and during testing.

6.7.4 Inform all concerned in advance of the testing.

6.7.5 Keep the vents open before opening any valve for filling/draining of liquid used for hydrotesting. The filling/draining should not exceed the designed rate for pressure testing.

6.7.6 Provide separate gauges of suitable range for pressurising pump and the equipment to be tested.

6.7.7 Provide gauges at designated locations for monitoring of pressures.

6.7.8 Check the calibration of all pressurising equipment and accessories and maintain records.

6.7.9 Take readings at pre-defined intervals.

6.7.10 Arrangement to be made to ensure that the pressurizing system i.e. motor-pump set is out of circuit so that the system under hydro testing is not re-pressurized by the contractor due to pressure drop before a pre-defined time.

6.8 WORKING AT HEIGHTS

6.8.1 General Provision

i) While working at a height of more than 2.2 meters, ISI approved full body harness shall be used.

ii) While working at a height of more than 2.2 meters, permit should be issued by competent person before commencement of the job.

iii) Worker should be well trained on usage of full body harness including its proper usage at the time of ascending/descending.

iv) All tools should be carried in tool bag/belt to avoid their falling.

v) If the job is on fragile/sloping roof, roof walk ladders shall be used.

vi) Provide lifeline properly designed, secured and anchored, wherever required. Mock Drill of use of lifeline at regular intervals to be carried out.

vii) Additional safety measures like providing Fall Arrestor type full body harness, safety net should be provided depending upon site conditions, job requirements.

viii) Keep working area neat and clean. Remove scrap material immediately.

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ix) Don't throw or drop material/equipment from height.

x) Avoid jumping from one member to another. Use proper passageway.

xi) Keep both hands free while climbing. Don't try to bypass the steps of the ladder. Same to be followed while climbing down. Further on climbing down, front of the body to be towards the ladder.

xii) Try to maintain calm at height. Avoid over exertion.

xiii) Avoid movements on any structural member without fall protection.

xiv) Elevated workplaces including roofs should be provided with safe means of access and egress such as stairs, ramps or ladders.

xv) Fall protection hierarchy to be followed as below:

(a) Elimination: Explore possibility whether job can be done avoiding work at height.

(b) Prevention: Prevent fall of a worker by providing appropriate fall prevention system.

(c) Fall arrest system: Arrest the fall using suitable fall arrest system. Ensure to have a strong suitably designed anchor point.

(d) Warning Lines: Use a warning line using a rope or wire barrier around roof to warn workers that they are getting close to the roof edge.

(e) Safety Monitoring: Use a safety monitor to warn the workers.

(f) Administration: Prepare a written administrative procedure to ensure workers are doing the best that they can.

6.8.2 Roof Work

i) All roof-work operations should be pre-planned and properly supervised.

ii) Roof work should only be undertaken by workers who are physically and psychologically fit and have the necessary knowledge and experience for such work.

iii) Work on roofs shouldn't be carried on in weather conditions that threaten the safety of workers.

iv) Crawling boards, walkways and roof ladders should be securely fastened to a firm structure.

v) Roofing brackets should fit the slope of the roof and be securely supported.

vi) Where it is necessary for a person to kneel or crouch near the edge of the roof, necessary precautions should be taken.

vii) On a large roof where work have to be carried out at or near the edge, a simple barrier consisting of crossed scaffold tubes supporting a tubing guardrail may be provided.

viii) All covers for openings in roofs should be of substantial construction and be secured in position.

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ix) Roofs with a pitch of more than 10 should be treated as sloping.

x) When work is being carried out on sloping roofs, sufficient and suitable crawling boards or roof ladders should be provided and firmly secured in position.

xi) During extensive work on the roof, strong barriers or guardrails and toe-boards should be provided to stop a person from falling off the roof.

xii) Where workers are required to work on or near roofs or other places covered with fragile material, through which they are liable to fall, they should be provided with suitable roof ladders or crawling boards strong enough and when spanning across the supports for the roof covering to support those workers.

xiii) A minimum of two boards should be provided so that it is not necessary for a person to stand on a fragile roof to move a board or a ladder, or for any other reason.

6.8.3 Work on tall chimneys

i) For the erection and repair of tall chimneys, scaffolding should be provided. A safety net should be maintained at a suitable distance below the scaffold.

ii) The scaffold floor should always be at least 65 cm below the top of the chimney.

iii) Under the working floor of the scaffolding the next lower floor should be left in position as a catch platform.

iv) The distance between the inside edge of the scaffold and the wall of the chimney should not exceed 20 cm at any point.

v) Catch platforms should be erected over:

(a) the entrance to the chimney;
(b) Passageways and working places where workers could be endangered by falling objects.

vi) For climbing tall chimneys, access should be provided by:

(a) stairs or ladders;
(b) a column of iron rungs securely embedded in the chimney wall;
(c) Other appropriate means.

vii) When workers use the outside rungs to climb the chimney, a securely fastened steel core rope looped at the free end and hanging down at least 3 m should be provided at the top to help the workers to climb on to the chimney.

viii) While work is being done on independent chimneys the area surrounding the chimney should be enclosed by fencing at a safe distance.

ix) Workers employed on the construction, alteration, maintenance or repair of tall chimneys should not:

a) work on the outside without a safety harness attached by a lifeline to a rung, ring or other secure anchorage;
b) put tools between the safety harness and the body or in pockets not intended for the purpose;

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c) haul heavy materials or equipment up and down by hand to or from the workplace on the chimney;
d) fasten pulleys or scaffolding to reinforcing rings without first verifying their stability;
e) work alone;
f) climb a chimney that is not provided with securely anchored ladders or rungs;
g) Work on chimneys in use unless the necessary precautions to avoid danger from smoke and gases have been taken. Ensure that the outside surface temperature of the chimney is at
h) room temperature before taking up any job after shut down of the (system) chimney.

x) Work on independent chimneys should not be carried on in high winds, icy conditions, fog or during electrical storms.

6.9 HANDLING AND LIFTING EQUIPMENT:

6.9.1 General Provisions

Following are the general guidelines to be followed with regard to all types of handling and lifting equipment in addition to the guidelines for specific type of equipments dealt later on.

i) There should be a well-planned safety programme to ensure that all the lifting appliances and lifting gear are selected, installed, examined, tested, maintained, operated and dismantled with a view to preventing the occurrence of any accident;

ii) All lifting appliances shall be examined by competent persons at frequencies as specified in "The Factories act".

iii) Check thoroughly quality, size and condition of all lifting tools like chain pulley blocks, slings, U-clamps, D-shackles etc. before putting them in use.

iv) Safe lifting capacity of all lifting & handling equipment, tools and shackles should be got verified and certificates obtained from competent authorities before its use. The safe working load shall be marked on them.

v) Check periodically the oil, brakes, gears, horns and tyre pressure, lighting fixtures of all moving equipments like cranes, forklifts, trailers, etc. as per manufacturer's recommendations.

vi) Check the weights to be lifted and accordingly decide about the crane capacity, boom length and angle of erection.

vii) Allow lifting slings as short as possible and check packing at the friction points.

viii) While lifting/placing of the load, no unauthorised person shall remain within the radius of the boom and underneath the load.

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ix) While loading, unloading and stacking of pipes, proper wedges shall be placed to prevent rolling down of the pipes.

x) Control longer jobs being lifted up from both ends.

xi) Only trained operators and riggers should carry out the job. While the crane is moving or lifting the load, the trained rigger should be there for keeping a vigil against hitting any other object.

xii) During high wind conditions and nights, lifting of heavy equipments should be avoided. If unavoidable to do erection in night, operator and rigger should be fully trained for night signaling. Also proper illumination should be there.

xiii) Allow crane to move on hard, firm and leveled ground. Ensure that all the crane pedestals/ hydraulic jacks taking weight of the crane and load are on a firm compacted surface.

xiv) When crane is in idle condition for long periods or unattended, crane boom should either be lowered or locked as per manufacturer's guidelines.

xv) Hook and load being lifted shall remain in full visibility of crane operators, while lifting, to the extent possible.

xvi) Don't allow booms or other parts of crane to come within 3 meters reach of overhead electrical cables.

xvii) No structural alterations or repairs should be made to any part of a lifting appliance, which may affect the safety of the appliance without the permission and supervision of the competent person.

6.9.2 Hoists

i) Hoist shafts should be enclosed with rigid panels or other adequate fencing at:

(a) ground level on all sides;
(b) all other levels at all points at which access is provided;
(c) all points at which persons are liable to be struck by any moving part.

ii) The enclosure of hoist shafts, except at approaches should extend where practicable at least 2 meters above the floor, platform or other place to which access is provided except where a lesser height is sufficient to prevent any person falling down the hoistway and there is no risk of any person coming into contact with any moving part of the hoist, but in no case should the enclosure be less than 1 meter in height.

iii) The guides of hoist platforms should offer sufficient resistance to bending and, in the case of jamming by a safety catch, to buckling.

iv) Where necessary to prevent danger, adequate covering should be provided above the top of hoist shafts to prevent material falling down them.

v) Outdoor hoist towers should be erected on firm foundations, and securely braced, guyed and anchored.

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vi) A ladderway should extend from the bottom to the top of outdoor hoist towers, if no other ladderway exists within easy reach.

vii) Hoisting engines should be of ample capacity to control the heaviest load that they will have to move.

viii) Hoists should be provided with devices that stop the hoisting engine as soon as the platform reaches its highest stopping place.

ix) Winches should be so constructed that the brake is applied when the control handle is not held in the operating position.

x) It should not be possible to set in motion from the platform a hoist, which is not designed for the conveyance of persons.

xi) Winches should not be fitted with pawl and ratchet gears on which the pawl must be disengaged before the platform is lowered.

xii) Hoist platforms should be capable of supporting the maximum load that they will have to carry with a safety factor.

xiii) Hoist platforms should be equipped with safety gear that will hold the platform with the maximum load if the hoisting rope breaks.

xiv) If workers have to enter the cage or go on the platform at landings there should be a locking arrangement preventing the cage or platform from moving while any worker is in or on it.

xv) On sides not used for loading and unloading, hoist platforms should be provided with toe-boards and enclosures of wire mesh or other suitable material to prevent the fall of parts of loads.

xvi) Where necessary to prevent danger from falling objects, hoist platforms should be provided with adequate covering.

xvii) Counterweights consisting of an assemblage of several parts should be made of specially constructed parts rigidly connected together.

xviii) Counterweights should run in guides.

xix) Platforms should be provided at all landings used by workers.

xx) Following notices should be posted up conspicuously and in very legible characters:

(a) on all hoists:

- on the platform: the carrying capacity in kilograms or other appropriate standard unit of weight;
- on the hoisting engine: the lifting capacity in kilograms or other appropriate standard unit of weight;

(b) on hoists authorised or certified for the conveyance of persons:

- on the platform or cage: the maximum number of persons to be carried at one time;

(c) on hoists for goods only:

- on every approach to the hoist and on the platform: prohibition of use by persons.

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xxi) Hoists intended for the carriage of persons should be provided with a cage so constructed as to prevent any person from falling out or being trapped between the cage and any fixed part of the structure when the cage gate is shut, or from being struck by the counterbalance weight or by articles or materials tailing down the hoistway.

xxii) On each side in which access is provided, the cage should have a gate fitted with devices which ensure that the gate cannot be opened except when the cage is at a landing and that the gate must be closed before the cage can move away from the landing.

xxiii) Every gate in the enclosure of the hoist shaft which gives access from a landing place to the cage should be fitted with devices to ensure that the gate cannot be opened except when the cage is at that landing place, and that the cage cannot be moved away from that landing place until the gate is closed.

6.9.3 Derricks

Stiff-leg derricks

i) Derricks should be erected on a firm base capable of taking the combined weight of the crane structure and maximum rated load.

ii) Devices should be used to prevent masts from lifting out of their seating.

iii) Electrically operated derricks should be effectively earthed from the sole plate or framework.

iv) Counterweights should be so arranged that they do not subject the backstays, sleepers or pivots to excessive strain.

v) When derricks are mounted on wheels:

a) a rigid member should be used to maintain the correct distance between the wheels;
b) they should be equipped with struts to prevent them from dropping if a wheel breaks or the derrick is derailed.

vi) The length of a derrick jib should not be altered without consulting the manufacturer.

vii) The jib of a scotch derrick crane should not be erected within the backstays of the crane.

Guy derricks

i) The restraint of the guy ropes should be ensured by fitting stirrups or anchor plates in concrete foundations.

ii) The mast of guy derricks should be supported by six top guys spaced approximately equally.

iii) The spread of the guys of a guy derrick crane from the mast should not be more than 45^0 from the horizontal.

iv) Guy ropes of derricks should be equipped with a stretching screw or turnbuckle or other device to regulate the tension.

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v) Gudgeon pins, sheave pins and fool bearings should be lubricated frequently.

vi) When a derrick is not in use, the boom should be anchored to prevent it from swinging.

6.9.4 Gin poles

i) Gin poles should:

(a) be straight;
(b) consist of steel or other suitable metal;
(c) be adequately guyed and anchored;
(d) be vertical or raked slightly towards the load;
(e) be of adequate strength for the loads that they will be required to lift/move.

ii) Gin poles should not be spliced and if a gin pole is composed of different elements, they should be assembled in conformity with their intrinsic material strength.

iii) Gin poles should be fastened at their feet to prevent displacement in operation.

iv) Gin poles, which are moved from place to place and re-erected, should not be taken into use again before the pole, lifting ropes, guys, blocks and other parts have been inspected, and the whole appliance has been tested under load.

v) When platforms or skips are hoisted by gin poles, precautions should be taken to prevent them from spinning and to provide for proper landing.

6.9.5 Tower cranes

i) Where tower cranes have cabs at high level, persons, capable and trained to work at heights, should only be employed as crane operators.

ii) The characteristics of the various machines available should be considered against the operating requirements and the surroundings in which the crane will operate before a particular type of crane is selected.

iii) Care should be taken in the assessment of wind loads both during operations and out of service. Account should also be taken of the effects of high structures on wind forces in the vicinity of the crane.

iv) The ground on which the tower crane stands should have the requisite bearing capacity. Account should be taken of seasonal variations in ground conditions.

v) Bases for tower cranes and tracks for rail-mounted tower cranes should be firm and level. Tower cranes should only operate on gradients within limits specified by the manufacturer. Tower cranes should only be erected at a safe distance from excavations and ditches.

vi) Tower cranes should be sited where there is clear space available for erection, operation and dismantling. As far as possible, cranes should be sited so that loads do not have to be handled over

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occupied premises, over public thoroughfares, other construction works and railways or near power cables.

vii) Where two or more tower cranes are sited in positions where their jibs could touch any part of the other crane, there should be direct means of communication between them and a distinct warning system operated from the cab so that one driver may alert the other of impending danger.

viii) The manufacturers' instructions on the methods and sequence of erection and dismantling should be followed. The crane should be tested before being taken into use.

ix) The climbing operation of climbing tower cranes should be carried out in accordance with manufacturers' instructions. The free-standing height of the tower crane should not extend beyond what is safe and permissible in the manufacturers' instructions.

x) When the tower crane is left unattended, loads should be removed from the hook, the hook raised, the power switched off and the boom brought to the horizontal. For longer periods or at times when adverse weather conditions are expected, out of service procedures should be followed. The main jib should be slewed to the side of the tower away from the wind, put into free slew and the crane immobilised.

xi) A windspeed measuring device should be provided at an elevated position on the tower crane with the indicator fitted in the drivers' cab.

xii) Devices should be provided to prevent loads being moved to a point where the corresponding safe working load of the crane would be exceeded. Name boards or other items liable to catch the wind should not be mounted on a tower crane other than in accordance with the manufacturers' instructions.

xiii) Tower cranes should not be used for magnet, or demolition ball service, piling operations or other duties, which could impose excessive loading on the crane structure.

6.9.6 Lifting ropes

i) Only ropes with a known safe working capacity should be used as lifting ropes.

ii) Lifting ropes should be installed, maintained and inspected in accordance with manufacturers' instructions.

iii) Repaired steel ropes should not be used on hoists.

iv) Where multiple independent ropes are used, for the purpose of stability, to lift a work platform, each rope should be capable of carrying the load independently.

6.10 VEHICLE MOVEMENT

6.10.1 Park vehicles only at designated places. Don't block roads to create hindrance for other vehicles.

6.10.2 Don't overload the vehicle.

6.10.3 Obey speed limits and traffic rules.

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6.10.4 Always expect the unexpected and be a defensive driver.

6.10.5 Drive carefully during adverse weather and road conditions.

6.10.6 Read the road ahead and ride to the left.

6.10.7 Be extra cautious at nights. Keep wind screens clean and lights in working condition.

6.10.8 All vehicles used for carrying workers and construction materials must undergo predictive/preventive maintenance and daily checks

6.10.9 Driver with proper valid driving license shall only be allowed to drive the vehicle

6.10.10 Routes shall be leveled marked and planned in such a way so as to avoid potential hazards such as overhead power lines and sloping ground etc.

6.10.11 While reversing the vehicles, help of another worker should be ensured at all times

6.10.12 An unattended vehicle should have the engine switched off

6.10.13 Wherever possible one-way system shall be followed

6.10.14 Barriers/fixed stops should be provided for excavation/openings to prevent fall of vehicle

6.10.15 Load should be properly secured

6.10.16 The body of the tipper lorry should always be lowered before driving the vehicle off.

6.10.17 Signs/signals/caution boards etc. should be provided on routes.

6.10.18 All vehicles in a running process plants to use spark arrester on the exhaust.

6.10.19 No material should be protruding outside the vehicle for the safety of the public. If necessary, same to be marked as per RTO regulations.

6.10.20 Proper caution tag should be available on the vehicle for hazardous material like oil,.LPG, explosives, nuclear material, toxic fluids etc and the vehicle staff should be well informed about the potential danger of the material being transported by them.

6.10.21 An earth chain for the discharge of static electricity generated during transportation of specific material with the vehicle to be provided.

6.10.22 Drunken driving should be prohibited.

6.11 ELECTRICAL

6.11.1 General Provisions

i) Only persons having valid licenses shall be allowed to work on electrical facilities as per prevailing IE Act and rules thereunder including CEA rules/regulations.

ii) No person should be allowed to work on live circuit. The same, if unavoidable, special care and written authorisation need to be taken.

iii) Treat all circuits as "LIVE" unless ensured otherwise.

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iv) Electrical " Lock Out - Tag Out (LOTO)" procedure "MUST" be followed for work on electrical system.

v) Display voltage ratings prominently with "Danger" signs in local language also.

vi) Put caution/notice signs before starting the repair works.

vii) All electrical equipment operating above 250V shall have two separate and distinct connections to earth grid.

viii) Proper grounding to be ensured for all switch boards and equipment including Portable ones prior to taking into service.

ix) Make sure that electrical switch boards, portable tools, equipment (like grinding machine etc.) don't get wet during their usage. If it happens, stop the main supply, make the tools dry, check for specified insulation value and then only use them. Check proper earthing.

All temporary switch boards/ KIOSKS put up at work site should be suitably protected from rain and the level of same should be high enough to avoid contact with water due to water logging.

x) Don't work wet on electrical system.

xi) Don't overload the electrical system.

xii) Use only proper rated HRC fuses / ELCB / MCB.

xiii) Only ISI marked or equivalent industrial type extension boards and Plug sockets are to be used.

xiv) ELCB for all temporary connections must be provided using 3 pin plug.

xv) All power supply cables should be laid properly and neatly so that they don't cause hindrance to persons working and no physical damage also takes place to the cables during various construction activities.

xvi) All Power cables to be properly terminated using glands and lugs of proper size, type and crimped.

xvii) Use electrical fittings in Hazard zones as per area classification under OISD-STD-113.

xviii) Ensure pipe sleeve / conduit to protect underground cables at crossings.

xix) Don't lay unarmored cable directly on ground, wall, roof or trees. All temporary cables should be laid at least 750 mm below ground and cable markers should be provided. Proper sleeves should be provided at road crossings. In case temporary cables are to be laid on wooden poles/steel poles, the minimum cable heights should be 4.5 M.

xx) Maintain safe overhead distance of HT transmission lines as per latest CEA Safety Regulation.

xxi) Don't use pipelines/structures for earthing.

xxii) Don't make any unsafe temporary connections, e.g. naked joints etc.

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xxiii) Ensure that temporary cables are free from cuts, damaged insulation, kinks or improper insulated joints.

xxiv) Check at periodic intervals that pins of sockets and joints are not loose.

xxv) Protect electrical wires/equipment from water and naked flames.

xxvi) Illuminate level in all the work areas should be in line with OISD-RP-149.

xxvii) All switchboards should be of MS structure only and incoming/outgoing feeders should be marked.

xxviii) Hand lamps/ Torch should not be of more than 24V rating, and E'x' type should be in line with hazardous area classification.

xxix) Fire extinguishers (DCP/CO_2/Sand buckets) should be kept near temporary switch boards being used for construction purposes. Don't use water for fighting electrical fires.

xxx) ISI marked Insulating mats shall be provided in the front and back end of switch boards.

xxxi) All parts of electrical installations should be so constructed, installed and maintained as to prevent danger of electric shock, fire and explosion.

Periodic checking of electrical safety appliances such as gloves, insulating mats, hoods etc. to be done/witnessed in line with OISD-STD-137, and records to be maintained duly endorsed by the concerned.

xxxii) A notice displaying following, should be kept exhibited at suitable places in local language also:

a) prohibiting unauthorized persons from entering electrical equipment rooms or from handling or interfering with electrical apparatus;
b) containing directions as to procedures in case of fire, rescue of persons in contact with live conductors and the restoration of persons suffering from electric shock;
c) specifying the person to be notified in case of electrical accident or dangerous occurrence, and indicating how to communicate with him.

xxxiii) No other cables/pipes to be laid in trench used for electrical cables.

xxxiv) Utmost care should be taken while excavating Earth from cable trench to avoid damage or any accident.

xxxv) Sub-station floor cut-outs meant for switch board installations to be covered wherever installation is incomplete.

xxxvi) Flameproofness integrity of all flameproof equipment / fittings/fixtures to be ensured at all times.

NOTE: A Residual Current Operated Circuit Breaker (RCCB) or Earth Leakage Circuit Breaker (ELCB), when installed, protects a human being to the widest extent. RCCB or ELCB should be provided as per latest CEA Safety Regulation.

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6.11.2 Inspection and maintenance

i) All electrical equipment should be inspected before taking into use to ensure suitability for its proposed use.

ii) At the beginning of every shift, the person using the electrical equipment should make a careful external examination of the equipment and conductors, especially the flexible cables.

iii) Apart from some exceptional cases subject to work permits, work on or near live parts of electrical equipment should be forbidden.

Before starting any work on conductors and/or equipment, it is to be ensured that: power supply should be isolated by an authorized person following the concept of LOTO;

iv) After work has been done on conductors and/or equipment, the power supply should only be switched on again after work permit is returned back, lock/tag on isolated feeder are removed and the workplace is reported safe.

v) Electricians should be provided with approved and tested tools and personal protective equipment such as rubber gloves, arc flash suit etc.

vi) All conductors and equipment should be considered to be live unless there is a proof of the contrary.

vii) When work has to be done in dangerous proximity to live parts the power supply should be cut off. If for operational reasons this is not possible, the live parts should be fenced off or enclosed by qualified staff from the sub-station concerned.

6.11.3. Testing

i) Electrical installations should be inspected and tested as per approved plan and the results recorded.

ii) Periodic testing for proper functioning of the earth leakage protective devices should be carried out.

iii) Particular attention should be paid to the earthing of apparatus, the continuity of protective conductors, polarity and insulation resistance, protection against mechanical damage and condition of connections at points of entry.

6.12 OFFSHORE

6.12.1 General

The isolated nature of offshore installations are hazardous. They call for greater need for health safety and survival at offshore. Safety at offshore is safety of installations and safety of personnel. Safety problems and accidents at offshore have high risks due to limited space, helicopter operation, sea transport etc. Following are the general health and safety guidelines to be followed in

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addition to the safety guidelines stipulated for specific jobs dealt later on:

i) Workers should be well trained to do their job independently with high degree of self-control and self-discipline.

ii) On arrival at offshore, everyone should be briefed about the safety rules to be followed at offshore, evacuation system etc. All personnel should wear overall (dangri), helmet and shoes for personnel protection.

iii) In case of emergency, workers should follow instruction of Field Production Superintendent (F.P.S.). In certain cases instructions may be given to abandon the offshore installation and evacuate the persons to safe location.

iv) To overcome above problems, offshore personnel must receive training for using life saving appliances and other personal survival techniques.

v) Any person working at offshore should have one person as standby for any eventuality.

vi) Periodical health check-up of all personal on platforms shall be ensured and remedial measures shall be taken as per statutory and other requirements.

6.12.2 Drilling Rigs

i) Location of jack up rigs should not be less than 5 Kms from shipping route. Orientation of the rig, wind direction, etc. are required for safe landing of helicopter. Information w.r.t. sea currents, wind speed, Hi- Low tide, etc. are required for mooring of supply vessels.

ii) Sea bed condition at every location should be ensured for safety of rig.

iii) Radio and other communication facilities should be such to maintain contact with base all times.

iv) During toeing of rig, the rig deck should be clear of load, toeing lines should be in good condition and tensions in various toeing lines should be constantly monitored.

v) Few steps during toeing are:

a) crane booms should be secured to their vesta,
b) all hatches and water tight doors should be closed,
c) number of personnel on board should be restricted,
d) evacuate in case of emergency and operation should be completed preferably in day light.

6.12.3 Drilling

i) In view of CO_2 and H_2S gas cut from well, effective ventilation should be provided where drilling is in progress.

ii) Safety alarm shall be checked in advance in view of failure of ventilation system.

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iii) Suitable sensors for H_2S and Methane should be function tested time to time and suitable colour code should be given.

iv) Working areas of the crane should be illuminated during night to avoid accident.

v) Clear space should be available for despatch and receipt of load and, in particular, basket transfer of passengers. Persons engaged in loading/unloading of materials should be protected from falling into the sea.

vi) Signal light should be fitted at the top of the jib.

vii) Crane hook should be fitted with safety latches.

viii) Experienced person should be engaged in operation of specific equipment like winches, cranes etc.

ix) At least three cable turns shall always be there on the winch drum.

x) Adequate communication like walkie talkie, round robin phone should be available between the crane operator, supervisor and helper.

xi) Crane operation should be completely stopped during helicopter landing/ taking off.

xii) Except for helicopter landing deck, all decks, platforms, bridges, ladders should have rigid and fixed guard rails atleast one meter high and should have one intermediate rail midway between the handrail and 100 mm toe board.

xiii) Wooden ladders shall not be used at offshore.

xiv) Flow sensor in the flow line should be ensured for safe working and to avoid blow out.

xv) Hydrogen sulphuide gas In offshore is of great risk and at 10 ppm (0.001%) concentration in air, a person should not be exposed for more than 8 hours, If concentration is more, then breathing apparatus should be used. Corrosion of equipment is also caused by H_2S.

xvi) Portable H_2S gas detector should be continously used.

6.12.4 Production Platforms

i) In case hydrocarbon Is released due to overpressure, leak, overflow, gas blow etc., shut down process to stop flow *of* hydrocarbon. Prevent ignition of released hydrocarbon and in case of fire shut in the process complex and follow emergency contigency plan.

ii) Sub surface safetv valve (SSSV)) below the well head should be actuated during uncontrolled well -flow and they should be regularly checked.

iii) Surface safety valve or SDV should be checked for no gas leakage from bleed port / flange etc., in the well head area. It should not be in "mechanical override" or bypassed from panel.

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iv) High pressure gas lift lines - blowdown system should be O.K.

* Auto actuation of SDVs in the inlet of pressure vessels should be O.K. and in "normal position" from shutdown panels. A record of status of switches normal/bypassed in auto-con* panels (PSH, PSL, LSL, ILSL) should be maintained.

* Shut Down Panels

v) Welders rectifier set and electrical connections to it should be checked and approved by electrical-in- charge for proper electrical safely.

vi) "SCADA" telementry system if available should be operational for remote opening and closing of wells at unmanned platforms (through RPMC).

vii) Local ESD/FSD (near the work site) should be provided for jobs of very critical nature, so that the persons working can access it immediately in emergency for safety. Safety officer should judge the requirement & inform FPS for the same.

viii) Railings and Gratings etc. in and around work area should be O.K. and inspected to avoid slippage of man into sea.

ix) Emergency Shut Down (ESD) system is initiated when an abnormal condition is detected. ESD should be checked once in six months.

x) Platform should be manned round the clock.

xi) Welding and cutting work should be regulated by hot work permit.

xii) All detectors should be calibrated as per recommendation of the manufacturer.

xiii) No system should be by-passed which affects the system of platform.

xiv) In H_2S field platforms, due care shall be taken as per recommendations.

xv) Follow the instructions of F.P.S. during stay at platform

6.12.5 Fire Prevention And Control

i) Provision be made for safe handling and storage of dirty rags, trash, and waste oil. Flammable liquids and chemicals applied on platform should be immediately cleaned.

ii) Paint containers and hydrocarbon samples, gas cylinders for welding and cutting should be stored properly. Cylinders should be transported in hand-cart.

iii) Smoking should be restricted and no smoking area should be identified.

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iv) Special attention should be given to crude oil pump seals; diesel and gas engines which are potential source of ignition in the event of failure.

v) Fire and smoke detectors i.e. ultraviolet heat, thermal and smoke detector should be function tested once in three months.

vi) Fire is controlled in offshore by water spraying, Halon, CO_2 flooding, DCP and sprinkler system.

vii) Foaming agent is applied for controlling fire in liquid hydrocarbon. The system is not effective in gas fire.

viii) Light weight breathing system should be used.

ix) The fire control plan at offshore should reveal control station, fire alarms and fire detectors, deluge valves and sprinkler, fire extinguishing appliances, fireman outfit and ventilation system.

x) Fire fighting equipment should be maintained in ready to use condition.

6.12.6 Life Saving Appliances

i) Life boats with a speed of 6 knots and carrying capacity upto 50 persons are used in offshore.

ii) No. of life boats on one installation should have a capacity to accommodate twice the number of persons onboard installation.

iii) Launching appliances and life boat equipment should be checked every week.

iv) Boat landing areas should be adequately illuminated.

v) Life raft has no power and they rely on drift.

vi) Life jacket lifts the wearer after entering water.

vii) Life buoys are used to rescue persons if any person accidentally falls in the sea.

viii) All life saving appliances should be inspected by the MMD surveyor /sr. officials once a year.

ix) Every life boat shall be inspected once a week.

x) Every life boat and life raft should be serviced once a year by a competent authority.

6.12.7 Safety Precautions during Helicopter Transportation

i) Passenger briefing regarding safety rules while travelling in helicopter should be carried out before boarding the helicopter.

ii) Emergency procedure should be briefed to all the passengers in case helicopter is to ditch into the sea.

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iii) Heli-pad should have a non-skid surface. Nylon rope net should be stretched on the deck.

iv) Proper drainage should be available on helideck.

v) There should be no obstruction on the helideck itself and within 3 meters of its perimeter. Closest super structure above the helideck should have red obstruction light.

vi) While landing on helicopter, fire crew of two persons should be standby adjacent to helideck.

vii) Heli-deck should be properly illuminated for night landing.

viii) During switching off helicopter, persons should not be allowed to go out/ towards helicopter

6.13 DEMOLITION

6.13.1. General provisions

i) When the demolition of any building or structure might present danger to workers or to the public:

(a) necessary precautions, methods and procedures should be adopted, including those for the disposal of waste or residues;
(b) the work should be planned and undertaken only under the supervision of a competent person.

ii) Before demolition operations begin:

(a) structural details and builders' drawings should be obtained wherever possible;
(b) details of the previous use should be obtained to identify any possible contamination and hazards from chemicals, flammables, etc.;
(c) an initial survey should be carried out to identify any structural problems and risks associated with flammable substances and substances hazardous to health. The survey should note the type of ground on which the structure is erected, the condition of the roof trusses, the type of framing used in framed structures and the load-bearing walls;
(d) a method of demolition should be formulated after the survey and recorded in a method statement having taken all the various considerations into account and identifying the problems and their solutions;

iii) All electric, gas, water and steam service lines should be shut off and, as necessary, capped or otherwise controlled at or outside the construction site before work commences.

iv) If it is necessary to maintain any electric power, water or other services during demolition operations, they should be adequately protected against damage.

v) As far as practicable, the danger zone round the building should be adequately fenced off and sign posted. To protect the public a fence 2m high should be erected enclosing the demolition operations and the access gates should be secured outside working hours.

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vi) The fabric of buildings contaminated with substances hazardous to health should be decontaminated. Protective clothing and respiratory devices should be provided and worn.

vii) Where plant has contained flammable materials, special precautions should be taken to avoid fire and explosion.

viii) The plant to be demolished should be isolated from all other plant that may contain flammable materials. Any residual flammable material in the plant should be rendered safe by cleaning, purging or the application of an inert atmosphere as appropriate.

ix) Care should be taken not to demolish any parts, which would destroy the stability of other parts.

x) Demolition activities should not be continued under adverse climatic conditions such as high winds, which could cause the collapse of already weakened structures.

xi) To prevent hazards parts of structures should be adequately shored, braced or otherwise supported.

xii) Structures should not be left in a condition in which they could be brought down by wind pressure or vibration.

xiii) Where a deliberate controlled collapse technique is to be used, expert engineering advice should be obtained, and:

(a) it should only be used where the whole structure is to come down because it relies on the removal of key structural members to effect a total collapse;
(b) it should only be used on sites that are fairly level and where there is enough surrounding space for all operatives and equipment to be withdrawn to a safe distance.

xiv) When equipment such as power shovels and bulldozers are used for demolition, due consideration should be given to the nature of the building or structure, its dimensions, as well as to the power of the equipment being used.

xv) If a swinging weight is used for demolition, a safety zone having a width of at least one-and-a-half times the height of the building or structure should be maintained around the points of impact.

6.13.2. Demolition of structural steelwork

i) All precautions should be taken to prevent danger from any sudden twist, spring or collapse of steelwork, ironwork or reinforced concrete when it is cut or released.

ii) Steel construction should be demolished tier by tier.

iii) Structural steel parts should be lowered and not dropped from a height.

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6.14 RADIOGRAPHY

6.14.1 All radiography jobs shall be carried out as per BARC Safety Regulations

6.14.2 During field radiography, nearby area around the radiation source should be cordoned off.

6.14.3 If the field radiography is to be done at the same location repeatedly, it is advisable to provide either a wire fencing around or a temporary brick enclosure.

6.14.4 Special permission/permit should be taken for radiography from area-in-charge.

6.14.5 As far as possible, field radiography should be done only during night time when there is little or no occupancy there.

6.14.6 Radiation warning signals should be pasted all along the cordoned off area.

6.14.7 Entry into the restricted area by unauthorised persons should be strictly prohibited during exposure.

6.14.8 The radiation level alongwith the cordon should be monitored by a suitable and well-calibrated radiation survey meter.

6.14.9 All personnel working with radiography sources should wear appropriate protective equipment and film badges issued by BARC.

6.14.10 Protection facilities such as manipulator rod, remote handling tongs, lead pots, radiation hazard placards and means of cordon off shall be available at each site.

6.14.11 The radiography source shall never be touched or handled directly with hands.

6.14.12 The package containing radiography cameras and sources should never be carried by public transport like bus, train etc.

6.14.13 Radiography sources and cameras, when not in use, should be stored inside a source pit with lock and key arrangement as approved by BARC. The storage room should preferably be located in an isolated area of minimum occupancy and radiation level outside the storage room should not exceed 0.25 mR/hr as per BARC Regulations.

6.14.14 In case of an accident (due to loss or of damage to radiography source), action should be taken in line with BARC Safety Rules/Guidelines.

6.14.15 Technologically advance methods should be preferred for reduced radiation effect wherever safety so warrants.

6.15 GRIT SHOT/ SLAG BLASTING/ SPRAY PAINTING

6.15.1 Blasting for surface preparation should be used only after approval from competent person.

6.15.2 Air Compressor used for grit/shot/slag blasting/painting should have guard and positioned away from the work place.

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6.15.3 Exhaust of the prime mover, if IC engine is used, should be fitted with PESO approved spark arrester (in case of work in hazardous area) and directed away from the work place.

6.15.4 In case of motor driven compressor, the body of the motor as well as the compressor to be properly earthed.

6.15.5 The hoses used for compressed air should be of proper quality, and health of the same to be ensured through regular check/ test.

6.15.6 The operator of grit/shot/slag blasting/painting should wear suitable PPE's including mask and the area should be cordoned off.

6.15.7 Adequate measures to be taken to suppress dust/spray particle.

6.15.8 When these activities are done in confined places, adequate measure to be taken including monitoring Oxygen level and ensuring proper ventilation.

6.15.9 Proper fire fighting arrangements are to be made where spray painting is in progress.

6.15.10 Some paints and their supplements are toxic also and emit offensive smell. PPE to workers should be suitable to address this issue.

6.15.11 "No Smoking Zone" boards should be displayed prominantly in paints shop/ spray paint area.

6.16 WORK ABOVE WATER

6.16.1 General Provisions

i) Where work is done over or in close proximity to water & where possibility of drowning exists, provision should be made for:
   a) preventing workers from falling into water;
   b) the rescue of workers in danger of drowning;
   c) safe and sufficient transport.
   d) deputation of lifeguards/divers.
   e) preventing of persons suffering from hydrophobia on deputation to work above water.

ii) Provisions for the safe performance of work over or in close proximity to water should include, where appropriate, the provision and use of suitable and adequate:
   a) fencing, safety nets and safety harnesses;
   b) lifebuoys, life jackets and manned boats;
   c) protection against such hazards as reptiles bushes/ polluted water and other animals.
   d) deputation of lifeguards/divers.

iii) Gangways, pontoons, bridges, footbridges and other walkways or work places over water should:
   a) possess adequate strength and stability;
   b) be sufficiently wide to allow safe movement of workers;
   c) have level surfaces free from tripping hazards;
   d) be adequately lit when natural light is insufficient;

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e) where practicable and necessary, to prevent danger, be provided with toe-boards, guard rails, hand ropes etc.
f) be secured to prevent dislodgment by rising water or high winds;
g) if necessary, be equipped with ladders which should be sound, of sufficient strength and length and be securely lashed to prevent slipping.

iv) All deck openings including those for buckets should be fenced.

v) All the employees (owner, contractor and contractor workers) working above and under the water should comply with the requirements of Standards of Training, Certification and Watchkeeping 95 (STCW 95).

6.16.2 Rescue & Emergency procedures

i) Persons who work over water should be provided with some form of buoyancy aid. Life jackets should be provided for sufficient freedom of movement, have sufficient buoyancy to bring persons to the surface and keep them afloat face upwards, be easily secured to the body, be readily visible by way of self luminous paint/strip.
ii) Nobody should work alone on or above water.
iii) Each worker should be trained in the procedure to be followed in the event of an emergency.
iv) Necessary rescue arrangements like divers, rescue boats etc to be in place.
v) Persons to be trained for CPR/ Artificial resuscitation as an first aid to the rescued person.
vi) Also for off shore operations. Speed of water current and water temperature to be considered.

7.0 ADDITIONAL SAFETY PRECAUTION FOR UNITS WITH HYDROCARBONS

In addition to general safety precautions as outlined above for the activities in Clause 6.0, following additional safety precautions need to be taken for the sites within the operating area or nearby, where presence of Hydrocarbons cannot be ruled out.

i) No job shall be carried out without a valid permit. Permit should be in line with OISD-STD-105 "Work Permit System".

ii) Smoking should be prohibited in all places containing readily combustible or flammable materials and "No Smoking" notices be prominently displayed.

iii) In confined spaces and other places where flammable gases, vapours or dusts can cause danger, following measures should be taken:

(a) only approved type electrical installations and equipment, including portable lamps, should be used;
(b) there should be no naked flames or source of ignition;
(c) oily rags, waste and clothes or other substances liable to spontaneous ignition should be removed without delay to a safe place;

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(d) Air operated ventilation system should be provided.

iv) Regular inspections should be made of places where there are fire risks. These include the vicinity of heating appliances, electrical installations and conductors, stores of flammable and combustible materials, welding and cutting operations.

v) Welding, flame/gas cutting and other hot work should only be done after issuance of work permit in line with the requirement of OISD-STD-105 after appropriate precautions, as required, are taken to reduce the risk of fire. For carrying out other jobs also, OISD-STD-105 should be followed strictly.

vi) Fire-extinguishing equipment should be well maintained and inspected at suitable intervals by a competent person. Access to fire-extinguishing equipment such as hydrants, portable extinguishers and connections for hoses should be kept clear at all times.

vii) All supervisors and workers should be trained in the use of fire-extinguishing equipment, so that adequate trained personnel are readily available during all working periods.

viii) Audio means to give warning in case of fire should be provided where this is necessary to prevent danger. Such warning should be clearly audible in all parts of the site where persons are liable to work. There should be an effective evacuation plan so that all persons are evacuated.

ix) Notices should be posted at conspicuous places indicating:

(a) the nearest fire alarm;
(b) the telephone number and address of the nearest emergency services.

x) The work site shall be cleared of all combustible materials, as Sparks and molten metal coming from the welding job can easily ignite combustible materials near or below the welding site. If the combustible materials cannot be removed from the area, the same shall be properly shielded.

xi) A dry chemical type fire extinguisher (DCP) shall be made available in the work area. Also fire protection facilities like running hoses etc. as per permit should be complied with.

xii) Wherever required, welding screens shall be put up to protect other equipment in adjoining areas against flying sparks. Material used should be metal/ fire proof blanket/water curtain.

xiii) Welding or cutting of vessels/ equipments used in Hydrocarbon/ hazardous flammable chemicals shall be done after ensuring hydrocarbon free area and verifying the same with the suitable hydrocarbon detector.

xiv) The confined space/equipment shall be made gas free (hydrocarbon and toxic) and cleaned and shall be ensured, with the help of suitable gas detectors.

xv) Used and hot electrode stubs shall be discarded in a metal bucket.

xvi) Use PESO approved and certified spark arrestors for vehicles, wherever applicable.

xvii) Relevant work permit (hot work, cold work, vessel entry etc. as the case maybe) to be obtained, if construction work is carried out within existing operating area.

xviii) Precaution against pyrophoric material shall be ensured.

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8.0 Environment Protection

8.1 Waste

The contractor is required to develop, institute and maintain a Waste Management Programme (WMP) during the construction of the project for his works and obtain approval of the owner. WMP may include: -

i) Identification of disposal sites.
ii) Identification of waste/surplus quantities to be disposed off.
iii) Identification of amounts intended to be stored temporarily on site location of such storage.
iv) Use of proper PPEs.
v) Identification of intended transport means and route.
vi) Obtaining permission, where required, for disposal.

Such a mechanism is intended to ensure that the designation of areas for the segregation and temporary storage of reusable and recyclable materials are incorporate into the WMP. The WMP should be prepared and submitted to the Engineer for approval.

The Contractor shall handle waste in a manner that ensures they are held securely without loss or leakage thus minimizing potential for pollution and fire. The Contractor shall maintain and clean waste storage areas regularly.

The Contractor shall make arrangement to stack the metal scrap at designated location and maintain the site free from obstruction. The scrap to be disposed as per owner instruction at regular interval.

8.2 Hazardous Waste Management

If encountered or generated as a result of Contractor's activity, then waste classified as hazardous under the "Hazardous Wastes (Management & Handling) Rules, 1989, and amendments thereunder time to time" shall be disposed off in a manner in compliance with the procedure given in the rules under the aforesaid act.

Chemicals classified as hazardous chemicals under "Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 of Environment (Protection) Act, 1986 (latest) shall be disposed off in a manner in compliance with the procedure given in the rules under the aforesaid act.

8.3 Air Quality

The Contractor shall take all necessary precautions to minimise fugitive dust emissions from operations involving excavation, grading, and clearing of land and disposal of waste. He shall not allow emissions of fugitive dust from any transport, handling, construction or storage activity to remain visible in atmosphere beyond the property line of emission source for any prolonged period of time without notification to the Employer.

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The Contractor shall use construction equipment designed and equipped to minimise or control air pollution. He shall maintain evidence of such design and equipment and make these available for inspection by Employer.

If after commencement of construction activity, Employer believes that the contractor's equipment or methods of working are causing unacceptable air pollution impacts then these shall be inspected and remedial proposals shall be drawn up by the Contractor, submitted for review to the Employer and implemented.

The Contractor shall maintain the MSDS of the chemicals used / stacked at site and same shall be handled as per the standard prescribed procedure. The quantity shall be stored strictly as per the norms and emergency handling procedure shall be known and displayed prominently.

8.4 Noise

The Contractor shall consider noise as an environmental constraint in his design, planning and execution of the Works and provide demonstrable evidence of the same. The Contractor shall, take all appropriate measures to ensure that work carried out by the Contractor, whether on or off the Site, will not cause any unnecessary or excessive noise.

8.5 Occupational Noise

i) Protection against the effects of occupational noise exposure should be provided when the sound levels exceed the threshold values as prescribed.
ii) When employees are subjected to expose the sound levels beyond the prescribed limit, feasible administrative or engineering controls should be ensured.
iii) If such controls fail to reduce sound levels within the levels, personal protective equipment shall be provided and used to reduce sound levels within the prescribed limit.

9.0 OCCUPATIONAL HEALTH

9.1 Medical Examination

The contractor shall arrange a medical examination of all his employees before employing, after illness or injury, if it appears that the illness or injury might have affected his fitness and, thereafter, at periodicity stipulated under Factories Act / Building & Construction Workers Regulation (BOCWR).

The Contractor shall maintain the confidential records of medical examination by the physician authorized by the Employer.

9.2 Occupational Health Centre

The contractor shall ensure at a construction site an occupational health centre, mobile or static is provided and maintained in good order. Services

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and facilities as per the scale lay down under Factories Act / Building & Construction Workers Regulation (BOCWR). A construction medical officer appointed in an occupational health centre possess the qualification as laid down under Factories Act / Building & Construction Workers Regulation (BOCWR).

9.3 First Aid

First aid facilities should be provided in line with various statutory regulations like The Factory Act etc. However following care should be taken:

i) First aid, including the provision of trained personnel should be ensured at work sites. Arrangement should be made for ensuring the medical attention of the injured workers.

ii) Suitable rescue equipment, like stretchers should be kept readily available at the construction site.

iii) First-aid kits or boxes, as appropriate and as per statutory requirements, should be provided at workplaces and be protected against contamination by dust, moisture etc.

iv) First-aid kit or boxes should not contain anything besides material for first aid in emergencies.

v) First-aid kits and boxes should contain simple and clear instructions to be followed, be kept under the charge of a responsible person qualified to render the first aid and be regularly inspected and replenished.

vi) Where the work involves risk of drowning, asphyxiation or electric shock, first-aid personnel should be proficient in the use of resuscitation and other life saving techniques as specified in rescue procedures.

vii) Emergency telephone numbers of nearby Hospitals, Police, Fire Station and Administration should be prominently displayed.

10.0 DOCUMENTATION

The intention of keeping documentation of all types of accident(s) is to prevent recurrence of similar accident(s). All accidents should be reported as per OISD Guidelines and The Factories Act, 1948/ BOCWR.

All accidents (major, minor or near miss) should be investigated, analysed and recommendations should be documented along with implementation status.

All related data should be well-documented and further analysis highlighting the major cause(s) of accidents be done. This will help in identifying thrust areas and training needs for prevention of accidents.

11.0 SAFETY AWARENESS & TRAINING

Safety awareness to all section of personnel ranging from site-in-charge to workmen helps not only preventing the risk but also build up the confidence. Time and expenditures also get saved as a result.

Safety awareness basically seeks to persuade/inform people on safety besides supplementing skill also. Awareness programme may include followings:

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i) **Poster:** Posters with safety slogan in humorous, gruesome demonstrating manner may be used to discourage bad habits attributable to accidents by appealing to the workers' pride, self-love, affection curiosity or human aspects. These should be displayed in prominent location(s).

ii) **Safety Sign Boards**: Different type of message of cautioning, attention, notice etc. should be displayed at the appropriate places for learning/ awareness of the workmen while working at site.

iii) **Films & Slides:** Film(s) narrating the accident case study including the causes and possible remedial ways of preventing the recurrence of a similar accident should be displayed at regular intervals. Slides consisting main points of the film show may also be shown to workers.

iv) **Talks, lectures & conferences:** The success of these events would depend much on audience's understandings of the speaker (s). The speakers are to be knowledgeable and good presenter. Speakers should know to hold the attention and to influence the audiences.

v) **Competitions:** Organise competition(s) between the different deptts/categories of workers. The sense of reward/recognition also will improve safety awareness and result in enhancing safety levels.

vi) **Exhibitions:** Exhibitions also make the workers acquainted with hazards and means of preventive measures.

vii) **Safety Publication:** Safety publications including pocket books dealing with ways of investigation and prevention in the field of safety and so on, may be distributed to workers to promote the safety awareness.

viii) **Safety Drives:** From time to time, an intensive safety drive by organising a safety day or a safety week etc. should be launched.

ix) **Training:** Training for covering the hazards for different trade should be imparted. Training should also include the specific hazards related to a job in addition to the general safety training as has been dealt in various chapters and should include all workers. Reference may be drawn from OISD-STD-154.

12.0 REFERRENCES

i) *Factory Act, 1948*

ii) *Indian Electricity Rules*

iii) *Safety & Health in Construction by ILO*

iv) *The Building & Other Construction Workers (Regulation, Employment and Conditions of Service) Act 1996 and Central Rules 1998*

v) CSB guidelines

vi) *IS 1161: 2006 or latest edition - Steel tubes for structural purposes — specification*

vii) *IS 2750: 1964 or latest edition - Specification for steel scaffolding.*

viii) *IS : 3696 (Part 1) – 1987 (Scaffolds)Safety code of scaffolds and ladders*

ix) *IS : 3696 (Part 2) – 1987 (Ladders)Safety code of scaffolds and ladders*

x) *IS 4014 Part I: 2006 or latest edition - Code of practice for steel tubular scaffolding - definitions and materials.*

xi) *IS 4014 Part II: 2005 or latest edition - Code of practice for Steel tubular scaffolding - Safety regulations for scaffolding.*

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xii) *Building & Other Construction Workers(Regulation on employment &conditions of service) central rules, 1998 (Provision related to Scaffold).*

xiii) *OHSA Standard on Scaffold (CFR 1926.452)*

ANNEXURE I

LIST OF SAFETY CODES FOR CIVIL WORKS PUBLISHED BY BUREAU OF INDIAN STANDARDS

Sr.no	Code No.	Title
01.	IS : 818	Code of Practice for Safety and Health Requirements in Electric and Gas Welding and Cutting Operations – First Revision.
02.	IS : 875	Code of practice for Structural safety of buildings: Masonry walls
03.	IS : 933	Specification for Portable Chemical Fire Extinguisher, Foam Type – Second Revision.
04.	IS : 1179	Specification for Equipment for Eye and Face Protection during Welding – First Revision.
05.	IS : 1904	Code of practice for Structural safety of buildings: Shallow foundations
06.	IS : 1905	Code of practice for Structural safety of buildings: Masonry walls
07.	IS : 2171	Specification for Portable Fire Extinguishers, Dry Powder Type – Second Revision.
08.	IS : 2361	Specification for Building Grips – First Revision.
09.	IS : 2750	Specification for Steel Scaffoldings.
10.	IS : 2925	Specification for Industrial Safety Helmets – First Revision.
11.	IS : 3016	Code of Practice for Fires Precautions in Welding and Cutting Operations – First Revision.
12.	IS : 3521	Industrial safety belts and harnesses
13.	IS : 3696 – Part I	Safety Code for Scaffolds and Ladders : Part I – Scaffolds.
14.	IS : 3696 – Part II	Safety Code for Scaffolds and Ladders : Part II – Ladders.
15.	IS : 3764	Safety Code for Excavation Work.
16.	IS : 4014 -Part I & II	Code of practice for Steel tubular scaffolding
17.	IS : 4081	Safety Code for Blasting and Related Drilling Operations.
18.	IS : 4082	Recommendations on staking and storage of construction materials at site
19.	IS : 4130	Safety Code for Demolition of Buildings – First Revision.
20.	IS : 4138	Safety Code Working in Compressed Air-First Revision
21.	IS : 4756	Safety code for Tunneling works
22.	IS : 4912	Safety requirements for Floor and Wall Openings, Railings and toe Boards –First Revision.
23.	IS : 5121	Safety Code for Piling and other Deep Foundations.
24.	IS : 5916	Safety Code for Construction involving use of Hot Bituminous Materials.
25.	IS : 5983	Specification for Eye Protectors – First Revision.

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26.	IS : 6922	Structures subject to underground blasts, criteria for safety and design of
27.	IS : 7155	Code of recommended practices for conveyor safety
28.	IS : 7205	Safety Code for Erection on Structural Steel Works.

Sr.no	Code No.	Title
29.	IS : 7069	Safety Code for Handling and Storage of Building Materials.
30.	IS : 7293	Safety Code for Working with Construction Machinery.
31.	IS : 7323	Guidelines for operation of Reservoirs
32.	IS : 7969	Safety code for handling and storage of building material
33.	IS : 8758	Recommendation for Fire Precautionary Measures in construction of Temporary Structures and Pandals.
34.	IS : 8989	Safety Code for Erection of Concrete Framed Structures.
35.	IS : 9706	Code of Practices for construction of Arial ropeways for transportation of material
36.	IS : 9759	Guidelines for de-watering during construction
37.	IS : 9944	Recommendations on safe working load for natural and man-made fibre rope slings
38.	IS : 10291	Safety code for dress divers in civil engineering works
39.	IS :10386 – Part I	Safety Code for Construction, Operation and Maintenance for River Valley Projects.
40.	IS :10386 – Part II	Safety Code for Construction, Operation and Maintenance of River Valley Projects.
41.	IS : 11057	Code of practice for Industrial safety nets
42.	IS : 13415	Code of Practice on safety for Protective barriers in and around building
43.	IS : 13416	Recommendations for preventive measures against hazards at working places

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OIL INDUSTRY SAFETY DIRECTORATE

कॉन्ट्रैक्टर सेफ्टी

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CONTRACTOR SAFETY

OISD -GDN- 207

ENGINEERS INDIA LIMITED

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FOR RESTRICTED CIRULATION ONLY

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PREAMBLE

Indian petroleum industry is the energy lifeline of the nation and its continuous performance is essential for sovereignty and prosperity of the country. As the industry essentially deals with inherently inflammable substances throughout its value chain – upstream, midstream and downstream – Safety is of paramount importance to this industry as only safe performance at all times can ensure optimum ROI of these national assets and resources including sustainability.

While statutory organizations were in place all along to oversee safety aspects of Indian petroleum industry, Oil Industry Safety Directorate (OISD) was set up in 1986 by Ministry of Petroleum and Natural Gas, Government of India as a knowledge centre for formulation of constantly updated world-scale standards for design, layout and operation of various equipment, facility and activities involved in this industry. Moreover, OISD was also given responsibility of monitoring implementation status of these standards through safety audits.

In more than three decades of its existence, OISD has developed a rigorous, multi-layer, iterative and participative process of development of standards – starting with research by in-house experts and iterating through seeking & validating inputs from all stake-holders – operators, designers, national level knowledge authorities and public at large – with a feedback loop of constant updation based on ground level experience obtained through audits, incident analysis and environment scanning.

The participative process followed in standard formulation has resulted in excellent level of compliance by the industry culminating in a safer environment in the industry. OISD – except in the Upstream Petroleum Sector – is still a regulatory (and not a statutory) body but that has not affected implementation of the OISD standards. It also goes to prove the old adage that self-regulation is the best regulation. The quality and relevance of OISD standards had been further endorsed by their adoption in various statutory rules of the land.

Petroleum industry in India is significantly globalized at present in terms of technology content requiring its operation to keep pace with the relevant world scale standards & practices. This matches the OISD philosophy of continuous improvement keeping pace with the global developments in its target environment. To this end, OISD keeps track of changes through participation as member in large number of International and national level Knowledge Organizations – both in the field of standard development and implementation & monitoring in addition to updation of internal knowledge base through continuous research and application surveillance, thereby ensuring that this OISD Standard, along with all other extant ones, remains relevant, updated and effective on a real time basis in the applicable areas.

Together we strive to achieve NIL incidents in the entire Hydrocarbon Value Chain. This, besides other issues, calls for total engagement from all levels of the stake holder organizations, which we, at OISD, fervently look forward to.

Jai Hind!!!

Executive Director
Oil Industry Safety Directorate

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FOREWORD

The Oil Industry in India is over 100 years old. As such, various practices have been in vogue because of collaboration/ association with different foreign companies and governments. Standardization in design philosophies, operating and maintenance practices remained a grey area. This coupled with feedback from some serious accidents that occurred in the past in India and abroad, emphasized the need for the industry to review the existing state-of-the-art in designing, operating and maintaining of Oil and Gas installations.

With this in view, the Ministry of Petroleum and Natural Gas in 1986 constituted a Safety Council assisted by the Oil Industry Safety Directorate (OISD) staffed from within the industry in formulating and implementing a series of self-regulatory measures aimed at removing obsolescence, standardizing and upgrading the existing standards to ensure safe operations. Accordingly, OISD constituted a number of functional committees of experts nominated from the industry to draw up standards and guidelines on various subjects.

The present guideline on "Contractor Safety" has been prepared by the functional committee based on, existing standards, guidelines & recommended practices of OISD, the recommendations arising out of recent major accidents and their analysis, the accumulated knowledge and experience of industry members in India and updation of National and International codes and practices.

The figures and photographs used in the document, if any, are representative in nature.

We, at OISD, are confident that the provisions of this standard, when implemented in totality, would go a long way in ensuring safe operation of the target group of locations.

Needless to mention, this standard, as always would be reviewed based on field level experience, incident analysis and environment scanning. Suggestions from all stake holders may be forwarded to OISD.

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NOTE

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Though every effort has been made to assure the accuracy and reliability of the data contained in these documents, OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from their use.

These documents are intended only to supplement and not to replace the prevailing statutory requirements of PESO, DGMS, Factory Inspectorate or any other Government body which must be followed as applicable.

Wherever Acts/ Rules/ Regulation and National/ International Standards are mentioned in the standard, the same relates to in-vogue version of such documents.

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SECOND FUNCTIONAL COMMITTEE ON CONTRACTOR SAFETY

LIST OF MEMBERS

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Manish Pandey	Sr. Manager (Mech), BORL	Member
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In addition to the above, several other experts from Industry contributed in the preparation, review and finalisation of this Guideline.

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R Chakravarty	Numaligarh Refineries Ltd.	Member
N R Adsul	Bharat Petroleum Corporation Ltd.	Member
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C M Sharma	Oil Industry Safety Directorate	Member
A K Ranjan	Oil Industry Safety Directorate	Member Coordinator

In addition to the above, several other experts from Industry contributed in the preparation, review and finalisation of this Guideline.

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CONTRACTOR SAFETY

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CONTRACTOR SAFETY

1.0 INTRODUCTION

Oil and Gas operations like Drilling, Production, Refining, Storage, Transportation and Distribution, etc. are inherently hazardous. A large number of contractor workforce is deployed to carry out construction, maintenance and other jobs. The analysis of the incidents in the Petroleum Sector indicates that a large number of incidents involved contractor workforce and have resulted in either casualty or injury besides leading to property damage and operational interruptions and environmental degradation.

In order to improve the safety levels of hydrocarbon installations, the contractor safety is of utmost importance and there is a need to institute a good contractor safety system.

2.0 SCOPE

This document covers broadly the guidelines on the HSE management system for enhancing the safety levels of the contractor workforce deployed in construction, maintenance and operation activities in the hydrocarbon industry.

The safety precautions to be taken while carrying out different activities during construction / maintenance have separately been covered in OISD-GDN-192 on "Safety Practices during Construction".

3.0 DEFINITIONS

Work station / Work site

A place / unit where the job is carried out by contractor/executing agency in specified manner with safety, during construction phase or in operation phase.

Owner
Any physical or legal person/entity for whom prescribed job is carried out.

It shall also include owner's designated representative / consultant /nominee / agent, authorised from time to time to act for and on its behalf, for supervising / co-ordinating the activities of the contractor/execution agency.

Contractor / Executing Agency

A physical or legal person/entity having contractual obligation with the owner, and who deploys one or more worker on the site.

Contractor Worker

It covers all workmen who are either self-employed or employed through contractor, the casual workers and includes contractor's supervisor, working at a location / site employed directly by Owner or through their contractor.

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Incident

An incident is an unplanned, uncontrolled, unintended or unforeseen event, caused by unsafe acts and / or unsafe conditions, resulting in or having the potential to result in personal injury and/or property damage.

Consultant

Consultant is a physical or legal person/entity engaged by owner to provide the consultancy services to owner for management of the contract on their behalf or as specified.

Designer

Designer is a physical or legal person / entity engaged by owner to provide design services of a work site.

Owner's Representative / Engineer In Charge

The Owner's representative/Engineer-in-charge is the one, who has been designated by the owner to manage the contract.

Owner's Safety Officer

A properly trained person designated by owner who ensures safety at work site.

4.0 DUTIES/ RESPONSIBILITIES

4.1 OWNER

4.1.1 Owner's Management

The commitment to safety has to be emphasized by the owner by practice by its own management and employees at all levels. The duties and responsibilities of owner should include:

i) To institute a mechanism for identification and compliance of all applicable statutory rules & regulations (Refer Annexure I for a list of few important Bureau of Indian Standards & statutory regulations).

ii) To provide specific information to contractors and make workers aware on the hazards associated with job assigned.

iii) To provide information about Risk Mitigation measures available at the place of work.

iv) To provide the contractor with information on Owners Safety Plan & Regulations, Emergency Management Plan, lockout / tag out procedure, confined space entry, work permit system, excavation / trench permit system etc.

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v) To specify rules (e.g. for security including access arrangements) and safety rules such as fire protection, first aid arrangements, Work Permit systems etc.

vi) To provide comprehensive list of statutory regulations / standards and specification, to be complied with during execution of contract, in the tender document itself.

vii) To ensure training of the contractor workforce, medical examination, and proper usage of safety equipment.

viii) To specify the requirements of Health, Safety and Environment (HSE) (commensurate with the nature of job) in Pre- Qualification criteria.

ix) To designate Engineer-in-charge and safety officer.

x) To arrange for a multi-disciplinary safety audit team to conduct surprise / regular safety audits and monitor the implementation of the recommendations.

xi) To introduce suitable schemes for motivation of the contractor worker to adhere to safety guidelines.

xii) To review safety practices & their implementation through periodic surprise visit of the work sites and monthly review meeting.

xiii) To develop the HSE plans and incorporate the same in the tender document.

xiv) To liaise with external agencies like press, public etc and with law enforcement, regulatory, statutory agencies etc.

xv) To report to statutory agencies on safety compliance and accidents, if any.

4.1.2 Owner's Representative/Engineer-in-charge

The duties & responsibilities of engineer-in-charge should include:

i) To ensure that all Contract requirements including Health, Safety, Environment & Security are complied with.

ii) To ensure that contractor workforce deployed is adequately qualified, trained and in state of health to commensurate with the requirements of the job.

iii) To ensure that the Tools / Tackles and Machinery being used are properly tested and are in sound working conditions and necessary resources proposed for providing safe place of work and necessary PPE are being used.

iv) To take the required necessary corrective action immediately upon noticing or receipt of a report on noncompliance or any such condition which poses a threat to health, safety or environment. If during the course of execution of the contract, any situation of non-compliance with the contractor's safety and health plan are noticed / reported, the same will be taken up with the contractor for correction. In the event of repeated non compliance, suitable action to be initiated as per the contract.

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v) To ensure that the incidents are reported to all concerned within stipulated time frame.

vi) To ensure submission of a plan for safe working (Method Statement) from contractor and approval of the same by competent person / department.

vii) To ensure that Work Permit System in line with OISD-STD-105 is adhered to.

viii) To ensure availability of all the documentation needed for the execution of contract.

ix) To ensure that the quality controls have been maintained during fabrication/erection and all jobs required for safe commissioning have been carried out.

x) To ensure safe dismantling of all temporary facilities/connections put up by the contractor, after completion of work.

xi) To compile a report on the safety performance (at the conclusion of each contract or periodically such as annually for renewable and long-term contracts), which is to be considered in future when selecting contractors.

xii) To ensure that the Consultant, contractor and sub-contractor employ / designate qualified & trained Safety Engineer / Officer commensurate with requirement of the job.

xiii) To comply with all applicable safety and health standards, rules, regulations and orders issued by competent authority pertaining to the assigned activities.

4.1.3 Owner's Safety Officer

The duties & responsibilities of the Owner's Safety Officer should include:

i) To assess the hazards associated with jobs in consultation with all concerned and establish safe working procedure including identification of the escape routes.

ii) To establish a written record of factors which can cause injuries and illnesses and maintain statistical information for use in analysing all types of incidents and events involving contract personnel.

iii) To undertake routine/surprise inspections of all work sites and identify unsafe conditions & practices, if any. Check for compliance of the safety practices being followed with approved HSE Plan.

iv) To investigate promptly the incidents (including near-miss) in order to advise corrective and/or preventive action and assist management for its compliance.

v) To ensure periodic internal audits, review meetings, monitor and analyse HSE performance, nonconformities and suggest its corrective & preventive action.

vi) To encourage contractor and contract workers for reporting requirements ~~for~~ of occupational injuries and illnesses.

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vii) To advise whether the proposed working arrangements are safe and satisfactory, particularly at the interface between the contractor's planned work and owner's existing facilities.

viii) To communicate to the Contractor the imposed restrictions which may affect the work/personnel such as the temporary closure of a corridor or electrical isolation of equipment.

ix) To review and monitor the contractor's adherence to approved HSE plan and compliance thereof.

x) To design and conduct either independently or in collaboration with the training department, suitable HSE training programme for the prevention of personal injuries to Consultant, Contractor's Managers, Supervisors and workmen at all levels

xi) To identify areas of operations where specialized training is required to deal with potential dangers.

xii) To document and to bring to the attention of the Owner's Supervisor and Contractor any non-compliance/violation of the safety norms against approved safety and health plan or safety and health requirements and also raise these issues in the Safety Committee Meetings.

xiii) To take part in Tool Box Meetings at random and to ensure maintenance of records.

I. Establish, implement, maintain and review HSE objectives and programs including responsibility, authority, means & time frame at all relevant functions and levels.
II. Apprise the management about HSE status & help formulate appropriate policies for continual improvement.
III. Standardize PPE & Safety Devices, identify and develop approved vendors wherever required.

To organise campaigns, competitions, contests and other activities in association with the concerned departments, which will develop and maintain the interest of the contractor and contractor workers in establishing and maintaining safe conditions of work and procedures;

4.2 CONTRACTOR

4.2.1 Contractor's Management

Duties & responsibilities of the contractor should include the following:

i) To implement safe methods and practices, deploy appropriate machinery, tools & tackles, experienced supervisory personnel and skilled work force etc. required for execution.

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ii) To prepare a comprehensive and documented plan for implementation, monitoring and reporting of Health, Safety and Environment (HSE) and implement the same after its approval.

iii) To nominate qualified & trained Safety Engineers / Officers reporting to the Site in charge, for supervision, co-ordination and, liaison for the implementation of the safety plan.

Similar HSE Plan should be implemented at the sub- contractor's or supplier's site /office. However the compliance with the HSE Plan is to be the sole responsibility of the Contractor.

iv) To arrange facilities at suitable location in liaison with the owner for drinking water, toilets, lighting, canteen, lunch shelter, crèche etc. as applicable as per Laws/ Legislation at site and also arrange for workmen compensation insurance, third party liability insurance, registration under ESI / PF act etc as applicable.

v) To arrange for fire protection equipment as per the advice of owner.

vi) To ensure that its employees have completed appropriate health and safety training as required by the statute / regulation and also as per requirements of the Owner / Consultant. The documentation of such training imparted to all its employees should be maintained and produced for verification as required.

vii) To comply with all the security arrangements of owner.

viii) To ensure that the plant and equipment used on-site by contractor / employees is correctly registered, controlled and maintained in sound working condition.

ix) To ensure availability of First Aid boxes and First Aid trained attendant and other facilities as per requirement of factory Act / Building & Construction Workers Regulation (BOCWR).

x) To ensure that all incidents including near misses are reported immediately. Investigated with corrective and preventive action and learning are shared with all workers and all concerned at the earliest.

xi) To have HSE policy

xii) Maintain HSE performance data on yearly basis and submit to owner for evaluation

In construction projects where sub-contractors are engaged, the contractor should set out the responsibilities, duties and safety measures that are expected of the sub-contractor's workforce. These measures should include the provision and use of specific safety equipment, methods of carrying out specific tasks on safety and the inspection and appropriate use of tools.

The responsibilities indicated separately under contractor's Supervisor, Safety Officer and contract worker are contractually that of the Contractor and legally binding on the

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Contractor only. However the specific detailing as above has been given separately for guidance and operational convenience.

The selection of sub contractors, if employed, should be approved by the owner. Sub-contractor should comply fully with all safety rules and conditions applicable to the main contractor.

4.2.2 Contractor's Supervisor / Safety Officer

Duties & responsibilities of the Contractor's supervisor/Safety Officer should include the following:

i) To ensure strict compliance with work permit system by carrying out work only with appropriate work permits and after ensuring that all safety precautions / conditions in the permit are complied with and closing the same after job completion.

ii) To ensure that required guards and standard personal protective equipment are provided, used, and properly maintained including contingency requirement.

iii) To ensure inspection, tested, certification and maintenance of all tools and ensure removal of defective tools.

iv) To plan the workload and assign workers to jobs in commensuration with their qualification, experience and state of health.

v) To ensure that all the preventive measures for identified hazards (e.g. Job Safety Analysis, Job Hazard Analysis, HIRA, etc.) are in place and communicated to workers

vi) To take immediate corrective action against the violation of safety rules observed or reported.

vii) To ensure that the workers likely to be exposed to hazardous chemicals/materials have access to appropriate Material Safety Data Sheets (MSDS), and provide necessary mitigation measures.

viii) To ensure that appropriate warning signboards or tags are displayed.

ix) To ensure that all workers have proper training for their job assignments, including use of appropriate PPE, first aid and fire fighting equipment.

x) To ensure that only medically fit person shall be engaged in work and also ensure that sick / or injured workers during course of work should receive timely and appropriate first aid and/or medical attention.

xiii) To report each incident and/or injury in accordance with established procedures and assist in investigation.

I. Maintain Daily HSE observation log book at site
II. Conduct Tool Box talks along with Site Engineers/ supervisors.

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Maintain the published HSE literature, HSE regulations, codes and other communications. Advise management of compliance and conditions requiring attention.

A fulltime / dedicated Safety Officer should be assigned, where more than 100 workers are employed at site. For smaller jobs, the supervisor should assume the role of the safety officer also.

4.2.3 Contract workers

The duties & responsibilities of the contractor worker should include the following:

i) To perform work safely as per the job requirement and instructions.

ii) To inform all concerned regarding unsafe conditions / and unsafe acts.

iii) To wear PPE as stipulated and necessary for the job.

iv) To inform promptly to their supervisor regarding all work related incidents resulting in personal injury, illness and/or property damage.

v) To take all necessary and appropriate safety precautions to protect themselves, other personnel and the environment.

4.3 CONSULTANT

The activities and responsibilities covered under the scope of the Owner may be delegated to the consultant in those cases as applicable, based on the respective contract conditions. The primary responsibility of Consultant is to ensure compliance with agreed HSE plan for the contract by the Contractor. However those responsibilities conferred on Owner as Principal employer cannot be delegated to consultant.

Where the consultant's scope involves Engineering and Design, those factors under Designer (Para 4.4) should also be applicable.

In all cases, the Consultant's scope should include submission of latest HSE plans for work under his and Contractor's purview and implementing the same till job completion. It should conform to owner's overall HSE plan. This should include Guidelines and Implementation and Reporting Methodology to be followed with required report formats.

Adequate number of Safety Officers shall be provided by the Consultant with necessary skills required for the work to be performed.

The Consultant shall review the documents submitted by the contractor and advise owner on acceptance as well as advise suitability and number of Contractor's safety officers / supervisors.

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4.4 DESIGNER

The Process Designer should identify all hazards and risks likely to be encountered during fabrication, erection including dismantling, Pre-commissioning, commissioning and Performance run to meet the Guarantees and advise the risk mitigation measures.

All the hazards and safety measures to be adopted while handling Dangerous chemicals and Catalysts should be detailed by the Process Licensor and the same should be again included in the scope of the suppliers. Specific write ups/MSDS should be obtained from Patented single source suppliers also.

Designs should recognize, include and apply safe practice during preparation, construction and subsequent operational use and maintenance after completion of the Project.

All documents including drawings and calculations are to be originated, checked and approved in accordance with latest international codes, standards, specifications and design basis philosophy.

Use of low risk materials, non hazardous substances, use of low noise and dust-suppressed equipment etc. should be encouraged.

5.0 SAFETY MANAGEMENT

5.1 JOB SAFETY ANALYSIS (JSA)

Job safety analysis (JSA) provides a mechanism by which the contractor / owner, safety officer(s) and job supervisor(s) take a detailed look at how an individual task is performed , and its inherent hazards and preventive measures. This procedure helps in integrating accepted safety and health principles and practices into a particular operation. In a JSA, each step of the job is examined to identify potential hazards and to determine the safest way to do the job.

A job safety analysis includes five steps as below:

- Select a job
- Break the job down into a sequence of steps
- Identify the hazards against each of these steps (based on knowledge of accident, causes of injuries and personal experience) and determine the preventive measures to overcome these hazards
- Apply the controls to the hazards
- Evaluate the controls measures and revisit JSA if necessary

5.2 CRITERIA OF SELECTION OF A CONTRACTOR & SAFETY PERFORMANCE REVIEW

"Contractor Safety" can be ensured to a large extent if competent agency for execution of assignment or job, based on HSE system agreed upon by owner, is selected. It is necessary to assess his capabilities and competencies to perform work safely.

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A databank should be developed for all the contractors for their past performance on HSE aspects. An attempt should also be made to get similar data from other similar industries.

The data required will depend upon complexity involved in the job and type / size of resources required. Format needs to be suitably developed depending upon size, nature of the job & hazard associated therein. The format designed should also take care of the skill required to carry out the job.

Performance review is essential for all type of contractors. It helps in recording actual performance/experience with contractors while the contract is in progress. It is essential that resources agreed as per the contract are reviewed at mobilization stage for ensuring compliance from the day one and thorough effective supervision / monitoring system are at place.

This activity also helps in taking timely action in case of unsatisfactory performance to correct the situation and ensure safe work during execution period and deciding about suitability of the contractor for future jobs.

The periodicity of such performance review will depend upon size/type/complexity of contract. However, the performance should be reviewed periodically from mobilisation stage till the demobilization stage. Appropriate corrective action should be ensured.

5.3 SITE PLANNING AND LAYOUT

Before starting the construction/maintenance job at existing workplace in operation or green field locations, following should be ensured: -

i) Details regarding location of workshop/ fabrication yard, site office, stores, laboratory, electrical installations, placement of construction machinery, medical and welfare facilities, lighting underground and above ground piping route, cable route etc. should be decided prior to commencement of the work in consultation with owner / Consultants and implementation should be ensured. Layout should be displayed at strategic locations.

ii) The resources required to meet any emergency situations like fire fighting, first aid etc. should be planned and mobilized as per the job requirement.

iii) The sequence or order in which work to be done and any hazardous operations or processes should be identified.

iv) Free access to site shall be provided with clear roads, passage, gangways, staircases etc. Access to construction site should be leveled, open and free from any obstructions like construction material or scrap/waste, exposure to hazards such as falling materials, material handling equipment and vehicles. Any pit or ditch shall be covered or barricaded.

v) Arrangements should be made to maintain good housekeeping at site. Scrap and debris generated out of construction work should be removed/disposed off at a regular interval as directed. Emergency exit should be provided in case of blockade of primary exit.

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vi) Suitable warning notices and also the routes to and from welfare facilities should be displayed prominently.

vii) Pedestrian pathways and routes for vehicular traffic (light/heavy vehicles including material handling equipment) should be earmarked.

viii) Artificial lighting to be provided at places where work continues or workers pass by after sunset or in case natural light is insufficient like confined spaces.

ix) Keep all equipment /machines under cover to prevent them from dust, rain/flood water, heat etc. and follow storage instructions as applicable for each of them.

5.4 GATE ENTRY PROCEDURE

Gate entry at any site / workplace / unit is to be restricted to ensure entry of only authorised persons / vehicles.

5.4.1 Entry procedure for all contractor workers should be as follows:

A. Issuance of Pass

i) The passes are to be issued after the owner's representative/engineer-in-charge forwards the application of the contractor providing complete details of the workers being engaged. The contractor should be asked to submit Character & Antecedents (C&A) verification of individual worker from concerned authorities.

ii) The actual deployment of the workers at the construction site should be done after imparting the necessary safety induction training.

iii) With regard to issuance of passes for all vehicles including material handling equipment, owner's representative / engineer-in-charge should forward the application only after ensuring that all documents pertaining to the fitness of the vehicle/equipment and valid driving license of the driver, PUC of the vehicle, insurance of vehicle, etc. are available.

iv) The passes should be serially numbered with address, contractor name, identification mark, signature of the worker etc.

v) Special colour code for passes should be used for persons entering different areas like Administrative Block, Unit area, Project Area (wherever applicable).

vi) Contractor workers engaged on routine basis for long periods should be provided with monthly photo pass.

vii) Special permit is required separately for working beyond normal working hours and holidays.

B. Gate Entry

i) Entry of the contractor's employees should be permitted with valid gate passes only.

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ii) Entry of contractor's workers should be allowed in presence of authorized representative of contractor.

iii) Records of persons at the time of entry/exit should be maintained.

iv) At the entry gate of the location, a physical checking for non-carrying of lighter, matchboxes, explosives etc. should be carried out.

v) Gate passes/Identity Cards should be displayed on persons at all the times.

vi) For Mega-projects at existing / operating installations, it is preferable to have a separate gate for entry of contractor workers and also the project areas should be segregated fencing from operational area by fencing / other physical means.

vii) No vehicle should be allowed to enter in an operational area without proper flame arrestor.

viii) Awareness on Safety through training / posters etc. highlighting Do's and Don'ts should be spread within entire contractor workforce. Video/Audio tapes on Safety Topics should be played preferably.

ix) For occasionally engaged workers such as for material handling etc., spot photograph should preferably take with two copies (one for preparing the pass and other for attachment with gate register). Specific advice and recommendation of User Department should be given due cognizance. Relevant details are to be written. The pass should be collected back at the gate after day's work.

5.4.2 Tank Truck Loading (TTL) Operation :

At the loading / unloading location, a large no. of Tank Trucks of petroleum products enter the installation. Crew members are generally not regular entrants. The procedure should be as follows:

i) The gate pass should be issued to the individual crew members on written request of the transporter mentioning TT registration nos., License and certificate of training as per MV rule 9.

ii) Character & Antecedent (C & A) verification of the TTL crew through local police is to be done preferably and record maintained.

iii) For loading/unloading purpose, register entry at security gate is made before allowing entry into the premises with recording of names of crew members, time of entry, pass Sr. No., TT no. etc.

iv) For loading/unloading, crew is allowed entry along with TT only, after checking of TT from explosive/security point of view.

v) Out time, invoice no., Destination etc., are recorded while TTs go out of the security gate.

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5.5 TRAINING

Training is to educate contractor workforce on various hazards associated with the job/workplace and on the respective preventive / mitigation measures to avoid untoward incidents.

i) Workers should be adequately and suitably:

(a) informed of potential safety and health hazards to which they may be exposed to at their workplace;

(b) instructed and trained in the measures available for the prevention, control and protection against those hazards.

ii) No person should be employed in any work at a workplace unless that person has received the necessary information, instruction and training so as to be able to do the work competently and safely. The competent authority should, in collaboration with employers, promote training programs to enable all the workers to read and understand the information / instructions related to safety and health matters.

iii) The information, instruction and training should be given in a language understood by the worker and written, Oral, visual and participative approaches should be used to ensure that the worker has assimilated the information.

iv) Every worker should receive instruction and training regarding the general safety and health measures common to the workplace. This should include:

(a) general rights and duties of workers at the workplace;

(b) means of access and egress both during normal working and in an emergency;

(c) measures for good housekeeping;

(d) location and proper use of welfare amenities and first aid facilities provided;

(e) proper use and care of the items of personnel protective equipment and protective clothing provided to the worker;

(f) general measures for personal hygiene and health protection;

(g) fire precautions to be taken;

(h) action to be taken in case of an emergency;

(i) requirements of relevant safety and health rules and regulations.

(j) training on hazards and mitigation measures for specific area where worker is assigned to work shall be given as part of entry procedure

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(k) Job specific training / refresher course shall also be given at regular intervals.

(l) It is also expected that behaviour based safety culture shall be encouraged and all the workers will be involved.

Copies of the relevant safety and health rules, regulations and procedures should be available to workers upon the commencement of and upon any change of employment.

5.5.1 Training Techniques

a) Lectures

This technique should be applied when it is required to transfer information in local language to a large contractor workforce with controlled content and time.

b) Case Study

This is an effective technique based on the presentation of case of real events by Trainer to highlight probable causes like Human Error, ignorance about the job etc.

c) Videos

Videos, an effective technique of communication, should be used to display the right techniques of performing a task in a safe manner and hazards associated with a job.

d) Demonstration at site

Right way to do a job should invariably be demonstrated to workers at the site itself. The right way is also a safe way. Hazards due to wrong procedures, short cuts and their adverse effects etc. should also be highlighted.

5.5.2 Training/Awareness Module and Frequency

A. General Safety Training to all categories of contractor employees should be imparted before induction and annually thereafter. No person should be allowed to enter the installation without undergoing this training. This training program should cover:

i) Mandatory uses of PPE like Cotton clothes, Helmet, Safety Shoes, Full Body Safety harness, dust masks, safety goggles, etc.

ii) Probable Hazards related to industry

iii) Job specific hazards

iv) Important Telephone No / Escape route

v) First Aid

vi) Use of Fire extinguisher

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vii) Location of assembly points

viii) Procedure of calling fire crew in case of any emergency

ix) Wind direction

The contractor workers, if engaged in operation of the plants/facilities, should be trained in line with Clause No. 4.6 of OISD-GDN-206 on "Safety Management System". For other categories of contractor workers, training modules for different category employees are as follows:

B. Contractor Supervisor

Contractor Supervisor should be trained in accordance with the provision of clause no. 5.1.1.2, 5.2.7, 5.3.10, 5.6.12 and 5.7.8 of OISD-STD-154 on 'Safety Aspects in Functional Training'

C. Contractor Worker

Yearly training programme should be carried out for contractor worker and the records should be maintained. The training programme should cover at least the following:

i) Worker responsibility for safety of himself and work area.

ii) Associated hazards with the job and job area including electrical shock hazards.

iii) Importance of First Aid fire fighting equipment, their use & operations

iv) Communication system at the installation

v) Fire / Accident Reporting procedure

vi) General Safety rules

vii) Safety Measures during execution of job such as:

- Welding / Cutting / Grinding
- Working at height
- Confined space entry
- X ray / radiation
- Erection / Dismantling of scaffolding
- Tank construction and repairs
- Handling of chemicals etc.
- Hydrojetting
- Leak testing of pipelines and equipment (hydro and pneumatic testing)
- Grit / other methods of blasting for surface preparation blasting etc.
- Chemical cleaning & pickling
- Catalyst loading & storage
- ELCB

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viii) Importance & use of PPE

ix) Emergency Routes

x) Assembly Points

xi) Job Specific Training

D. Consultant / Contractor

Awareness program should be carried out for demarketed Consultant / Contractor at the time of induction. This program should cover at least the following:

i) Responsibility of contractor for safety of their personnel and work area

ii) Hazardous property of Petroleum products and chemical used

iii) Communication system

iv) Fire / Accident Reporting procedure

v) Medical facility available

vi) Statutory requirements

vii) Importance of First Aid equipment and required at the site

viii) Work Permit system

ix) Direct/ Indirect losses due to accident

x) Safety Measures while executing the jobs such as:

- Welding / Cutting / Grinding
- Working at height
- Confined space entry
- X ray / radiation
- Erection / Dismantling of scaffolding
- Tank construction and repairs
- Handling of chemicals etc.
- electrical jobs
- Hydrojetting
- Leak testing of pipelines and equipment (hydro and pneumatic testing)
- Grit / other methods of blasting for surface preparation blasting etc.
- Chemical cleaning & pickling
- Catalyst loading & storage
- ELCB

xi) Safety training needs of their supervisors and workers

xii) Importance & Use of PPE at the site

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xiii) General Safety rules at the installation –

General points:

Workers should not be allowed to take meals or take rest inside the construction / plant area.

E Security Personnel

Training program should be carried out for Security personnel at the time of induction and annually thereafter and the records should be maintained. The training program should cover at least the following:

i) Layout of Plant and Facilities
ii) Vulnerable locations
iii) Safety regulations (Statutory and in company)
iv) Fire Protection Facilities and Locations
v) Role in case of Fire / Disaster
vi) Emergency Procedure and Drills
vii) Industrial First Aid
viii) Use of Personnel Protective Equipment
ix) Disaster Management Plan

5.6 INSPECTION / AUDIT

Inspection / Audit is a tool to evaluate compliance of all safety requirements. Most of the information could be gathered through site inspection using ready-made check lists to ensure that contractors / agencies abide by the safety rules and norms while working at operating / construction sites.

A checklist, while carrying out different type of jobs, should be developed based on hazards associated with the job being performed and requirements as per OISD-GDN-192 on "Safety Practices during Construction". Typical format is enclosed at Annexure II, which should be modified to suit the requirement of the site / job to be done.

Before starting the work and at regular intervals thereafter, Contractor's Supervisor/safety Officer and Owner's representative / Engineer-in charge/safety Officer should inspect as per the checklist so prepared to ensure that contractor has prepared to start the work with all safety precaution required for safe execution of job.

5.7 FINANCIAL DETERRENTS FOR NON-COMPLIANCE OF SAFETY RULES/ PROCEDURES

Financial or other type of penalties like seizure of gate passes, stoppage of work for a limited period etc. should be levied on the contractors or their workers for non-compliance of safety rules. A provision of suitable accident severity based penalty clause for contractor should be incorporated to ensure adherence of systems and procedures.

The financial deterrent clauses shall be included in the general terms and conditions of the contract. The violators of the clauses shall be suitably punished. Following list shall be taken as a guide while preparing the financial deterrent clauses but need not be limited to these conditions only.

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A few of the usual non-compliance are as follows:

I. Working without valid work permit/ Violation of any of the conditions specified in the permit.

II. Throwing up/down any material from height or not making proper provision to bring down material safely from height

III. Non standard/unsafe platform/ladder, Non standard/unsafe Scaffolding

IV. Non-usage of PPEs like Safety helmet / Safety shoes / Safety goggles / Welding Shield / Respiratory protection etc. by the contractor personnel

V. Non use of ELCB , using poor joints of cable, using naked wire without top plug into the socket, laying wire/cables on the roads without sleeve.

VI. Carrying out electrical jobs by un-authorised person

VII. Non deployment of the licensed electricians for electrical job.

VIII. Unsatisfactory fencing / barricading of excavated areas, Not providing proper shoring /strutting /proper slope and Not keeping the excavated earth at least one meter away from excavated area

IX. Over speeding of vehicles, rash driving, wrong side parking & parking in front of any fire-fighting equipment.

X. Riding on material handling vehicles or trolleys or hydra.

XI. Non-deployment of safety supervisor / supervisor responsible for safety at work site

XII. Failure to maintain safety register and record by Contractor Safety Supervisor or Supervisor responsible for safety.

XIII. Acting in contravention to any of the provision mentioned in Factories Act 1948 and/or the rules framed there under including all amendments thereto.

XIV. Failure to furnish a first information report (FIR) as per prescribed Pro-Forma within 4 hours of the incident.

XV. Keep and maintain proper records of all incidents occurred at work site.

XVI. Working beyond statutory limits by contractor's workers.

XVII. Deployment of child or adolescent labour.

XVIII. Use of untested and uncertified pressure vessel. Use of untested and uncertified lifting tools/tackle.

XIX. Unsafe handling of compressed gas cylinders No trolley or jubilee clips or double gauge regulator or flash back arrestor on both gas lines & both ends or improper storage / handling or cylinders without caps when not in

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use/damaged hoses). Keeping compressed gas cylinders in horizontal position.

XX. Transporting metallic items below overhead lines, without isolation.

XXI. Damage to fire equipment like hydrant & monitors, fire extinguishers including non return of fire equipment

XXII. Horseplay at work site.

XXIII. Non-provision of basic safety requirement such as 24 V lamp for working in confined space, uncertified / non standard lifting tools, earth leakage protection & earthing connections for electrical appliances as per Indian Electricity Rules, emergency isolation switches etc.

XXIV. Keeping gas cylinders inside the confined spaces.

XXV. Non-usage of the full body safety harness and fall back arrester with life line properly anchored by the workers while working at height

XXVI. Violation of Safety Permit conditions like Firefighting equipment.

XXVII. Non-barricading of area while rigging, digging etc.

XXVIII. Working without valid work permit.

XXIX. Un-authorised road closure/blockage.

XXX. Not clearing the work site on regular basis.

XXXI. Leaving contractor owned leftover material at site at the time of demobilization.

5.7.1 REWARDS AND RECOGNITIONS

The contract employees should be suitably rewarded as per a scheme, with monetary benefits/ prizes for timely reporting of the Near miss incidents/ Unsafe conditions/ Unsafe Acts based on the accident potential if it could have occurred.

The compliance to safety procedures by the contractors shall be evaluated annually as per the scheme based on different leading and lagging indicators and shall be awarded during the safety week celebrations.

The best safety conscious worker as recommended by the safety officers of different contractors during short term jobs such as the turnaround maintenance activities shall be suitably rewarded for motivating the workers to comply with safety requirements.

The best safety officer/supervisors of the contractor shall be recognized and shall be suitably rewarded during the safety week celebrations.

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5.8 INCIDENT REPORTING AND INVESTIGATION SYSTEM

All the incidents including near-miss should be reported immediately by contractor's Supervisor to Contractor and owner's Supervisor / Engineer-in-charge, who should inform to Owner's Safety Officer and owner's Management. Owner's Safety Department will be required for onward reporting as per OISD, Statutory requirements.

All accidents regardless of the extent of injury or damage should be investigated in order to find probable causes, lessons learnt thereof and remedial measures required to prevent its recurrence.

The incident investigation should be done as per provision of clause no. 4.12 of OISD-GDN-206 on 'Safety Management System'.

All the recommendations of investigation / Enquiry Report need to be monitored closely for its implementation. A proper record should be maintained to ensure implementation of all the recommendations and same should be reviewed from time to time.

5.9 SAFETY COMMITTEE MEETINGS

Following three type of safety committee meetings should be held aiming at raising the level of safety consciousness at the site:

5.9.1 Toolbox meeting

To maintain awareness, update training and convey important safety and health information, contractor supervisors should conduct tool box meetings at least weekly and also prior to start of any work. All the contractor workers should attend this meeting. The owner's supervisor/Engineer-in-charge and safety officers should also attend these meetings on random basis. Tool box meeting should be conducted more frequently depending upon circumstances. Record of the same can be maintained in the following typical format.

TOOL BOX MEETING FORM

A Toolbox Talk is a safety meeting allowing open environment for discussion with the work force. It focuses on safety topics related to the specific job, such as workplace hazards and safe work practices. It is aimed to refresh workers' knowledge, cover last minute safety checks, to raise workers' awareness of specific problems on site. Toolbox Talks are also intended to facilitate health and safety discussions on the job site and promote safety culture. It also helps to remind workers that health and safety are an important part of the working day.

Toolbox talk should be short in duration and conducted at the job site prior to the commencement of a new job or work shift. Toolbox Talks can be used for post-accident communications / accident case study, re-enforcement of safe work practice and pre-task planning etc.

Contractor supervisors should conduct tool box meetings at least weekly and also prior to start of any work. All the contractor workers should attend this meeting. The owner's supervisor/Engineer-in-charge and safety officers should also attend these meetings on

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random basis. Tool box meeting should be conducted more frequently depending upon circumstances.

A toolbox talk should cover following topics;

- Review of the hazards related to job being done. What safety equipment and PPEs should be used? What procedures should be followed?
- Review and analyse recent safety violations— What was the violation? What hazard did it create? What injury could have occurred?
- Review and analyse recent injuries— What happened? Why did it happen? What should have been done?
- Ergonomics and behaviour related tips.
- Importance of PPEs and proper tool for specific jobs.
- Housekeeping

Records of such talks should be maintained. Following information should be included when completing a Toolbox Talk Form:

- Names and signatures of all persons present,
- Topics discussed,

Any job specific training or instructions that have been given in the meeting and who raised the issue or added to the discussion, to show that there has been active consultation with all persons attending the meeting and that all parties have had a chance to raise issues.

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TOOL BOX TALK RECORD

DATE_____ TIME:_____LOCATION:_____
DELIVERED BY:_____WITNESSED B Y: _____
JOB DISCRIPTION:_____
NAME OF THE CONTRACTOR:_____

Toolbox Talk – Topics / Issues discussed
Other points or issues raised by attendees

NAME	SIGNATURE	NAME	SIGNATURE

5.9.2 Site Safety Committee Meeting

Primary purpose of this safety committee is to enable owner, contractor and workers to work together to monitor the site safety and health plan so as to prevent accidents and improve working condition on site. Its size and membership will depend on the size and nature of job.

The safety committee should include representatives of owner, consultant, contractor identified as safety officer / supervisor. It should be headed by Engineer-in-charge.

The safety committee should have regular and frequent meetings, atleast fortnightly, to discuss the safety and health program on site and to make suggestions for improvement. The meetings should be documented with a time bound action plan. The functions carried out by safety committee should include:

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i) Review compliance of pending items of last Safety meetings. All critical items should be identified and their compliance ensured.

ii) Consideration of the reports of safety personnel.

iii) Discussion of accident/near-miss and illness reports in order to make appropriate recommendation for prevention.

iv) Examination/evaluation of suggestions made by workers.

v) Dissemination of acquired knowledge through training programs and information sharing sessions.

vi) Discussion & review of Fire Prevention & Disaster Management Plan.

vii) To send recommendation to Apex Body for consideration / approvals.

5.9.3 Safety Review Meeting by Location Head

This meeting should be headed by the Location head and attended by Owner's Supervisor / Engineer-in-charge, owner's safety Officer and all concerned department heads. Prime purpose of this review is to ensure that all the recommendations of various committees are being complied with and to take decisions on critical points raised. This meeting should take place at least once in every quarter. All the investigation reports / audit findings with status of implementation of recommendations should be discussed.

5.10 SAFETY EQUIPMENT / PERSONNEL PROTECTIVE EQUIPMENT

The type of safety equipment to be used is decided based on the job requirement. Selection should be made based on OISD-GDN-192, OISD-STD-155 (Part I & II) and the job requirement. Safety equipment / Personnel Protective Equipment (PPE) shall be of approved make. Contractor shall provide necessary training to each employee regarding proper usage and upkeep of PPE including its limitation.

A register showing stock and issue of PPE should be maintained by the contractor at site and must be available for inspection. 10 to 20 % of PPE in excess of actual requirement to meet contingency requirement should be maintained at site.

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REFERENCES

1) OISD-GDN-206 on "Safety Management System"

2) OISD-GDN-192 on "Safety During Construction"

3) OISD-STD-155 Part (I & II) on "Personnel Protective Equipment"

4) Building & Other Construction workers (Regulation of Employment & Condition of Service) Act 1996 & Rules thereof

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ANNEXURE I

LIST OF SAFETY CODES FOR CIVIL WORKS PUBLISHED BY BUREAU OF INDIAN STANDARDS

Sl.no.	Code No.	Title
1	IS: 818	Code of Practice for Safety and Health Requirements in Electric and Gas Welding and Cutting Operations – First Revision.
2	IS: 875	Code of practice for Structural safety of buildings: Masonry walls
3	IS: 933	Specification for Portable Chemical Fire Extinguisher, Foam Type – Second Revision.
4	IS: 1179	Specification for Equipment for Eye and Face Protection during Welding – First Revision
5	IS: 1904	Code of practice for Structural safety of buildings: Shallow foundations
6	IS: 1905	Code of practice for Structural safety of buildings: Masonry walls
7	IS: 1989 – Part II	Leather Safety Boots and shoes for heavy metal industry
8	IS: 2171	Specification for Portable Fire Extinguishers, Dry Powder Type – Second Revision
9	IS: 2361	Specification of Building Grips – First Revision
10	IS: 2750	Specification for Steel Scaffoldings
11	IS: 2925	Specification for Industrial Safety Helmets – First Revision
12	IS: 3016	Code of Practice for Fires Precautions in Welding and Cutting Operations – First Revision
13	IS: 3521	Industrial Safety Belts and harnesses
14	IS: 3696 – Part I	Safety Code for Scaffolds and Ladders: Part I – Scaffolds
15	IS: 3696 – Part II	Safety Code for Scaffolds and Ladders: Part II – Ladders
16	IS: 3764	Safety Code for Excavation Work
17	IS: 4014 – Part I & II	Code of Practice for Steel Tubular Scaffolding
18	IS: 4081	Safety Code for Blasting and Related Drilling Operations
19	IS: 4082	Recommendations on stacking and storage of construction materials at site

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20	IS: 4130	Safety Code for Demolition of Buildings – First Revision
21	IS: 4138	Safety Code for working in compressed air – First Revision
22	IS: 4756	Safety Code for Tunneling works
23	IS: 4912	Safety requirements for Floor and Wall openings, Railings and toe boards – First Revision
24	IS: 5216 – Part I & II	Recommendations on safety procedures and practices in electrical work
25	IS: 5121	Safety code for piling and other deep foundations
26	IS: 5916	Safety Code for Construction involving use of Hot Bituminous materials
27	IS: 6994 – Part I	Specifications for safety gloves: Part I – Leather and Cotton gloves
28	IS: 5983	Specification for Eye Protectors – First Revision
29	IS: 6922	Criteria for safety and design of structures subject to underground blasts
30	IS: 7155	Code of recommended practices for conveyor safety
31	IS: 7205	Safety Code for Erection on Structural Steel Works
32	IS: 7069	Safety Code for Handling and Storage of Building Materials
33	IS: 7293	Safety Code for Working with Construction Machinery
34	IS: 7323	Guidelines for operation of Reservoirs
35	IS: 7969	Safety Code for handling and storage of building materials
36	IS: 8758	Recommendation for Fire Precautionary Measures in construction of Temporary Structures and Pandals
37	IS: 8989	Safety Code for Erection of Concrete Framed Structures
38	IS: 9706	Code of Practices for construction of Arial ropeways for transportation of material
39	IS: 9759	Guidelines for de-watering during construction
40	IS: 9944	Recommendations on safe working load for natural and manmade fibre rope slings
41	IS: 10667	Guide for selection of industrial safety equipment for protection foot and leg

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42	IS: 10291	Safety Code for dress divers in civil engineering works
43	IS: 10386 – Part I	Safety Code for Construction, Operation and Maintenance for River Valley Projects
44	IS: 10386 – Part II	Safety Code for Construction, Operation and Maintenance for River Valley Projects
45	IS: 11057	Code of Practice for Industrial Safety Nets
46	IS: 13415	Code of Practice on safety for Protective barriers in and around building
47	IS: 13416	Recommendations for preventive measures against hazards at working places

Statutory Regulations

Latest Statutory Acts and Rules, as given below, should be referred:-

1. The Petroleum Acts 1934 and Petroleum Rules 2002
2. The Factory Act, 1948 (As amended by Factory Amendment Act 1987) and concerned Factory Rules
3. The Water (Prevention and Control of Pollution) Act 1974 & Rules 1975
4. The Environment (Protection) Act 1986 and rules thereunder
5. The Manufacturing, Storage and Import of Hazardous Rules 1989
6. The Hazardous Wastes Management (Management & Handling) Rules 1989
7. The Indian Electricity Act 1901 and Rules 1956
8. The Indian Explosive Acts, 1884 & The Indian Explosive Rules 1983
9. The Gas Cylinder Rules 1981and the static & Mobile Pressure Vessels (Unfired) Rules 1981
10. The Indian Boiler Act 1923 and Regulations 1950
11. The Public Liability Act 1991 as amended in 1992
12. The Motor Vehicle act 1988 and Central Motor Vehicle rules 1989
13. Building & Other Construction workers (Regulation of Employment & Condition of Service) Act 1996

In addition to above, various other statutory acts like EPF, ESIS, Minimum wage act and other local statutory requirements shall also be complied with.

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ANNEXURE II

CHECK LIST FOR SAFETY INSPECTION / AUDIT

Job_____Location_____Date of Audit_____Frequency _____

Inspected by _____ Contractor (s) _____

Sl.no.	ITEM	YES	NO	NA	REMARKS / ACTION
1.0	**PERSONNEL PROTECTIVE EQUIPMENT (PPE):** Are following PPEs being used as per the job requirements?				
A.	**Minimum mandatory PPEs**				
A1	Safety Helmets (with chin strap)				
A2	Safety Shoes				
A3	Safety Goggles				
A4	Safety hand gloves				
B.	**Job specific PPEs**				
	Whether need of specialised safety PPE identified and documented?				
B1	Full body safety harness with double lanyard				
B2	Fall arrester				
B3	Ear Plug / Ear Muff				
B4	Gum Boots				
B5	Face shield				
B6	Shot/Grit/Slag blasting hood				
B7	Breathing Apparatus				
B8	Gas Filter Mask / Dust Mask				
B9	Hand Gloves (Chemical/ Welding/ Electrical/ anti-vibration/ High temperature/ cold burn etc.)				
B10	Boiler Suit / Fire-retardant suit / Electrical flash fire retardant suit /High pressure water cleaning (Hydrojetting-Turtle) suit /				

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	Chemical suit / Low temperature suit etc.				
B11	Others				
C.	Whether workers are trained / briefed to use the PPEs?				
D.	Whether system of checking the quality / quantity of PPEs provided by contractor exists and in practice?				
E.	Whether as per contract the contractor is obliged to arrange the required PPEs to its workmen and the same is being complied with ?				
2.0	**HOUSE KEEPING**				
2.1	Whether Standards of housekeeping are defined in contract and housekeeping is being maintained accordingly?				
2.2	Whether areas are identified and marked for stacking of material like scrap, pipes, plates, cement, sand, loose excavated material etc.?				
2.3	Whether surplus excavated material, debris and scrap material is being removed and disposed on regular basis as per contract?				
2.4	Whether path ways, roads, stairs etc. in the vicinity of work place are maintained free from obstructions?				
2.5	Whether appropriate actions are taken to avoid the slippery area due to water logging / oil spillage?				
2.6	Whether system for collecting and disposal of small size scraps like welding buds, small size metal pieces, insulation material in place.				
2.7	Whether area is maintained free from vegetation, garbage etc. and the work place is kept clean and free of any hazard?				
2.8	Others				
3.0	**EXCAVATION**				
3.1	Whether detailed plan of excavation including soil stability is made and approved by competent authority?				
3.2	Whether excavation hot work permit is taken?				

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3.3	Whether the workplace is thoroughly inspected before issuance of work permit, as stipulated in OISD-STD-105?				
3.4	Whether special conditions mentioned in the permit are clearly explained to the supervisor and in turn to the contractor workers and documented?				
3.5	Whether proper shoring for the excavation is provided to prevent cave-in for side of slope more than the safe angle of repose (generally around 45 degrees) of the soil being excavated?				
3.6	Whether proper precautions have been taken if the excavation is adjoining to heavy structure like building, street and roadways?				
3.7	While excavating whether proper slope usually 45^0 & suitable benches of 0.5 m width at each 1.5 m depth are provided?				
3.8	Whether barricading of 1m height with glowing caution board is provided for excavation beyond 1.5m depth?				
3.9	Whether excavating earth is placed beyond 1m or depth of the excavation whichever is more, from the edge of the trench?				
3.10	Whether heavy vehicle movement is restricted to come too close (minimum 2 M from the edge of excavation) to the excavating area?				
3.11	Whether adequately anchored stop blocks and barriers are provided to prevent vehicles being driven into the excavation? Heavy vehicles should not be allowed near the excavation unless the support work has been specially designed to permit it.				
3.12	Whether necessary precaution is taken for underground pipes, sewers, cables by contractors?				
3.13	Whether extra precaution is taken for bailing out water properly while excavating?				
3.14	During rains whether the excavation is				

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	done with extra precaution to prevent caving in?				
3.15	Whether two separate entry/ exit points with necessary ladders / steps, as per requirement, have been provided?				
3.16	Whether required no. of persons are available (as per OISD-STD-105) at all the time to communicate any hazards noticed with workers working in deep trenches or excavation?				
3.17	Whether necessary precautions like regular gas testing are being taken in areas having hydrocarbons and toxic gases so that no gas accumulation takes place in the trenches.				
3.18	Whether IS: 4081-1986 & Indian Explosive act & rules for storage, handling & carrying of explosive material and execution of blasting operation is followed?				
3.19	Whether in case of mechanised excavation, caution board is provided for do's and don'ts like 'Nobody to enter' within one meter of the extreme reach?				
3.20	Whether the following observations are being documented during excavation work and corrective actions taken :- a) Boulder formation encountered b) Collapsing / development of cracks of sides c) Marked damage to support d) Unexpected fall of ground e) Inspection of site after each blast. f) Water logging g) Unexpected utility/cabling				
3.21	Others				
4.0	**PERMITS**				
4.1	Whether valid work permit is issued in compliance to OISD-STD-105 to start any work?				
4.2	Whether before issuing the permit, JSA carried out and mitigation measures made				

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	part of work permit?			
4.3	Whether personnel working at site were given tool box talk about the hazards and emergency procedure with important do's and don'ts and record maintained?			
4.4	Whether all conditions of the permit are fulfilled before starting the job?			
4.5	As noted in the permit, whether compliance of all the recommendations are ensured during entire duration of the job?			
4.6	Whether permits are available at work site all the times?			
4.7	Whether hot work permit registered in fire station / designated safety officer?			
4.8	Whether permits are being closed after the completion of job?			
4.9	Others			
5.0	**SAFETY IN CUTTING / WELDING/GRINDING**			
5.1	Whether LPG / Oxygen / Acetylene/ Gas cylinders are kept outside only while working in confined space?			
5.2	Are Acetylene/ O_2 / LPG cylinders kept in upright position with required valve cap and secured at designated places under shed – wet fire retardant clothes ~~gunny bags~~ wrapped around it if the same is under sun at designated place?			
5.3	Check cylinder and cylinder valves for approved quality & any kind of damage?			
5.4	Whether protective valve ~~s~~ caps are kept on cylinders while not in use?			
5.5	Whether proper means and method for transportation of cylinders to avoid dropping and rolling are being adopted / followed?			
5.6	Whether gas cylinders, regulators are			

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	kept away from combustible materials and ~~/~~free from oil and grease?				
5.7	Whether all hoses are of approved quality and found to be free of any damage or crack?				
5.8	Whether oxygen and acetylene cylinders are stored separately at a distance of at least 5 feet from each other and kept under shade as per Gas Cylinder rules 2002?				
5.9	Whether gas cylinders are kept at safe location particularly in case job is being done at different elevations while in use?				
5.10	Whether color coding is being used for easy identification of different type of cylinders and hoses?				
5.11	Whether cylinder keys are available near the cylinder?				
5.12	Whether gas torches with flash back arrestors of approved make are only being used?				
5.13	Whether pressure gauges are in working condition and checked from time to time?				
5.14	Whether welding shields are used while welding?				
5.15	Whether proper earthing for welding machines are provided?				
5.16	Whether power is taken from approved sources (welding receptacles)?				
5.17	Whether welding receptacles are properly grounded?				
5.18	Whether welding cables are maintained in good condition and without any joints/ cuts?				
5.19	Whether to avoid short circuit, welding machines are protected against rain?				
5.20	Whether earth connectors are securely connected to the job and not to the				

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	adjoining pipeline or structure?				
5.21	Whether flame arrestor of DG set is of approved make and quality?				
5.22	Whether 30mA rating ELCB is provided on power supply.				
5.23	Whether separate power supply arrangement is provided for portable oven?				
5.24	Others				
6.0	**ABRASIVE (SHOT/GRIT/SLAG) BLASTING**				
6.1	Whether abrasive blasting is used only after getting approval from competent authority / work permit?				
6.2	Whether air compressor used for abrasive blasting are positioned away from work place?				
6.3	Whether exhaust of the prime mover is directed away from the work place?				
6.4	Whether in case of motor driven compressor, the body of the motor as well as the compressor is properly earthed?				
6.5	Whether line operator of abrasive blasting wear suitable PPEs including mask?				
6.6	Whether adequate measures are adopted to confine dust / flying particles?				
6.7	Whether adequate measures are taken for proper ventilation while the work is done in confined space?				
6.8	Whether the Air receiver vessel of the compressor is pressure tested.				
6.9	Others				
7.0	**SAFETY WHILE WORKING AT HEIGHTS / SCAFFOLDING / LADDERS**				
7.1	Whether work permit is obtained to take up work at height above 2.2 meters?				
7.2	Whether steel pipes scaffoldings are used in unit/off site areas?				

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7.3	Whether provision for suitable platform with all scaffoldings are made? Whether its construction is as per specification with toe board and railing?				
7.4	Whether the area below working at height is cordoned?				
7.5	Whether ISI approved quality and good condition full body safety harness with shock absorber are used while working at heights?				
7.6	Whether life line of full body safety harness with shock absorber is anchored to an independent secured support capable of withstanding load of a falling person?				
7.7	Whether the area around the scaffold is cordoned off to prohibit the entry of unauthorized person?				
7.8	Whether lifeline ropes used are of good condition and adequate strength free of defects?				
7.9	Whether ladder is placed at secured and leveled surface?				
7.10	Whether it is extended 1.0 Meters above the landing point?				
7.11	Whether ladder used are of adequate length and tying short ladder is avoided?				
7.12	Whether metallic ladders are placed away from electrical system?				
7.13	Whether tools or materials are removed after completion of the day's job at heights?				
7.14	Whether a valid permit is obtained before taking up work on asbestos or fragile roof?				
7.15	Whether sufficient precaution like roof ladders, nets, lifeline, full body harness, etc. is taken while working on fragile roof?				

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7.16	Whether provision is made to arrange duck ladder, crawling board for working at fragile roof?				
7.17	Whether scaffolding has been erected on rigid / firm / leveled surfaces only?				
7.18	Whether scaffold has been inspected by competent person & tagged accordingly prior to being put in use?				
7.19	Whether the scaffolding has been designed for the load to be borne?				
7.20	Whether the erection and dismantling of the scaffolding is being done only by trained persons and under competent supervision?				
7.21	Whether safety net with proper working arrangement and life line has been provided?				
7.22	Others				
8.0	**SAFETY IN CONFINED SPACE**				
8.1	Whether positive isolation is done as per approved blind list and crossed checked by competent person?				
8.2	Whether a permit is obtained to enter a confined space?				
8.3	Whether gas test for hydrocarbon, toxic gas, oxygen level is checked for acceptable limits before entering any confined space and recorded? If levels are beyond permissible limit, whether required PPE like BA, Gas Mask are used.				
8.4	Whether adequate oxygen level is ensured in confined space before entering? If not, whether all precaution like using of Breathing Apparatus set is ensured?				
8.5	In case of chance of ingress of hydrocarbon gases / toxic gases, whether Personnel Monitoring System (PMS) is used ?				

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8.6	Whether only in presence of a supervisor, worker enters in confined space?				
8.7	Whether provision of sufficient means of entry and exit is available?				
8.8	Whether provision of ventilation to remove welding fumes, dust, exhaust gases are made?				
8.9	Whether provision of 24V (Hand lamps with cage as per OISD-STD-155) light for working inside space is made?				
8.10	Is it strictly ensured that stand-by trained persons (2 nos.) are standing outside before a person enters a confined space and communication is being maintained all the time with workers working inside?				
8.11	Whether life belt with one end under control of stand-by person outside is kept while working in confined space?				
8.12	Whether Personnel protective Equipment as specified in the permit are in good condition?				
8.13	Whether boxing up is done only as per the approved procedures and under the supervision of competent persons?				
8.14	Whether all the safety precautions listed in OISD-GDN-192 are taken while working in sewers, OWS etc.?				
8.15	Whether proper house keeping is being maintained inside the confined space?				
8.16	Whether training has been provided to workers working in the confined space and the workers only of sound health are being asked to work in the confined space?				
8.17	Others				
9.0	**SAFETY IN MATERIAL HANDLING**				
9.1	Whether all lifting tools, tackles, machines, chains, ropes etc. are of sound construction, made of sound material and				

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	maintained in good condition?				
9.2	Whether lifting tools & tackles are tested as per norms and safe working load, date of testing visibly marked/painted on the equipment?				
9.3	Whether lifting tools, tackles are of adequate strength for the load to be handled?				
9.4	Whether all parts including the working gears fixed or movable of every lifting machine, chain, rope, tackles specify the following condition: a) Thoroughly examined by competent person at least once a year or such interval as required by statutory authority. b) Document of such examination are maintained and produced to owner supervisor before use of particular equipment?				
9.5	Whether chain blocks and cables are inspected before each use to assure their sound condition?				
9.6	Whether hoist and lift, if used are: a) Properly maintained and thoroughly examined by competent authority at least once in every year. b) A register to be maintained to record particulars of such examination in prescribed forms and shall be produced to the owner supervisor before use.				
9.7	Whether area below the movement of boom of crane is cleared to avoid injury from falling objects?				
9.8	In crane handling area whether it is ensured that crew of truck, leave the truck before starting loading / unloading?				
9.9	Whether transporting material from one place to another is done by suitable				

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	means?				
9.10	Whether carrier with sufficient capacity without projecting parts is used for transporting materials?				
9.11	Whether riggers engaged are well trained and conversant with signaling procedures including night signaling if required?				
9.12	Whether permission of authorized person is obtained before working on or near an overhead crane?				
9.13	Whether trained riggers are available all the time along with crane?				
9.14	Whether barricading has been done to ensure no unauthorised person enters in the working area of the crane?				
9.15	Whether lifting (rigging) plan has been prepared and approved before start of the work?				
9.16	Whether route of crane movement has been planned before the crane moves out of the garage?				
9.17	Whether it has been ensured that no electrical cable comes within 3 meters or safe distance from the boom of the crane?				
9.18	Whether boom is being kept in the horizontal position or locked while idling?				
9.19	Whether material is being stacked / destacked in trucks with the help of wedges to ensure no slippage while loading / unloading takes place?				
9.20	Whether the forklift / crane is being operated only by trained / authorized person?				
9.21	Others				
10.0	**ELECTRICAL SAFETY**				
10.1	Has the Electrical Line Clearance				

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	procedure been followed involving electrical and other concerned Dept. and filling of formats?				
	Whether the "LOTO" system is defined properly and all personnel are aware with the procedure?				
	Whether "LOTO" system is being used in all electrical isolation jobs, by all departments?				
10.2	Have Danger Signs with Voltage rating/ Men at work signboards been displayed at both Sub Station as well as the work site?				
10.3	Has the contractor worker understood the electrical circuit on which he is going to work with probable electrical hazards and mitigation measures to be adopted?				
10.4	Whether contractor has engaged electrician (s) having valid electrical license in line with provisions in Indian Electricity Rules?				
10.5	Have all checks prior to switching operation been carried out and authorisation of owner/ user section obtained subsequently?				
10.6	Have all earthing links on electrical conductors removed before charging the line/ apparatus?				
10.7	Are PPE as prescribed under Indian Electricity Rules available, kept healthy and being used?				
10.8	Are earthing and bonding arrangement of non-current carrying metallic parts in line with provisions of Indian Electricity Rules – 1956 amended time to time as IS: 3043?				
10.9	Have electrical part of OISD-GDN-192 and Clause No. 9.0 for Temporary installations in OISD-STD-173 been understood and followed wherever applicable?				
10.10	Are flexible wires having voltage of 240 volts above earth potential taken through				

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	PVC conduits?				
10.11	Whether portable hand lamps with a voltage rating of not more than 24 volts used with flameproof enclosures in confined spaces within columns, vessels etc?				
10.12	Have the Switches, MCBs, fuses etc. been inspected for proper ratings?				
10.13	Has Earth Leakage Circuit Breaker (ELCB) been used on the incoming side to protect against leakage of current? Is the device tested every time the work is started?				
10.14	Whether all portable appliances are provided with insulated Three pin plugs and socket arrangement?				
10.15	Whether industrial type extension boards and plug sockets are used?				
10.16	Has the electrical equipment brought to site by contractor been inspected by owner's supervisor/ safety officer for damage/cuts/abrasion etc? Is record of Insulation Resistance, wherever required being kept?				
10.17	Have standard practices for termination of conductors/ cables been followed (e.g. use of proper lugs, crimping tool, cable glands etc)? Is cable armour in continuity from feeding point to load?				
10.18	Are the Contractor supervisor and workmen well acquainted with first aid for electrical shock?				
10.19	Are the wires/ cables identifiable along their route towards the load by using colour coding and/or markers?				
10.20	Others				
11.0	**ROAD WORK**				
11.1	Whether site is barricaded and provided with warning signs including night warning lamps/ self glowing markers at appropriate location for diversion of traffic?				

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11.2	Whether mixing aggregates with bitumen is done with the help of batch mixing plants? If no, whether adequate precautions have been taken?				
11.3	Whether road rollers, bitumen sprayers, pavement finishers are driven by experienced drivers with valid driving licenses?				
11.4	Whether the worker handling hot bitumen sprayers or spreading bitumen aggregate mix or mixing bitumen with aggregate are provided with PVC hood, hand gloves rubber shoes (gum boot) with pegging upto knee joints?				
11.5	Others				
12.0	**FORM WORK, REINFORCEMENT**				
12.1	Whether form work, shuttering, shoring etc. are adequately designed and provided to erect the structure and to support the expected load?				
12.2	Whether staging (support) for shuttering is designed for loads like worker movement, impact load and other incidental loads during construction?				
12.3	Whether workers use PPEs at work site like safety shoes, gloves, helmet with chin strap, goggles and dust masks etc.?				
12.4	Whether all safety procedures are adopted while cutting rod?				
12.5	Whether proper staging and bundling is provided for supplying rods at height?				
12.6	Whether sufficient cross bracings are provided for high staging works as per design requirement?				
12.7	Others				
13.0	**CONCRETING**				
13.1	Whether the concreting area is barricaded?				

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13.2	Whether vibrator hoses, pumping concrete accessories are in healthy condition and mechanically strong?				
13.3	Whether it is ensured that no pipe line in concrete pumping system is attached to any temporary strut such as scaffolds etc.?				
13.4	Whether it is checked that safety guards around moving parts are provided in concrete mixer/ machines?				
13.5	Whether earthing of electrical mixers, vibrator etc. are provided?				
13.6	Whether entry of unauthorised person in the concreting area is restricted?				
13.7	Whether adequate lighting arrangement is made in the concreting area if working during night?				
13.8	Whether PPEs like gum boots, gloves, helmet with chin strap, goggles and dust masks etc. are being used?				
13.9	For overhead or underground work, whether form work and shuttering have been checked with respect to design?				
13.10	Whether boom placers are properly secured?				
13.11	Others				
14.0	**DEMOLISHING (DEMOLISHING BY BLAST NOT CONSIDERED)**				
14.1	Whether an initial survey carried out to identify any structural problems and risks associated with flammable substances and substances hazardous to health?				
14.2	Whether sequence of demolition is formulated and approved by competent person after the survey and recorded in a method statement having taken all the various considerations into account and identifying the problems and their solutions?				
14.3	Are non-sparking tools being used, if required?				

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14.4	Is intermittent clearing operation being done to keep the area reasonably tidy and clean?				
14.5	Whether effective barricading has been provided?				
14.6	Whether Electrical and other facilities like water, oil, gas pipelines, etc. have been isolated / protected?				
14.7	Whether required PPEs like helmet with chin strap, goggles, ear plug/muff, hand gloves, safety shoes, dust mask, etc. used?				
14.8	Others				
15.0	**RADIOGRAPHY**				
15.1	Are safety precautions for handling of source as per guidelines of BARC being followed?				
15.2	Is the potency of the source being used within acceptable limits as per the BARC regulations?				
15.3	Is the area being cordoned with proper signs during radiography as per guidelines of BARC?				
15.4	Does proper place exist as per BARC regulations for storage of source / Personnel safety equipment?				
15.5	Does the radiographer have valid certificate of radiography from competent authority (BARC)?				
15.6	Is radiographer using Exposure Meter / Dosi Meter?				
15.7	Whether minimum occupancy of the premises / workplace is being ensured while radiography is in progress?				
15.8	Is permit system being followed?				
15.9	Whether Radiation Safety Officer is				

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	available at site?				
15.10	Others				
16.0	**ADDITIONAL SAFETY PRECAUTION FOR UNITS WITH HYDROCARBONS**				
16.1	Are jobs being carried out with a valid work permit only as per OISD-STD-105 "Work Permit System".				
16.2	Is smoking prohibited in all places containing combustible or flammable materials and "No Smoking" notices prominently displayed?				
16.3	Are only approved type electrical installations and equipment, including portable lamps, being used?				
16.4	Are oily rags, waste, wooden materials and clothes or other substances liable to spontaneous ignition being removed?				
16.5	Are the combustible materials properly shielded in case same cannot be removed from the area?				
16.6	Has welding screens (like metal/ fire retardant cloth/ water curtain) been put up to protect other equipment / facilities/ OWS cement ceiling/ drains in adjoining areas against flying sparks, as may be required?				
16.7	Is Gas-testing being done with the means of a calibrated Gas detection Meter prior to start of Hot work and being done subsequently at regular intervals as per the requirement and recorded?				
16.8	Are regular inspections being done of places where there are fire risks like in the vicinity of heating appliances, electrical installations and conductors, stores of flammable and combustible materials, welding and cutting operations?				
16.9	Are fire-extinguishing equipment being placed at strategic locations and are kept well maintained and inspected at suitable intervals by a competent person?				

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16.10	Are accesses to fire - extinguishing equipment such as hydrants, portable extinguishers and connections for hoses kept clear at all times?				
16.11	Are all supervisors and a sufficient number of workers trained in the use of fire-extinguishing equipment?				
16.12	Are audio means, to give warning in case of fire provided, audible in all parts of the site where persons are liable to work?				
16.13	Is there an effective evacuation plan in place so that all persons are evacuated speedily without panic?				
16.14	Others				
17.0	**EMERGENCY PROCEDURES**				
17.1	Is signaling / siren system effective?				
17.2	Is arrangement for rescuing affected person adequate?				
17.3	Are signs showing emergency exit route installed?				
17.4	Is emergency exit route clear of obstacles?				
17.5	Is communication system adequate?				
17.6	Whether emergency vehicle with driver has been provided to meet any emergency situation?				
17.7	Does any tie-up with hospitals or local doctors exist?				
17.8	Has the assembly point for workers in case of emergency been identified and earmarked?				
17.9	Has training been provided to a few workers for First Aid?				
17.10	Emergency procedure and telephone numbers are known to all and same are prominently displayed at site? (Sample				

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	compliance check)				
17.11	Whether emergency mock drills are being regularly done?				
17.12	Others				
18.0	**WELFARE FACILITIES**				
18.1	Are hygienic conditions prevailing at labour camps?				
18.2	Are First Aid facilities available?				
18.3	Does proper sanitation exist at site office and labour camps?				
18.4	Does any arrangement of medical facilities like tie ups with nearby hospital exist?				
18.5	Is proper drinking water facility available for workmen & staff?				
18.6	Are crèches provided for children (if applicable)?				
18.7	Is any proper place/canteen/restroom provided for eating food and taking rest?				
18.8	Is any place earmarked for storing / keeping clothing?				
18.9	Is adequate washing facility available?				
18.10	Does proper ventilation at working place exist?				
18.11	Others				
19.0	**GENERAL**				
19.1	Are illumination levels at workplace and passages adequate?				
19.2	Is communication system adequate?				
19.3	Are display and caution boards provided at strategic locations?				
19.4	Are road barriers being used for blocking any roads/passage?				

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19.5	Has the structure been adequately secured against storm/high winds during construction/ erection?				
19.6	Are the equipment properly earthed?				
19.7	Are vehicles being checked like brakes, oil, lights etc. on regular basis?				
19.8	Is compressed air being used only for its intended purpose and not for any other purpose?				
19.9	Are only proper clothes and not loose clothes being used while working around machinery?				
19.10	Are nails or other sharp objects being removed or bent?				
19.11	Are machine guards over moving parts of machinery such as coupling, pulley, wheel etc. installed?				
19.12	Whether after maintenance of machinery the guards are securely fitted before putting into operation?				
19.13	Are working platforms / gangways provided with hand rails & toe guards?				
19.14	Are swing platforms provided with chains & secured adequately when not in use?				
19.15	Are the approaches to work sites being maintained & kept clear of obstacles?				
19.16	Whether engines of equipment entering into the operating area have exhaust and muffler system with approved spark arrestor?				
19.17	Whether vehicles/engine driven equipment, electrical equipment and tools used are certified?				
19.18	Whether contractors inform his workers about hazards and safe procedures?				

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19.19	Whether sufficient care is taken so that spark do not go outside working enclosure & falls below?				
19.20	Whether contractor's qualified / trained supervisor is present?				
19.21	Whether all exhausts of engines are provided with approved type of flame arrestors and exhaust is not facing toward the place where the workers are working?				
19.22	Others				

Signature of the Auditor

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RELEASE OF FRONT TO THE CONTRACTOR

[ANNEXURE - XVII TO SPECIAL CONDITIONS OF CONTRACT]

EIL COMMITMENTS VIS-A-VIS SUPPLIER COMMITMENTS FOR TENDERs

Fronts shall be released to the contractor as per the following.

	Drawing front	Physical front (Corresponding to drawing)	Remarks
On award of work	100%	100%	Time extension due to non-availability of Drawing and/or Physical front shall be considered only if the progress of work is corresponding to the work fronts released.

Note:- Contractor to take approval from regulatory authority prior to work.

INSURANCE EXIBIT
[EXIBIT –I TO SPECIAL CONDITIONS OF CONTRACT]

1. CONTRACTORS LIABILITY INSURANCE

1.1 The Contractor shall purchase and maintain at its cost and expenses and in accordance with the terms set forth in sub paragraph 1.2 of this Exhibit-I during the duration of the Contract Schedule, till Final Acceptance, from an insurance company in India such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's performance of the Work or otherwise under the Contract, whether such claim may arise due to action or omission by the Contractor or a Subcontractor or by anyone directly or indirectly contracted or used by any of them, or by anyone for whose acts any of them may be liable:

a) claims under workers or workmen's compensation, disability benefit and other similar employee benefit acts, which are applicable to the Work to be performed;

b) claims for damages because of bodily injury, occupational sickness or disease, or death of employees of the Contractor or any Subcontractor;

c) claims for damages insured by usual personal injury liability coverage, which are sustained by a person as a result of an offence directly or indirectly related to employment of such person by the Contractor;

d) claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle and/or marine craft or vessel and/or aircraft as applicable, if used in the performance of the work; and

e) Claims involving contractual liability insurance applicable to the Contractor's obligations under the Contract which are not insured under para 2.1 mentioned hereinafter;

f) Any other mandatory/obligatory insurance which the Contractor may be required to effect and keep in force, in accordance with Applicable Laws of India and other countries as and where applicable. The Contractor shall defend, indemnify, and hold the Owner harmless for any liability or penalty which maybe imposed by any Governmental Authority by reason of any asserted violation by the Contractor or Subcontractor of any mandatory/obligatory insurance requirement, including but not limited to those listed in (a) to (e) above, and also from all claims, suits or proceedings that maybe brought against the Owner arising under, or growing out of or by reason of the Work provided for by this Contract, whether brought by employees of the Contractor or by third parties.

g) The Contractor shall use all reasonable endeavors to ensure that its subcontractors (and their respective direct and indirect Subcontractors) maintain insurance similar to the insurance required of Contractor under para 1.1 with limits of liability and levels of deductibles acceptable to Contractor.

h) All policies of insurance required to be maintained by Contractor shall:

   (i) provide a severability of interests or cross liability clause,

   (ii) name the Owner and the Lender as additional insureds for their respective interests;

   (iii) provide that the interests of the Owner and the insureds shall not be invalidated by any action or inaction of the Contractor and shall insure Owner notwithstanding the breach of any warranties by the Contractor, the breach of any policy condition by the Contractor or misrepresentation by the Contractor

i) All policies of insurance referred to in para 1.1 shall be endorsed to specify that they are primary to and not excess to or on a contributing basis with any insurance or self-insurance maintained by

the Owner and the Contractor (and their respective Affiliates) or any Subcontractors in respect of losses arising out of or in connection with the Work. A confirmation to the effect from the Insurer of the Contractor would be required.

1.2 The insurance required under paragraph 1.1 should be written for not less than the limits of liability specified and/or required by Indian Law. Coverage, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment.

1.3 Certificates of insurance evidencing the above referred insurance, acceptable to the Owner, shall be filed with the Owner prior to thirty (30) Days of the commencement of physical execution of relevant part of the Work. The certificates and the insurance policies required under paragraph 1.1 of this Exhibit-I shall contain a provision that coverage afforded under the policies will not be cancelled or allowed to expire until at least sixty (60) Days prior written notice has been given to the Owner. If any of the foregoing insurance coverage are required to remain in force after Final Payment and are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the final invoice for payment under the Contract.

1.4 The Contractor, at its cost and expense, in the interest of the Work, shall maintain adequate insurance during the duration of the Work in respect of the Contractor's Equipment including Third party liability insurances as required by Law in respect of such equipment.

1.5 The Contractor shall at its cost and expense, purchase, secure and maintain such insurance as may be required or necessary in foreign country (under Applicable Law in connection with its performance of its obligations under the Contract).

1.6 The Contractor shall use all reasonable endeavors to ensure that its Sub contractors (and their respective direct and indirect sub-contractors) maintain insurance similar to the insurance required of Contractor in paragraph 1.1 with limits of liability and levels of deductibles acceptable to the Contractor and the Owner.

2. OWNER LIABILITY INSURANCE-

2.1 Third Party Liability

The Owner shall purchase and maintain an insurance (hereinafter referred to as "Owner Liability Insurance") during the duration of the Work, with an insurance company in India, in the joint names of the Owner, Lender(s), Contractor and Subcontractors, Owner Liability Insurance arising from their performance under the Contract. Such insurance shall be arranged for a limit of Rupees 25 Crore for any one occurrence with no deductibles for death/bodily injury and with standard deductibles for property loss/damage and such policy shall have an aggregate limit during the period of policy. Such cover shall include a cross liabilities clause to protect the liability of one insured party against another provided nothing contained in the said clause shall extend the insurer's total liability for any one occurrence beyond the limit agreed to pursuant to this subparagraph.

3. OWNER PROPERTY INSURANCE

3.1 The Owner shall purchase and maintain an insurance (hereinafter referred to as "Owner Property Insurance") during the duration of the Work, with an insurance company in India, with coverage as follows:

(a) Marine cargo insurance for all Plant and Equipment and materials to be installed as part of the Work, in transit from anywhere in the world to anywhere in the world, on a 'warehouse to warehouse' basis against loss or damage arising from customary all risks' perils (including war, strikes, riot and civil commotion) while in transits by conveyances and vessels and/or vessels and/or air and/or barge and/or road and/or rail and/or any other conveyance by land, sea or air and connections, including during loading, unloading and temporary storage, up to full replacement value of such equipment and Materials on a basis of valuation including costs, insurance, freight charges plus customs duties plus anticipated future escalation of 10% (i.e. CIF plus 10%).

(b) Erection–All Risk Insurance for all works & temporary works at the Site up to the full replacement value including import duties plus anticipated future escalation of 10%.

(c) The sum insured under the Owner Property Insurance shall cover and be based on the estimated Project Cost and the likely impact of inflation in the economy, at all times during the Contract Schedule. Such cover shall include physical loss or damage during the maintenance period (not exceeding 12/24 months as available) arising from operations carried out by the Contractor, Sub Contractors for the purpose of complying with their obligations under any maintenance conditions of the Contract during the Defects liability period agreed in the Contract.

(d) Such insurance shall carry deductibles, an indication of which is given below:

(i) Fire and Explosion/ Testing & Commissioning/ Design Defect/ Act of God Perils/ Maintenance - 15% of Claim Amount Subject to Minimum INR 75,000,000 each and every loss.

(ii) All Other Perils including TPL: 5% of Claim Amount subject to Minimum INR 50,000,000 each and every loss.

In the event of a claim, the deductibles will be borne by the Contractor.

3.2 Marine Cargo insurance shall be based on the following indicative conditions:

- Institute Cargo Clauses (A) CL382 dated 1/1/09.
- Institute War Clauses (Cargo) CL385 dated 1/1/09.
- Institute Strikes Clauses (Cargo) CL386 dated 1/1/09.
- Institute Cargo Clauses (AIR) CL387 dated 1/1/09 (excluding sending by post).
- Institute War Clauses (AIR CARGO) CL388 dated 1/1/09 (excluding sending by post).
- Institute Strike Clauses (AIR CARGO) CL389 dated 1/1/09.
- Institute Classification Clause CLS354 dated 1/1/01.
- Institute Radioactive Contamination, Chemical Biological, Bio-Chemical and Electromagnetic Weapons Exclusion Clause 10/11/03.
- Warranties & Exclusions

- Excluding Mechanical &/or Electrical Derangement unless caused by an insured peril.
- Excluding Rusting, Oxidization & Discoloration of unprotected &/or unpainted items &/or all on deck shipments unless caused by an ICC (C) Clause peril.
- Communicable Disease Exclusion
- Over Dimensional Cargo Survey Warranty
- Excluding shipments from Cuba, North Korea, Syria, Iran and Crimea absolutely.
- HRA Warranty & Specified Territory Exclusion (Russia, Ukraine, Belarus) & Excluding War, Strikes, Riots and Civil Commotion Risks for all transits to, from and within Ukraine, Ukraine territorial waters, Russian Black Sea territorial waters, Sea of Azov, Russian Black Sea ports, Sea of Azov ports and Russian territories within 200kms of the Ukrainian border in Marine.
- War, Strikes, Riots and Civil Commotion Risks for marine import subject to JCC Global Cargo Watch List.
- Sanction Limitation and Exclusion Clause
- Paramount War Clause
- No Cover for unexplained shortages
- Institute Cyber Attack Exclusion Clause
- Five Power War Clause
- War & SRCC exclusion for High-Risk Areas.
- General conditions to be agreed.
- Any other warranties & exclusions as applicable at the time of policy placement.
- The above coverages, warranties, exclusions shall be as per the latest available wordings at the time of placing the policy.

3.3 Erection All Risk insurance shall be on an all-risk of physical loss or damage policy form. Cover Note will be available prior to the commencement of physical execution of relevant part of the Work, but the policy form will be based on the following conditions or an alternative form to be advised:

Standard Erection All Risks Policy plus indicative endorsements:

- SRCC/RSMD Cover
- Extended Maintenance for 2 years from Mechanical Completion
- Overtime, Night Work and Express Freight
- Airfreight
- Structures in Earthquake Zones
- Design Improvement Exclusion DE3 (1995) or LEG 2/96
- Fire Fighting Facilities
- Civil Engineering Works
- Clearance of Debris
- Surrounding Property
- Architects & Consulting Engineers Fees
- Including inland transit and offsite storage of indigenous supplies

- Including offsite storage of foreign goods not otherwise insured under the Marine Cargo Policy
- Wet Risk Exclusion
- Pro-rata extension of policy period subject to Loss Ratio not exceeding 50%.
- Multiple Insured's Clause.
- Cut Through clauses acceptable to the Lenders. or any other variation as is achievable.
- Standard Exclusions
- Any other warranties & exclusions as applicable at the time of policy placement.
- The above coverages, warranties, exclusions shall be as per the latest available wordings at the time of placing the policy

3.4 The coverage referred to above shall be set forth in full in the respective policy forms as and when taken as per availability in international/domestic markets and as is reasonable in view of the exposures involved at reasonable cost.

3.5 If any of the Owner's Property Insurance policies provides for minimum deductibles, loss or cost, to the extent of such deductibles, the liability shall be to the account of the Contractor. If deductibles are not identified in the insurance documents, the Owner shall notify the Contractors prior to the commencement of the Work of the required minimum deductibles and the Contractor shall pay costs not covered on account of such deductibles.

3.6 If the Contractor requests in writing that insurance for risks other than those described herein or for other special hazards be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

3.7 If during the Contract Schedule the Owner insures properties, real or personal or both, adjoining or adjacent to the Site by property insurance under policies separate from those insuring the Project, or if after Final Payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the Contract Schedule, the Owner shall waive all rights in accordance with the terms of Subparagraph 2.10 for damages/loss caused by perils under this policy. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

3.8 Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project.

3.9 The contractors / sub-contractors will comply with all the terms and conditions of the insurance policy and for any breach of conditions which results in denial of insurance claim, the contractor will be responsible and hold the owners harmless for such breach of warranties / conditions.

3.10 Waivers of Subrogation. The Owner, the Lender(s) and Contractor and their respective insurers waive all rights against each other and any of their Subcontractors, agents and employees, each of the other, for damages caused by perils to the extent proceeds are recovered under the Owner's Property Insurance and Owner Liability Insurance obtained pursuant to this Paragraph 2, except such rights as they have to the proceeds of such insurance held by the Owner as fiduciary. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not

pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

3.11 All matters pertaining to post purchase of the Owner Property Insurance and Owner Liability Insurance such as but not limited to filing claim intimations, arrangement of surveys, documentation, declarations and /or any other requirements as stipulated or as may arise or as required by the insurers shall be performed by the Contractor. All losses in excess of the amounts insured, or all losses or insurance claims not recoverable either totally or partially from insurance company(ies), or any deductible under the insurance policies; shall be to the account of the Contractor.

3.12 A loss insured under Owner Property Insurance and Owner Liability Insurance under Paragraphs 1 and 2, shall be adjusted by the Contractor as fiduciary and made payable to the Contractor as fiduciary for the insured, as their interests may appear, subject to requirements of any applicable Lender's clause and of Paragraph 3.13. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, the Contractor shall require Subcontractors to make payments to their Subcontractor and/or agents in similar manner.

3.13 Under no circumstances shall the Contractor sign the discharge voucher for the full and final settlement of any loss payable under the Owner Property Insurance and Owner Liability Insurance, over an amount of US Dollars 5,000 or equivalent Indian rupees without the written approval of the Owner. In case of issue of any discharge voucher without the written approval of Owner as above, the difference in amount, if any, between the amount claimed or the actual loss suffered under the insurance and amount of settlement by the insurers, shall be borne by the Contractor.

3.14 The Contractor as fiduciary shall have power to adjust and settle a loss, payable under the Owner Property Insurance and Owner Liability Insurance, with insurers unless one of the parties in interest shall object in writing within five (5) days after occurrence of loss to the Contractor's exercise of this power; if such objection be made arbitrators shall be chosen as provided in the arbitration agreement of the Contract. The Owner as fiduciary shall, in that case, make settlement with insurers in accordance with directions of such arbitrators. If distribution of insurance proceeds by arbitration is required, the arbitrators will direct such distribution.

3.15 Partial occupancy or use in accordance with agreed Contract conditions shall not commence until the insurance company or companies providing Owner Property Insurance and Owner Liability Insurance, have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

BIDDING DOCUMENT

FOR

HDPE PIPELINE LAYING & INSTALLATION

(BIDDING DOCUMENT NO.: RCM/B862-ST-VB-T-9003/03)

PROJECT: PDH PP PLANT WITH ETHANE AND PROPANE STORAGE AND HANDLING FACILITIES AT DAHEJ, GUJARAT

PART-II OF III : PRICED PART

NAME OF WORK: **HDPE PIPELINE LAYING & INSTALLATION FOR PDH PP PLANT WITH ETHANE AND PROPANE STORAGE & HANDLING FACILITIES AT DAHEJ, GUJARAT**

BIDDING DOCUMENT NO. : **RCM/B862-ST-VB-T-9003/003**

PREAMBLE TO SCHEDULE OF PRICES

1 The Schedule of Rates shall be read in conjunction with all other sections of this Bidding Document.

2 The Contractor is deemed to have studied the drawings, specifications and details of works to be done within the Time Schedule and should have acquainted himself of the conditions prevailing at site.

3 The quantities shown against the various items are only approximate and may vary to any extent individually subject to conditions given in General Conditions of Contract/Special Conditions of Contract.

4 No claim shall be entertained during currency of this Contract towards any items due to the above including where the CONTRACTOR has quoted low/ high rates.

5 EIL/OWNER reserves the right to interpolate or extrapolate the rates for any new item of work not covered in Schedule of Rates from the similar items already available in schedule of rates. In case any activity though specifically not covered in schedule of rates descriptions but the same is covered under scope of work/ scope of supply/ specification/ drawings etc. no extra claim on this account shall be entertained, since Schedule of Rates is to be read in conjunction with all other documents forming part of the Contract.

6 All items of work mentioned in the Schedule of Rates shall be carried out as per the specifications, drawings and instructions of EIL/ OWNER and the rates are deemed to be inclusive of material, consumable, labour, supervision, tools & tackles and detailing of construction/fabrication drawings, isometric wherever required as called for in the detail specification and conditions of the Contract.

7 Bidder shall furnish this Form duly filled in all respects along with unpriced part.

8 The quoted price shall be deemed to be inclusive of all taxes and duties except “Goods and Services Tax” (GST) as per Provisions of taxes & duties specified in SCC.

9 Any errors of interpretation of applicability of taxes/duties by bidders shall be to their account.

10 **Pre-filled SOR with prices is enclosed herewith as FORM SP-0. Bidders shall quote their prices as single percentage increase / decrease in terms of percentage upto 2 decimal places on total estimated value/price in the “SUMMARY OF PRICES [FORM SP-0]”. This percentage increase / decrease as quoted by the bidder will apply uniformly to all items of FORM SP-1. Bidder shall not change Pre-filled rate/amount indicated in ‘Schedule of Rates / Price’ (FORM SP-1).**

11 Employer/Consultant reserves the right to cancel/ delete/ curtail any item or group of work if necessary. Such a step shall not be construed as reason for changing the rates.

Name of authorized person submitting the tender on behalf of the Bidder (s):

Designation of authorized person:

Name of firm / Contractor:

Address of firm / Contractor:

Date:

SCHEDULE OF RATES
(SP-0) (BoQ1)

Validate Print Help

Percentage BoQ

Tender Inviting Authority: EIL on behalf of PLL

Name of Work : HDPE PIPELINE LAYING & INSTALLATION

Bidding Document No.: RCM/B862-ST-VB-T-9003/03

Name of the Bidder/ Bidding Firm / Company :	

SUMMARY OF PRICE [FORM SP-0]

1. This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only.

2. If percentage is not quoted in Col. 5 of Form SP-0, it shall be considered "NIL" for price evaluation/award.

3. Bidder to select appropriate percentage option from "Percentage Option [Excess (+), Less (-)]"

NUMBER #	TEXT #	NUMBER #	TEXT #	NUMBER	NUMBER #	TEXT #
Sl. No.	Item Description	Quantity	Units	Estimated Rate in Rs. P	TOTAL AMOUNT Without Taxes in Rs. P	TOTAL AMOUNT In Words
1	2	3	4	5	6	7
1	**HDPE PIPELINE LAYING & INSTALLATION** **(BIDDING DOCUMENT NO.: RCM/B862-ST-VB-T-9003/03)** **(For details refer pre-filled rate as per Form SP-1)**	1.00	Lumpsum	13584640.00	**13584640.00**	INR One Crore Thirty Five Lakh Eighty Four Thousand Six Hundred & Forty Only
Total in Figures					**13584640.00**	INR One Crore Thirty Five Lakh Eighty Four Thousand Six Hundred & Forty Only
	Percentage increase/ decrease on Total estimated cost as stated in COL.6 above, applicable uniformly on all items of pre-filled SOR		**Select**		**0.00**	INR Zero Only

DETAILED SCHEDULE OF RATES

(PRE-FILLED)

(FORM SP-1)

SL. NO.	DESCRIPTION	QTY	UOM	Unit Rate	Total Cost
	SUPPLY & INSTALLATION OF UNDERGROUND HDPE PIPELINE WITHIN PLL BOUNDARY LIMITS:				
1	Design & Detailed Engineering for installation of pipeline & associated facilities, Procurement, supply and delivery of 160 mm (6") nominal outer diameter (OD) HDPE pipes of Standard dimension ratio (SDR) 11, material grade PE -100 & PN 12.5 conforming to IS 14333/2022 & IS - 4984/2016 and their latest version or amendments in standard lengths; Transportation including loading, unloading, handling, stacking, hauling and stringing of pipes to contractor's worksite(s)/ workshop(s)/ pipeline Right-Of-Use (ROU), including arranging all pipe trailers, cranes, arranging all necessary intermediate storage area(s) required thereof till the complete pipeline system is permanently installed; Loading, unloading, handling, stacking, storing and transportation to workshop(s)/ work site(s) of all materials (other than HDPE pipes) that may be used for the construction of pipeline system; Mobilizing and providing all equipment, manpower (skilled and unskilled), consumables and other resources etc., as required for the execution of complete work and thereafter demobilizing the same upon completion of work; Laying/ Installation of pipeline, associated fittings and accessories, etc. as per specifications, standards, drawings, other provisions of Contract and Instructions of Engineer-in-Charge; Supply & Installation of all materials whatsoever, as required for carrying out complete works. Supply of all materials, consumables, equipment, labor, etc; Staking and installation of construction markers, clearing, grubbing, grading (as required) of Standard Right-of-Use (ROU) / Right of Way (ROW); Cutting Trees, if required; Counting the number and type of trees cut in presence of DFO/ concerned authorities and keeping record thereof; Carrying out welding as per butt fusion welding using hydraulic operated HDPE welding machine to form required lengths as per tender document using low pressure fusion procedures as per ISO 21307 including testing thereof; Thorough internal cleaning of all pipes by suitable methods to remove debris, shots, grits etc.; Stringing of pipes along Standard ROU/ ROW including providing straw bags, soft padding/sand padding; Trenching to all depths and to a width to accommodate the pipeline as specified in Scope Document by excavation in all types of soil/ strata (including Normal Strata/ Hard Strata/ Hard Rock) & terrain(s), blasting, chiseling or otherwise cutting etc.; Providing Warning Devices (Mat/ Tape or Mesh), as required; Providing trench padding as required with sand/ graded earth approved by Engineer-in-Charge; Lowering the pipelines in trench, adhering to all safety norms implied by the PLL, providing required padding over and around the pipeline with sand/graded material approved by Engineer-In-Charge, backfilling with available approved excavated material and/or other suitable soil approved by Engineer-In-Charge; Carrying out hydrostatic testing including air cleaning, flushing, filling, pressurization of complete pipeline as approved by Engineer-In-Charge to the specified test pressure, providing all equipment, pumps, fittings, instruments, dead weight tester, all types of temporary flushing & cleaning devices etc., and services, supervision, labor, consumables, arranging adequate quantity of water of suitable quality required for hydrostatic testing, air, etc. as required, locating of leaks and rectification of defects, re-testing after rectification, successful completion of hydro-testing of pipeline including all tie-in(s) with the pipeline/ piping installed by others; Carrying out all temporary, ancillary, auxiliary works and all incidental works required to make the pipeline ready for pre-commissioning; Final clean-up and restoration of right of use/ right of way including obtaining work permits/ NOCs as required and disposal of debris; Restoration of land, facilities and boundary wall etc. at associated facilities dismantled/damaged by the Contractor during construction; Obtaining work permits/ NOC from various statutory authorities having jurisdiction and complying with all stipulation/ conditions/ recommendation of the said authorities; Preparation of As-Built drawings, pipe-book and other records. SOR shall be read in conjunction with drawings, scope of work, specifications, standards and other provisions of contract document. **All above works for 160 mm (6") Nominal OD HDPE SDR-11 Pipe in Generally Flat Terrain with Normal Strata**	300	m	2,520	7,56,000

SL. NO.	DESCRIPTION	QTY	UOM	Unit Rate	Total Cost
	SUPPLY & INSTALLATION OF ABOVEGROUND HDPE PIPELINE FROM PLL BOUNDARY WALL TO GIDC PUMPING STATION BOUNDARY:				
2	Design & Detailed Engineering for installation of pipeline & associated facilities, Procurement, supply and delivery of 160 mm (6") nominal outer diameter (OD) HDPE pipes of Standard dimension ratio (SDR) 11, material grade PE -100 & PN 12.5 conforming to IS 14333/2022 & IS - 4984/2016 and their latest version or amendments in standard lengths; Transportation including loading, unloading, handling, stacking, hauling and stringing of pipes to contractor's worksite(s)/ workshop(s)/ pipeline Right-Of-Use (ROU), including arranging all pipe trailers, cranes, arranging all necessary intermediate storage area(s) required thereof till the complete pipeline system is permanently installed; Loading, unloading, handling, stacking, storing and transportation to workshop(s)/ work site(s) of all materials (other than HDPE pipes) that may be used for the construction of pipeline system; Mobilizing and providing all equipment, manpower (skilled and unskilled), consumables and other resources etc., as required for the execution of complete work and thereafter demobilizing the same upon completion of work; Laying/ Installation of pipeline, associated fittings and accessories, etc. as per specifications, standards, drawings, other provisions of Contract and Instructions of Engineer-in-Charge; Supply & Installation of all materials whatsoever, as required for carrying out complete works. Supply of all materials, consumables, equipment, labor etc.; Staking and installation of construction markers, clearing, grubbing, grading (as required) of Standard Right-of-Use (ROU) / Right of Way (ROW); Cutting Trees, if required; Counting the number and type of trees cut in presence of DFO/ concerned authorities and keeping record thereof; Carrying out welding as per butt fusion welding using hydraulic operated HDPE welding machine to form required lengths as per tender document using low pressure fusion procedures as per ISO 21307 including testing thereof; Carrying out repairs of pipe and coating defects; Thorough internal cleaning of all pipes by suitable methods to remove debris, shots, grits etc.; Stringing of pipes along Standard ROU/ ROW including providing straw bags, soft padding/sand padding; Carrying out hydrostatic testing including air cleaning, flushing, filling, pressurization of complete pipeline as approved by Engineer-In-Charge to the specified test pressure, providing all equipment, pumps, fittings, instruments, dead weight tester, all types of pigs etc., and services, supervision, labor, consumables, arranging adequate quantity of water of suitable quality required for hydrostatic testing including, air, etc. as required, locating of leaks and rectification of defects, re-testing after rectification, successful completion of hydro-testing of pipeline; including all tie-in(s) with the pipeline/ piping installed by others; Carrying out all temporary, ancillary, auxiliary works and all incidental works required to make the pipeline ready for pre-commissioning; Final clean-up and restoration of right of use/ right of way including obtaining work permits/ NOCs as required and disposal of debris; Restoration of land, facilities and boundary wall etc. at associated facilities dismantled/damaged by the Contractor during construction; Obtaining work permits/ NOC from various statutory authorities having jurisdiction and complying with all stipulation/ conditions/ recommendation of the said authorities; Preparation of As-Built drawings, pipe-book and other records. SOR shall be read in conjunction with drawings, scope of work, specifications, standards and other provisions of contract document. **All above works for 160 mm (6") Nominal OD HDPE SDR-11 Pipe in Generally Flat Terrain with Normal Strata**	1250	m	2,430	30,37,500
3	**ABOVE GROUND PIPE SUPPORT WORKS** Carrying out piping support design for above ground pipeline along with generation of piping support drawings, Supply of all materials required for fabrication of pipe supports & special supports including supply of bolts, nuts, washers, U Clamps, Neoprene Pads, Insert Plates (as required) etc. as mentioned in the drawing/ standards and as defined in scope of work document, fabrication and erection of pipe/ equipment supports (for all sizes/ thickness) including shoes, pipes, cradles, turn buckles, T-posts for all types of guides, anchors etc. if applicable, all necessary equipment, consumables, labor etc. for completing all works. All structural and mechanical works including supply of all required materials required, including construction of foundations (PCC/ RCC works) for pipe supports and sleepers, fabrication and erection of supporting structural elements for piping such as shoes, pipes, T posts, cradles, clamps, anchors, guides, insert plates etc.; Providing TType pipe supports, based on EIL Std. 7-44-0636 at a maximum spacing of 3.0 m along the aboveground pipeline route for supporting the HDPE pipeline without sagging including clamp type guides (without restraining axial movement) as per EIL Std. 7-44-0635 with minimum 6 mm thick neoprene rubber liner between the HDPE pipe and the support to avoid point loading, abrasion and local flattening; Providing additional supports near valves, fittings, and changes in direction; Providing anchors near pumps & structures. , supply and application of paints and primers suitable for painting environment as defined in contract document and as per standard specification for Surface preparation and protective coating and completing the work as per drawings, scope of work, specifications, standards, other provisions of Contract and instruction of Engineer-in-Charge. All works as defined below:				
3.1	**PCC WORKS:** Providing and laying PLAIN CEMENT CONCRETE for all depths below and up to plinth level in foundations, drains, fillings, non-suspended floors, pavements & ramps or any other works etc. including shuttering, tamping, ramming, vibrating, curing etc. all as specified in any shape, position, thickness and finishing the top surface rough or smooth as specified and directed all complete for concrete of nominal mix 1:5:10 by mass (1 Cement: 5 Coarse Sand: 10 Crushed Stone Aggregates/Gravels) with 40mm and down size graded crushed stone aggregates/Gravels. ALL MATERIALS INCLUDING CEMENT SUPPLIED BY THE CONTRACTOR.	12	m^3	6,760	81,120
	RCC WORKS:				

SL. NO.	DESCRIPTION	QTY	UOM	Unit Rate	Total Cost
3.2	Providing and laying REINFORCED CEMENT CONCRETE OF M-30 GRADE with 20 mm and down size graded crushed stone aggregates/ gravel in SUB-STRUCTURE, applying cement wash on concrete surface (wherever no other surface application is specified), providing pockets, openings, recesses, chamfering, etc., wherever required, vibrating, tamping, curing and rendering if required to give a smooth and even surface etc. (EXCLUDING THE COST OF REINFORCEMENT, SHUTTERING & BI-POLAR ADMIXTURE) for all depths below and up to plinth level in any shape, position and thickness etc. all complete as specified, shown and directed. ALL MATERIALS INCLUDING CEMENT SUPPLIED BY THE CONTRACTOR.	40	m^3	9,930	3,97,200
3.3	**RCC REINFORCEMENT:** Supplying and placing in position HIGH YIELD-STRENGTH DEFORMED STEEL BARS REINFORCEMENT of Grade Fe550D (TMT) conforming to IS:1786, for RCC work including transporting the Steel, straightening, cleaning, decoiling, cutting, bending to required shapes and lengths as per details, binding with 18 SWG black soft annealed binding wire at every intersection, supplying and placing with proper cover blocks, supports, chairs, overlaps, welding, spacers, fan hooks etc. for all heights and depths etc. all complete as directed. SUPPLY OF ALL MATERIAL IN CONTRACTOR'S SCOPE.	21	MT	92,600	19,44,600
3.4	**SHUTTERING WORKS:** Providing and fixing CENTERING AND SHUTTERING in foundations, pedestals, pipe sleepers, columns etc. for all depths below and up to & inclusive of plinth level including shuttering for single pour concreting, strutting, bracing, propping etc., keeping the same in position during concreting and removal of the same after specified period etc. for Straight/ Inclined Shuttering, keeping necessary provision for inserts, projecting dowels, anchor bolts or any other fixture etc. all complete and as specified and directed.	300	m^2	580	1,74,000
3.5	**STRUCTURAL STEEL:** Supplying, transporting, storing, fabricating & erecting in position and testing/ examining bolted and/ or welded STRUCTURAL STEEL WORKS of Grade E250A / E250BR / E250B0 (confirming to per IS:2062) at all locations and levels including all built-up sections/ compound sections made out of rolled sections and/or plates/ bent plates in all types of structural frameworks or any other structural items or accessories to support equipment, piping, etc., cutting to required size, straightening/ bending if required, edge preparation, cleaning, preheating, bolting/ welding of joints, (including sealing the joints of box sections with continuous welding and plugging any open ends & holes of box sections), finishing edges by grinding, fixing in line and level with temporary staging & bracing and removal of the same after erection, grouting with Ordinary Grout or premix free flow Non-shrink Grout as specified, including preparation and submission of detailed fabrication drawings, preparing the surface for painting (SSPC-SP-10) and applying pre-erection/ shop primer (1 coat of F-9 @ 65-75 micron DFT) & all final painting works as per EIL Specification No. 6-79-0020 (or as per Job Specification, wherever applicable) after fabrication etc., all complete. SUPPLY OF ALL MATERIAL IN CONTRACTOR'S SCOPE.	15	MT	1,17,750	17,66,250
3.6	**ANCHOR BOLTS:** Supplying, fabricating, fixing and keeping in position at all levels and locations THREADED ANCHOR BOLTS of all diameters and nomenclature including nuts, washers, anchor plates, pipe sleeves etc. in foundations, columns, pedestals, slabs, beams, walls etc. or any other place as directed including handling & transporting, straightening if required, turning from relevant size M.S. rounds to required diameter, threading, welding, providing necessary templates and auxiliary dummy structures, if any, necessary tying and welding with reinforcement, adjustment of shuttering & reinforcement/any other fixture, greasing exposed metal surfaces, covering bolts and packing the sleeves with jute cloth etc. all complete as specified and directed.(SUPPLY OF ALL MATERIALS IN CONTRACTOR'S SCOPE).	3	MT	1,35,900	4,07,700
3.7	**EARTHWORK EXCAVATION IN SOIL** Earth work in EXCAVATION below ground level for all kinds of works in ALL TYPES OF SOILS for a depth up to 1.5m including removal of vegetation, shrubs and debris, cutting and dressing of sides in slopes, levelling, grading and ramming of bottoms, dewatering of accumulated water from any source and keeping the surface dry for subsequent works and disposal or stacking of excavated material within a lead of 100m, as directed including providing temporary supports to existing service lines like water pipes, sewage pipes, electric overhead and underground cables etc. all complete.	100	m^3	330	33,000
3.8	**BACKFILLING AFTER EXECUTION OF WORK** BACKFILLING after execution of the WORK to proper grade and level with selected materials from available excavated soil from spoil heaps within a lead of 100m, including re- excavating the deposited soil excavated earlier, breaking clods, laying at all depths and heights in layers of thickness not exceeding 15 cm watering, rolling and ramming by manual methods/ mechanical compactors to achieve 90% laboratory maximum dry density, dressing, trimming etc. in foundations, plinths, trenches, pits etc. all complete.	50	m^3	270	13,500
3.9	**BI-POLAR CONCRETE PENETRATING CORROSION INHIBITING ADMIXTURE** Supplying and mixing of approved brand of bi-polar concrete penetrating corrosion inhibiting admixture (confirming to EIL Specification No. 6-68-0017) in concrete as per manufacturer's specification for protection of reinforcement against corrosion. Supply of admixture in Contractor's scope.	130	kg	211	27,430
	PILING WORKS				
3.10	Construction of Bored cast-in-situ RCC straight shafted piles as specified in specific requirements and as per items given below by approved techniques to depths specified using stone chips of 20mm and down size, through all types of soil strata, maintaining borehole sides in position by bentonite slurry by suitable method, tremie concreting, supply of necessary material including plasticizers if required, mobilization of piling rigs and other ancillary equipment / accessories as specified including demobilization etc. complete, labor & carry out any ancillary work adjunct to piling work, disposal of surplus materials including earth, muck etc. beyond specified lead, shifting plant and equipment from one pile location to another, all complete as per specifications, drawings & direction of Engineer-in-charge (Cost of reinforcement is excluded, cement supplied by contractor at his own cost and duly approved by Engineer-in-Charge). Diameter of pile 300 mm, Length below COL 5 M, Grade of concrete M30	1500	m	1,540	23,10,000

SL. NO.	DESCRIPTION	QTY	UOM	Unit Rate	Total Cost
	Conducting INITIAL PILE LOAD TESTS by direct loading on piles as per specifications and directions of Engineer-in-Charge,				
4	**SHALLOW HDD WORKS:** Complete work for crossings by shallow Horizontal Directional Drilling method in accordance with specifications, SCOPE OF WORK and as per approved Horizontal Directional Drilling Design & Methodology, in concurrence with Site/ Owner; Installation of 12" CARBON STEEL CASING PIPE FOR SUBDUCTING 6" HDPE pipeline across canal/ drain/ road/ other crossings by shallow horizontal directional drilling method in Normal Strata (Soft Soil/ Sand/ Clay/ Silty Sand/ Silty Clay etc.), including all additional drilled lengths necessitated by Contractor's engineering, design & based on site conditions; Mobilization and demobilization; Trial pit(s) for underground utility identification, Preparation of ramps and temporary launching and receiving pit(s) at entry & exit side of rig & restoration of the same after completion of work, Engineering, Preparation of crossing drawings and detailed construction method statement; supply of all materials (including casing insulators and casing end seals, materials for casing vents and drain assemblies etc.), all consumables, equipment, machinery, manpower and other resources; acquiring all additional land required for Contractor's storage, fabrication & construction; Carrying out inspection and repairs including supply of all repair materials; Handling, transportation and unloading of pipes; Preparation of string including BUTT FUSION welding, pre-post hydro-testing of completed string; Cutting of pipes, if required; Installation of pipeline as required by shallow horizontal directional drilling to the specified depth as per approved methodology; Disposal of corrosion inhibited water & bentonite as directed by Engineer In charge; Restoration and clean-up etc.; Preparation of as-built drawings, documents and other records etc.; Obtaining NOCs from relevant authorities & owners; Obtaining approval from Company for the design, engineering, calculations, drawings & documents; Carrying out all works in accordance with Scope of Work/ Standard/ Job specifications, drawings, in compliance to statutory authorities requirement & all provisions of the tender document and as per instructions of Company/ Engineer-Incharge. All above defined works for **Shallow HDD of 323.9 mm (12.75") OD x 6.35 mm WT (min) IS 3589 Gr FE 410, EW Carbon Steel Casing Pipe (Excluding supply of Casing Pipe covered under item sl. no. 7 below)**	108	m	14,130	15,26,040
5	**CASED CROSSING WORKS:** **Installation of 323.9 mm (12.75") OD x 6.35 mm WT (min) IS 3589 Gr FE 410, EW Carbon Steel Casing Pipe for subducting 6" HDPE pipe by Jacking/ Boring (Excluding supply of Casing Pipe covered under item sl. no. 7 below)** for road/ drain/ nala/ canal crossings wherever required (as defined in SOW/ Alignment sheet) (including 500µm of Epoxy coating on Casing Pipes, vent & drain pipes) including design & detailed engineering in all types of soil/ strata (including Normal Strata/ Hard Strata/ Hard Rock, as defined subsequently) & terrain(s), supply of all other Contractor supplied materials viz. casing insulators and casing end seals, materials for casing vents and drain assemblies etc., including transportation, supply of all other materials, equipment, consumables, manpower, welding including visual inspection of all weld joints, installation of casing insulators, end seals, vents and drain- off pipes, backfilling and restoration as original of the facility crossed and performing all works as per drawings, scope of work, specifications, standards and instructions of Engineer-in-Charge and provisions of Contract document.	24	m	3,100	74,400
6	**INSTALLATION OF CASING PIPE BY OPEN CUT:** **Installation of 323.9 mm (12.75") OD x 6.35 mm WT (min) IS 3589 Gr FE 410, EW Carbon Steel Casing Pipe for subducting 6" HDPE pipe by Open Cut (Excluding supply of Casing Pipe covered under item sl. no. 7 below)** for road/ drain/nala/ canal crossings wherever required (as defined in SOW/ Alignment sheet) (including 500µm of Epoxy coating on Casing Pipes, vent & drain pipes) including design & detailed engineering in all types of soil/ strata (including Normal Strata/ Hard Strata/ Hard Rock, as defined subsequently) & terrain(s), supply of all other Contractor supplied materials viz. casing insulators and casing end seals, materials for casing vents and drain assemblies etc., including transportation, supply of all other materials, equipment, consumables, manpower, welding including visual inspection of all weld joints, installation of casing insulators, end seals, vents and drain- off pipes, backfilling and restoration as original of the facility crossed and performing all works as per drawings, scope of work, specifications, standards and instructions of Engineer-in-Charge and provisions of Contract document.	24	m	3,100	74,400
7	**SUPPLY OF CARBON STEEL PIPE:** Supply, procurement and transportation to worksite(s)/workshop(s) including loading, unloading and handling of Carbon Steel Casing Pipes as per, scope of work, specifications and standards, instructions of Owner/ Engineer-in-Charge and other provisions of Contract for **323.9 mm (12.75") OD x 6.35 mm WT (min) IS 3589 Gr FE 410, EW Carbon Steel Casing Pipe**	156	m	4,800	7,48,800
8	**WARNING MARKERS:** Supply, fabrication and installation of **Pipeline Warning Markers** along the route including all associated civil works such as excavation in all types of soil, construction of pedestals and grouting with concrete, clearing, supply and application of approved color & text and quality of primer and paint, stencil letter cutting for numbers, direction, chainage etc., restoration of area to original condition and performing all works as per drawings, scope of work, specifications, standards and instructions of Engineer-in-Charge. The painting of all markers shall conform to environments specified as per scope of work and protective coating specification.	10	nos.	14,500	1,45,000
9	Supply and installation of one(1) nos. HDPE Tank suitable for storage of treated effluent with storage volume of 5KL; Construction of RCC platform for the tank including supply of all required materials and manpower etc; Provision of one (1) nos. 3" dia. HDPE sampling connection with gate valve, as per P&ID, on the outlet line from the tank, including supply of all materials, as required.	LS	1	67,700	67,700
	Total Cost (in Rs.)				**1,35,84,640**

BIDDING DOCUMENT

FOR

HDPE PIPELINE LAYING & INSTALLATION

(BIDDING DOCUMENT NO.: RCM/B862-ST-VB-T-9003/03)

PART-III OF III : TECHNICAL PART

PETRONET LNG LIMITED

TREATED EFFLUENT PIPELINE FROM PLL DAHEJ RO-DM PLANT TO GIDC PUMPING STATION D-1

SCOPE OF WORK FOR HDPE PIPELINE LAYING & INSTALLATION (PIPELINE ENGINEERING)

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
A	21.01.2026	ISSUED FOR BIDS	SYG	SRG	RSB /MSG

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1.0 INTRODUCTION

PLL is setting up a Petchem (PDH-PP) plant integrated with Ethane and Propane import facility and associated Utility & Offsite facilities at Dahej in the state of Gujarat, India. The upcoming Petchem Complex will use propane as a feedstock, dehydrogenate it to form propylene in a Propane Dehydrogenation Unit (PDH) and further polymerize to produce Polypropylene in a PP unit targeting import substitution

Under this project, a 160 mm nominal OD (6" NB) Treated Effluent Water HDPE pipeline is envisaged which will originate from RO-DM Plant at PLL Dahej and will terminate at GIDC Pumping Station D-1.

EIL has been engaged as Project Management Consultant for EPCM SERVICES.

1.1 This document covers details of Work Tendered, Scope of Work, and Scope of Supply pertaining to HDPE treated effluent pipeline including Procurement, Construction, Testing, Pre-Commissioning & Commissioning of pipelines and associated facilities.

1.2 This document shall be read in conjunction with Schedule of Rates, Specifications, Standards, Drawings and other documents forming part of Bid Document.

2.0 WORK TENDERED

2.1 Scope of works tendered in this bid package broadly consists of (but not limited to): -

- Design & Engineering of entire works for installation of 6" HDPE Pipeline from RO-DM plant at PLL Dahej to GIDC Pumping Station D-1.
- Obtaining permissions from concerned authorities/ agencies for lowering/ installation of underground and above ground pipeline along with all crossing permissions, as required.
- Providing, supplying, lowering, installation, jointing, testing and commissioning of 160 mm dia. HDPE PE-100 treated effluent pipeline from RO-DM Plant at PLL Dahej to GIDC Pumping Station D-1 including all crossings enroute.
- Carrying out hook-ups at identified locations at RO-DM Plant, PLL Dahej and GIDC Pumping Station D-1.
- Installation of pipeline using shallow HDD technique across various crossings as specified elsewhere in bid document
- Procurement & supply including engineering for procurement of Contractor supplied items as detailed subsequently in the documents.
- All works related to pre-testing, cleaning, flushing, hydrostatic testing, dewatering, tie-in/ hook-up with adjoining piping sections, as applicable.
- Pre-commissioning and commissioning of the pipeline and associated facilities.

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2.2 Refer IFC Alignment Sheet drawing no. B862-000-83-44-10001 for overview of the tender scope. The Pipeline Alignment Sheet indicates the overall project details in brief and is for reference purpose only. Contractor's quotation shall be based on complete scope of work & all documents forming part of the bid package. Details of HDPE Pipeline to be executed in this tender is as below:

Parameter	Value
Size OD, mm (inch)	160 mm (6")
Standard Dimension Ratio (SDR)	11
Pipe Material Grade	PE-100
Nominal Pressure Rating	PN 12.5
Total Pipeline length	1.542 km (approx.)
P/L Start point	TP-0-RO-DM Plant, PLL Dahej
P/L End point	TP-10-GIDC Pumping Station D-1
Underground P/L portion (Laying)	TP-0 to TP-2 (0.273 km approx.)
Aboveground P/L portion (Installation)	TP-2 to TP-10 (1.269 km approx..)

2.3 Contractor shall provide complete details of manpower, equipment etc. to be deployed. Contractor shall mobilize and provide all equipment, manpower (skilled and unskilled), consumables and other resources etc. as required for the execution of the complete job defined herein.

2.4 The design, supply, installation, jointing, testing, and commissioning of the HDPE treated effluent pipeline shall conform to the codes and standards listed below, as applicable. In case of conflict, project specifications shall govern, followed by applicable Indian Standards.

Sl. No.	Activity / Aspect	Applicable Code / Standard
1	Pipe material, dimensions, pressure rating	IS 4984:2016
2	Suitability for treated effluent	IS 14333:2022

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Sl. No.	Activity / Aspect	Applicable Code / Standard
3	Handling, storage and transportation of pipes	IS 7634 (Part 2):2012
4	Trenching, bedding and underground laying	IS 7634 (Part 2):2012
5	Butt fusion welding	IS 7634 (Part 2):2012 & ISO 21307
6	Welder and procedure qualification	IS 7634 (Part 2):2012
7	Inspection and acceptance of fusion joints	IS 7634 (Part 2):2012
8	Hydrostatic testing	Project Specification
9	Above-ground pipeline supports & Installation	EIL Standard Drawings / Industry Practice

3.0 SCOPE OF WORK

The scope of work detailed herein shall be read in conjunction with the IFC Alignment Sheet drawing no. B862-000-83-44-10001, specifications, standards and drawings enclosed with the bid. The detailed scope of work tendered shall consist of, but not limited to, design & engineering complete, procurement including engineering for procurement, supply (as required & detailed subsequently), jointing, lowering/ installation, testing, pre-commissioning and commissioning and hook-up works along with all associated works pertaining to complete HDPE pipeline system as described here under/ elsewhere in the bid document.

However, all such works which are not indicated here below but are otherwise required to complete the work in all respects in accordance with specifications, drawings and other requirements of bid package shall also form part of Contractor's Scope of Work.

The scope indicated below shall be read in conjunction with SOR, drawings, standards, specifications and other documents forming part of the Bid document.

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3.1 PIPELINE LAYING & INSTALLATION WORKS

3.1.1 Design & Engineering for entire works for installation of 6" HDPE Pipeline & associated facilities from RO-DM plant at PLL Dahej to GIDC Pumping Station D-1 including engineering for procurement complete. The works shall include but not limited to the following:

- Review/ update the survey data (provided along with the Bid) along the pipeline route/ re-routes and road/ canal/ drain/ nala/ existing pipeline/ other water crossings etc., soil stratification / soil resistivity data, geotechnical data including collection of additional data, carrying out topographical/ Geo-technical surveys, as required, during detailed engineering.

- Collection of data at site and compilation of all data/ information furnished in the bid package and additionally collected/ generated by Contractor. Firming up of route survey drawings considering rerouted sections, if any.

- Carrying out design & detailed engineering for the pipeline including crossings in accordance with scope of work, applicable industry codes & standards and project specifications contained in this bid package. Requirements of Indian standards and codes shall be complied with, wherever applicable.

- Carrying out piping support design for above ground pipeline along with generation of piping support drawings

3.1.2 Procurement, supply and delivery of 160 mm (6") nominal outer diameter (OD) HDPE pipes having nominal pressure rating PN-12.5, Standard dimension ratio (SDR) 11 & material grade PE -100 conforming to **IS – 4984 :2016** & suitable for treated effluent service as per **IS 14333 :2022** and their latest version or amendments. The HDPE pipes shall be supplied in standard length.

3.1.3 Transportation including loading, unloading, handling, stacking, hauling and stringing of HDPE pipes to contractor's dumpsite, worksite(s)/ workshop(s)/ pipeline Right-Of-Use (ROU), including arranging all pipe trailers, cranes, arranging all necessary intermediate storage area(s) required thereof till the complete pipeline system is permanently installed. Handling, storage and transportation of HDPE pipes shall be carried out in accordance with **IS 7634 (Part 2):2012**.

3.1.4 Loading, unloading, handling, stacking, storing and transportation to workshop(s)/ work site(s) of all materials (other than HDPE pipes) that may be used for the construction of pipeline system.

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3.1.5 Carrying out thorough internal cleaning of all pipes to remove debris, etc. to the satisfaction of Company/ Engineer-in-Charge.

3.1.6 Mobilizing and providing all equipment, manpower (skilled and unskilled), consumables and other resources etc., as required for the execution of complete work and thereafter demobilizing the same upon completion of work.

3.1.7 Contractor shall obtain all necessary permissions, approvals and work permits from concerned authorities having jurisdiction, as applicable for laying/ installation of pipeline along the route including installation of pipeline across various crossings. Contractor shall comply with all stipulations/ conditions/ recommendations of the authorities at no cost to Company, including stipulations/ conditions/ recommendations by GIDC/ MOEF/ SPCBs and various other bodies and agencies, as applicable. Appraisal and taking cognizance of site-conditions, pipeline route, Central Government, State Government rules and regulations/ bye-laws, applicable Standards and Codes. Contractor shall inform all local authorities in advance and obtain all necessary approvals and work permits from concerned authorities having jurisdiction for crossing underground utilities/ pipelines wherever encountered along the pipeline route. Contractor shall be required to carry out all the works as mentioned in the work permit. The scope of Contractor would include implementation of all the conditions of statutory approvals, permissions, NOCs etc.

3.1.8 Cutting/ uprooting of trees within ROU, counting the number and type of trees to be cut (before cutting) during pipeline laying works in presence of District Forest Officer/ concerned authorities keeping record thereof and handing over the cut trees as directed by concerned authorities/ Company. Tree cutting in the forest areas, if any, shall be performed through approved contractors of forest department and timbers to be deposited at forest authorities as per their instruction. To the extent possible, trees shall be re-planted or shifted to appropriate location as directed by Engineer-in-Charge in line with environmental guidelines. Obtaining prior permission from concerned authorities for cutting of trees shall be in the scope of the Contractor.

3.1.9 Contractor/Supplier shall furnish his recommended Butt Fusion Welding Procedure Specification (WPS) for the HDPE Pipes. WPS shall capture the following parameters:

- Temperature range of heating plate
- Fusion Time
- Maximum change over time
- Welding Pressure
- Cooling time under pressure
- Range of bead width and height in mm.

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The pipes should be joined together by butt fusion welding using hydraulic operated HDPE welding machine to form required lengths as per tender document using low pressure fusion procedures. Butt fusion and electrofusion jointing of HDPE pipes shall be carried out in accordance with **IS 7634 (Part 2):2012**. Butt fusion welding parameters and procedures shall additionally conform to **ISO 21307**, wherever detailed guidance is not covered by IS standards.

Welder qualification and acceptance of fusion joints shall be as per **IS 7634 (Part 2):2012**. The HDPE welding machine operator should have an experience in Butt fusion procedure. The operator should have a minimum of 6 months' experience in operating and maintaining the fusion equipment/welding machine which will be utilized for this project.

The welding machine shall have DG set, hydraulically operated-clamps, hydraulically operated roller supports, hydraulically operated heating plate and hydraulically operated facers, all fitted on the machine. The welding machines and other required accessories should be arranged by the contractor.

The temperatures, pressures, methods of computation of welding parameters and suitable methodology for welding and testing of butt fusion joints considering site conditions should be given by Contractor/Pipe supplier before commencement of work. The welding parameters should be agreed upon by EIC. Any deviations from the accepted welding parameters for any weld will not be allowed by EIC.

The test welds on specimen pipes should be made prior to the welding of the pipes. Specimens across such welds as per **ISO 13953** should be tested in presence of EIC representative. Approval from EIC should be sought for commencement of welding. In addition to above, specimens across welds should be given to EIC for testing as and when requested. Any problem encountered during testing on the welded pipe shall be rectified and replaced by the contractor within contract price and without any additional claim. EIC's decision on testing, acceptance or rejection of weld is final and shall be binding on the contractor. EIC's representatives will inspect the butt fused welded joints during welding. Company reserves its right to accept or reject any weld if not found satisfactory.

Welders shall be qualified by one successful destructive test (tensile or bend) for the applicable pipe size and SDR. The certificate of the operator and the experience details to be submitted prior to commencement of work.

Fusion parameters shall be controlled as per approved WPS and recorded in weld logs. All butt-fusion joints shall be subjected to 100% visual inspection. Inspection and acceptance of fusion joints shall be carried out as per visual inspection requirements of **IS 7634 (Part 2):2012**.

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3.1.10 Supply & installation of all types of pipeline markers including their painting suitable for uninsulated and above ground CS surfaces as per painting specification no 6-79-0020 (Sl. No. 6.2 of Table 6.0) enclosed with the bid document and all associated civil works. Location of markers shall be as per "IFC" alignment sheets/ specification/ standard and as directed by Engineer In-charge.

3.1.11 **The pipeline shall be fully buried inside PLL plant premises and shall be installed aboveground on supports outside PLL plant up to GIDC pumping station except at road and other crossings where the pipeline shall be installed underground in CS casing pipe using trenchless technique.**

3.1.12 Staking, clearing, grading of the pipeline route/ RoU as required, trenching to all depths in all types of soils including soft and hard rock, including chiseling, or otherwise cutting etc. to a width as per trench drawings, support drawings, specifications etc., stringing, aligning, butt welding, including supply of all materials, providing sand/ soft soil padding including supply of sand/ soft soil where ever required, padding, laying and lowering of the underground pipeline, installation of above-ground pipeline on supports including locating existing pipelines and maintaining the specified minimum spacing of pipe trench/ support footings from existing pipeline(s), back filling, carrying out road, drain, utility crossings as required, arranging all additional temporary land/ area required for construction purposes. Disposal of excess earth, pebbles, rocks etc. outside the RoU limit to a suitable place as directed by Statutory authority / EIC. **The Pipeline corridor shall be kept as narrow as possible at all times.**

3.1.13 Obtaining all necessary approvals and work permits from concerned local authorities having jurisdiction including hot work permit as applicable for performing the work in existing PLL plant. Arranging of adequate firefighting equipment viz. fire brigade, fire extinguisher, shielding from existing facilities, oxygen mask etc. for carrying out the work safely to the satisfaction of Company.

3.1.14 Locating all existing nearby underground pipelines & cables by trial pits etc. and marking/ flagging-off their location suitably before beginning of any construction activity, on both sides of the crossing and within crossing limits, such that no existing pipeline/ cable gets damaged. Any damage to the existing pipelines/ cables due to the constructional activities by the contractor shall be attributable to the Contractor. Contractor shall be responsible for claims if any arising out of damage/ obstruction to any existing facilities such as public utilities like roads, electric cables, pipes, OFC lines of DOT etc. where the claims will cover the restoration costs as well as loss of revenue due to down time. All such claims including claims due to delay in restoration of such facilities shall be settled by the Contractor at Contractor's own expense including carrying out coordination & Liasioning with local people, without any time and cost implication to Company.

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3.1.15 Supply and installation of warning mat as per BS EN 12613 Type-1 and installation over underground portion of the pipeline as per EIL standard 7-71-0031

3.1.16 Supply of bolts, nuts, gaskets, washers, U bolts, clamps, clips, gaskets, 6 mm thick neoprene pads for supports for all piping works.

3.1.17 All structural and mechanical works including supply of all required materials required, including construction of foundations (PCC/ RCC works) for pipe supports and sleepers, fabrication and erection of supporting structural elements for piping such as shoes, pipes, T posts, cradles, clamps, anchors, guides, insert plates etc.

T-Type pipe supports, duly engineered by the contractor and approved by EIC shall be based on EIL Std. 7-44-0636 and shall be installed at a maximum spacing of 3.0 m along the aboveground pipeline route for supporting the HDPE pipeline without sagging. Additional supports shall be provided near valves, fittings, and changes in direction.

Pipe supports shall use support/clamp type as per EIL Std. 7-44-0655 only as a guide support. A minimum 6 mm thick neoprene rubber liner shall be provided between the HDPE pipe and the support to avoid point loading, abrasion and local flattening. The clamp shall not be tightened to restrain axial movement. Anchors shall be provided near pumps & structures.

3.1.18 Hook-up of HDPE pipeline at the battery limit with the piping installed by others/ existing equipment, tanks etc. as per P&ID including interface/ co-ordination as required with other Contractor(s)/Agencies. Supply of specialized flanges/ transition fittings etc., as required, at the battery limit shall be in scope of the Contractor.

3.1.19 Painting of above ground structural steel elements for pipe supports and all related miscellaneous items as required and as directed by Engineer-in-charge. Painting shall be as per painting specification no 6-79-0020 (Sl. No. 6.2 of Table 6.0). Wherever touch up/ repair of primer is required, high build epoxy zinc phosphate primer shall be used.

3.1.20 Supply & Installation of 323.9 mm (12.75”) OD x 6.35 mm WT (min) IS 3589 Gr FE 410, EW Carbon Steel Casing Pipe subducted with 160 mm OD PE-100, PN 12.5, SDR-11 HDPE pipe by shallow Horizontal Directional Drilling method (HDD) at various roads etc. as listed out elsewhere in this document shall be executed under this Contract.

- Carrying out all required topographic surveys and geo-technical investigations for the above roads & other crossings, preparing plan and profile drawings as directed by Engineer-in-Charge.
- Company’s provided survey details shall be for Contractor’s reference purpose only. Contractor shall submit the crossing drawings and installation design calculations to

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Company for review and approval.

- After HDD completion, the ends of the casing shall be sealed to outside of the carrier pipe using casing end seals to prevent ingress of debris, water etc in the annular space.

Contractor shall engage an experienced HDD agency for execution of these shallow HDDs. PTR for proposed HDD Sub Contractor shall be submitted for Company's approval post award. Work shall start only after approval of the same.

3.1.21 Contractor shall carry out detailed MTO for HDPE pipe/ elbows/ fittings, CS casing pipe, end seals, casing insulators, casing vents & drains, structural steel, clamps, neoprene pads & RCC/ PCC for support fabrication etc. from provided drawings i.e. alignment sheets, route maps, Contractor's own verification surveys etc. and as per requirements of concerned authorities / instructions of EIC.

3.1.22 All works related to cleaning, flushing, hydrostatic testing, dewatering & commissioning of the pipeline up to battery limits including providing all equipment, manpower, machinery, consumables etc. as required during commissioning.

3.1.23 Repair of leaks/ burst shall be carried out by Contractor at no extra cost to Company. Contractor shall submit a report for failure to Company.

3.1.24 Final clean-up and restoration of ROU and other conveniences like temporary approach roads/ temporary works, barren land, road, crossings etc. to original condition as per specification and drawings to the entire satisfaction of Company and/ or authorities having jurisdiction over the same, including disposal of surplus construction materials to location decided by Company/ EIC and approved by local authority without causing any disturbance to environment and to entire satisfaction of Company. Contractor shall obtain written NOC from all concerned authorities/agencies/ land owners to the effect that ROU has been restored back to the original condition.

3.1.25 Disposal of surplus excavated soil from trench/ support locations outside ROU.

3.1.26 Preparation of as-built drawings, pipe-books, documents and project records as per specification and instructions of the Company.

3.1.27 Furnishing of all Test Certificates/ Inspection Reports for all materials used for permanent installation.

3.1.28 Contractor shall take into consideration all regulations, stipulations, practices applicable for the works and specifically all the factors that are agreed upon between Company and Statutory authorities/ other agencies as per agreements reached as a part of permissions for crossings. Contractor shall provide all design data/ drawings/ documents/ calculations/

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reports as required for statutory clearances including obtaining necessary approvals. Appraisal and taking cognizance of site-conditions, pipeline route, Central Government, State Government rules and regulations/ bye-laws, applicable Standards and Codes.

3.1.29 Development of temporary approach/ access road from nearest road to work site/ location for transportation of line pipes, other materials, construction equipment's, etc. to site.

3.1.30 All mechanical works of underground and above ground, complete HDPE piping including fabrication, butt fusion welding, hydrostatic testing, cleaning/flushing, functional testing, excavation in all types of soil for installation of piping and pipe supports.

3.1.31 All incidental and associated works along with any other works not specifically listed herein but are required to be carried out to complete entire work related to pipelines and the associated facilities and making the pipeline system ready for operation.

3.1.32 In case any activity though not specifically covered in schedule of Rates description but same is covered under Scope of work/ specification/ drawings, it is understood that the contractor shall do such performance & provisions so mentioned without any time & cost implication.

3.1.33 All Coordination and liaising with local people and authorities during all phases of construction for smooth installation works of Pipeline and station.

4.0 SCOPE OF SUPPLY

4.1 Company Scope of Supply

No material whatsoever shall be supplied by Company as free issue material (FIM). All the materials, components etc. for complete HDPE pipeline system shall be supplied by the Contractor including material mentioned in subsequent clauses.

4.2 Contractor Scope of Supply

The procurement and supply, including inspection of all materials and consumables required for completion of the work as defined in this bid document shall be entirely the Contractor's responsibility and rates quoted for the execution of the work shall be inclusive of supply of all these materials. All materials supplied by the Contractor shall be strictly in accordance with the requirements of relevant specifications/ standards referred in the Contract document. All equipment, materials, components etc. shall be new and specifically purchased for this job from Company approved vendors, duly inspected by EIL/ third party inspection agency like Lloyds, Bureau Veritas etc. As a minimum, the materials to be supplied by Contractor shall include but not limited to the following: -

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4.2.1 **HDPE Pipes**

Procurement, supply & delivery of 160 mm (6") nominal outer diameter (OD) HDPE pipes having nominal pressure rating PN-12.5, standard dimension ratio (SDR) 11 & material grade PE -100 conforming **IS – 4984 :2016** & suitable for treated effluent service as per **IS 14333 :2022** and their latest version or amendments with IS certification mark.

a. Temperature Variation:

All the pipes to be supplied and delivered shall be subject to weather condition like sun, dust, rain, wind as available in the state of Gujarat. They shall also be subject to carry and convey highly concentrated untreated industrial effluent.

b. Marking:

The method of marking to all the pipes to be used under the scope of contract shall ensure that all the information as mentioned in clause 10 of **IS:14333 :2022** and/or its latest amendments. The marking will remain legible even after transportation, storage in open space etc. In general, the legible and indelible marking upon the pipes shall indicate the following:

- Manufacturer's name or trade mark.
- Grade of material.
- Class of pipes and pressure rating.
- Nominal diameter.
- Lot number / Batch number of manufacturer.
- ISI certification Mark.
- Purchaser's mark as " PLL".
- Any other important matter that the manufacturer or purchaser deems fit to be inscribed.

c. Packing and handling:

Handling, storage and transportation of HDPE pipes shall be carried out in accordance with **IS 7634 (Part 2):2012**. When the pipes are transported by Railway or any other means, special packing as per IRCA rules and/or concerned authority are absolutely necessary for which the extra cost, if any, shall be borne by in total by bidders only.

The bidder shall have proper handling instrument / equipment and shall follow suitable method of handling of pipes as may be approved by Engineer while unloading, and stacking material.

d. Material and workman ship:

Pipe manufacturer/Supplier should have past experience of minimum 5 years for manufacturing of HDPE Pipes for sizes 160 mm and above and should possess BIS license as per **IS – 4984 :2016** & complying **IS 14333 :2022** for manufacturing of HDPE Pipe for minimum 5 years. Pipe manufacture / Supplier should have in-house HDPE Specials manufacturing facility like Bend/ Tee- molded/fabricated, stub end, reducers etc. and same

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are to be manufactured from the same raw material i.e., HDPE Pipe and specials to be made from same grade of raw material.

General requirement of material and workmanship shall mean any material or articles either raw material or additives or finished are required to be used in the manufacturing process of pipes.

The material used for manufacturing of pipes should not constitute any toxic hazards should not support microbiological growth and should not give rise to unpleasant test or odour, cloudiness or discoloration of water. The bidder shall have to produce Pipe manufacturer's certificate, that the material meets the PE 100 requirements as per **IS – 4984 :2016** & **IS:14333 :2022** and their latest revision /amendments.

All other quality parameters like density, MFR, carbon black content, anti-oxidant and reworked material of raw material use for manufacturing of pipes shall be strictly as per **IS – 4984 :2016** & **IS:14333 :2022** and their latest revision /amendments.

The original invoice of raw material requires to manufacture ordered length of HDPE pipes and batch wise test certificate of raw material will be verified and certified by EIL or third-party inspecting agency fixed by EIL.

The carbon black master batch if used shall be certified by the master batch seller as fit for the purpose of standard for which the HDPE pipes are under order.

The HDPE pipe shall be manufactured from the certified raw material of PE-100 grade and suppliers has to submit the certificate from raw material manufacturer.

e. Supply of material and manufacture of pipe:

The general requirement relating to supply of material and manufacture of HDPE pipe shall be confirming to the relevant IS specification.

The dimensions, material compositions, test etc. shall be as per **IS – 4984 :2016** & **IS:14333 :2022** and their latest revision /amendments. HDPE pipe shall be marked with the ISI certification mark.

The minimum and maximum wall thickness of pipe shall be as per specification in **IS – 4984 :2016** & **IS:14333 :2022** and their latest revision /amendments. The colour of pipe shall be black. For the identification purpose each pipe shall contain minimum three equi-spaced longitudinal strips of width 3 mm (min) in blue colour. These strips shall be co-extruded during pipe manufacturing itself and shall not be more than 0.2 mm in depth. The material of the strips shall be of the same types of resin as used in based compound for the pipe.100 % virgin material shall have allowed no rework is to be used for the production of pipes.

4.2.2 All bends, elbows, fittings and flanges of all sizes, all ratings & materials including CS/ DSS to HDPE transition fittings, if required.

4.2.3 Supply of 323.9 mm (12.75”) OD x 6.35 mm WT (min) IS 3589 Gr FE 410, EW Carbon Steel Casing Pipe or equivalent for all road / other crossings where ever the HDPE pipeline is

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installed by shallow HDD method/ trenchless method including supply of casing insulators, end seals, casing vents and drains and any other accessories for successful execution of these crossings.

4.2.4 All equipment for HDPE butt fusion welding and associated works including hydraulic operated HDPE pipe welding machine all required accessories, power supply, all skilled and unskilled manpower, tools and tackles etc.

4.2.5 Supply of warning mat as per BS EN 12613 standard (latest edition) Type-1 and complying with the requirements of EIL Standard no. 7-71-0031.

4.2.6 All material, equipment & consumables for HDD works.

4.2.7 All stud bolts, nuts, jack screws, all type of nuts, bolts, gaskets, washers, U bolts, clamps, clips etc. for pipe supports.

4.2.8 All types of coating and painting materials including primer and paints for painting above supports, sand blasting materials & cleaning agents, compressed air etc.

4.2.9 All pipes, fittings, flanges, blind flanges, gaskets, nuts, bolts, clamps, strainers, equipment/ consumable, metallic blinds, temporary gaskets as required for filling, pressurizing, hydrostatic testing and dewatering etc. including test headers for hydrostatic testing.

4.2.10 All equipment and consumables required for hydrostatic testing like pumps, pressure & temperature gauges and suitable test water for hydrostatic testing.

4.2.11 All materials for all types of pipeline markers including cement, sand, reinforcements, structural steel etc. and paint conforming to painting specification no 6-79-0020 (Sl. No. 6.2 of Table 6.0).

4.2.12 All materials required for construction of foundations (PCC/ RCC works) for pipe supports and sleepers, fabrication and erection of supporting structural elements for piping such as shoes, pipes, T posts, cradles, clamps, anchors, guides, insert plates, brackets, etc.

4.2.13 All materials required for repair/ restoration of pavements, roads, bunds, walls, irrigation pipes, other structures affected/ damaged by Contractor's construction activities. Materials shall be equivalent/ superior to those used for original construction of the facility

4.2.14 All consumables and equipment required for all types of destructive & nondestructive tests.

4.2.15 All safety tools, tackles, devices, apparatus, equipment, personal safety gadgets to be used as PPE (such as helmets, safety bolts, safety shoes etc.) etc. including ladders and scaffolding complete as recommended by Engineer-In-Charge as per relevant safety standards.

4.2.16 Sand ridges (sand, polyethylene sheets etc.) and other materials for pipe stacking of at Contractor's warehouse/ Worksite.

4.2.17 All materials and consumables required for commissioning of pipeline.

4.2.18 All other materials not specifically listed herein but required for successful completion of the entire work whether temporary or permanent in nature.

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4.2.19 Contractor's scope of work shall be inclusive of supply of all materials mentioned above. Contractor shall carryout MTO of all materials required based on Issued for Construction drawings, P & IDs etc. and firm up the actual requirement of materials. All escalation/ extra materials procured by Contractor for contingencies shall be Contractor's property and no payments shall be made for such materials. Payment shall be made for actual materials installed by the Contractor as a part of permanent installation.

5.0 OTHER CONDITIONS OF BID

5.1 BASIS OF WORK

5.1.1 All pipeline works shall be carried out as per following:

a) Piping and Instrumentation Diagram (P & IDs) & other process documents
b) Issued for Construction Alignment sheets
c) Specifications and standards.
d) Piping support standards/ drawings
e) Any other drawings/ sketches prepared by Company and/ or by the Contractor and approved by the Company.

5.2 SURVEY

Company has got carried out detailed route survey for the entire pipeline route and is enclosed with the bid package. The survey alignment sheet including plan and ground profile details and details of one major crossing are enclosed along with the bid document for Contractor's reference and information only.

It shall be the Contractor's responsibility to verify the pipeline routes. Wherein Contractor's opinion the survey and geotechnical investigation data is not found to be sufficient in detail, it shall be the responsibility of the Contractor to carry out such topographic surveys & geotechnical investigations. Carrying out all additional topographical survey and/or geotechnical surveys required for re-routes, local detours, detours at crossing locations and elsewhere during execution and for crossings, as required, for which details are not available/ insufficient details are available in the bid document including preparation of plan and profile drawings as directed by Engineer-in-Charge.

5.3 DESCRIPTION OF PIPELINE ROUTE

5.3.1 <u>ROUTE DESCRIPTION</u>

- All chainages and pipeline length indicated are approximate.
- The Proposed Route Take off from RO-DM at TP0 in Luvara village in Bharuch District of Gujarat state and End point at Drainage Pumping Station D-1 at TP10 in Luvara Village in Bharuch District of Gujarat state.

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- The pipeline shall be fully buried inside PLL plant premises and shall be installed aboveground on supports outside PLL plant up to GIDC pumping station except at road and other crossings where the pipeline shall be installed underground in CS casing pipe using trenchless technique.
- The total length of the proposed pipeline is **01+541.94KM**.
- The proposed pipeline travels through the least obstructive areas.
- The proposed pipeline is passing through the Flat / Slightly Undulating terrain respectively with its length.
- The proposed pipeline does not pass through any Reserve Forest area and Wildlife Sanctuary within the 10 km ESZ buffer zone.
- The proposed pipeline route does not cross any Crop/ Plantations along the route of the pipeline.
- The pipeline route passes through the **GIDC Land.**
- The proposed pipeline route crosses a number of factory/ industry gates and one major GIDC road along the route of the pipeline.
- For details of route and soil stratification refer detailed survey reports enclosed in the bid package.

The salient features along the entire pipeline route are as given below:

S. No.	Description	Unit	Quantity
1.	**Total Pipeline Length**	km	1.542
1a.	**Inside PLL Plant (U/G)**	km	0.273
1b.	**In GIDC land (A/G)**	Nos.	1.269
2.	**PLL Plant Road Crossing**	Nos.	1
3.	**Industry Gates/ Approach Roads**	Nos.	2
4.	**GIDC Road + Lab approach Road**	Nos.	1
5.	**Undeveloped road (Cart Track)**	Nos.	1

5.3.2 The number of crossings and features along the pipeline route described above are approximate. Contractor shall not be entitled for any compensation in terms of time and cost in case of variation in the above. Contractor shall verify the above data and carry out pipeline laying/ installation works without any extra cost & time to Company.

5.3.3 SOIL INVESTIGATION AND SOIL RESISTIVITY SURVEY

Company has carried out soil investigation (visual classification/ stratification) and resistivity survey along the entire pipeline route.

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It shall be Contractor's responsibility to verify the data and satisfy himself with regard to accuracy and utility of data. Any additional soil data/ investigation required for execution of job shall be carried out by Contractor. Contractor shall not be entitled for any compensation in terms of time or cost in case of any variation in actual site conditions from the data furnished. It shall be Contractor's responsibility to familiarize himself with sub-soil conditions along the pipeline route and workout the lengths of pipeline to be laid in different subsoil conditions including the quantum of rock excavation that would be necessary.

Price quoted by the Bidder shall be inclusive of all rock excavation. No extra compensation shall be payable to Contractor for any rock excavation whatsoever.

5.3.4 PIPELINE R.O.U.

The pipeline does not have any dedicated ROU and only Construction ROU shall be utilized for laying/ installation of the underground & aboveground pipeline. Responsibility of obtaining permission from statutory authorities i.e. GIDC, various concerned industries etc. for pipeline laying/ installation lies with the Contractor.

It shall be Contractor's responsibility to make arrangement for any additional land required for fabrication, construction, storage and all other work areas.

Contractor shall also arrange additional land & suitable approach for mobilization & placement of equipment, pipe string etc during installation of Pipeline in shallow HDD crossings.

Damages, if any, to existing pipeline and facilities shall be to the Contractor's account.

5.3.5 SITE VISIT

Contractors, as a part of bid requirement, have to make site visits along the pipeline route prior to quoting to familiarize themselves with all the salient features of terrain, availability of infrastructure along the pipeline route. Contractor shall be deemed to have considered all constraints and eventualities on account of site conditions along pipeline route while formulating his bid. Contractor shall not be eligible for any compensation in terms of cost and/ or time, on account of site conditions along pipeline route varying to any extent from whatever is described in the bid package and the survey drawings/ data furnished along with the bid package.

5.3.6 STATUTORY PERMISSIONS & WORK PERMITS

Contractor shall obtain all necessary permissions, approvals and work permits from concerned authorities having jurisdiction, as applicable for laying/ installation of pipeline along the route including installation of pipeline across various crossings. Contractor shall comply with all stipulations/ conditions/ recommendations of the authorities at no cost to Company, including stipulations/ conditions/ recommendations by GIDC/ MOEF/ SPCBs and various other bodies and agencies, as applicable. Appraisal and taking cognizance of

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site-conditions, pipeline route, Central Government, State Government rules and regulations/ bye-laws, applicable Standards and Codes. Contractor shall inform all local authorities in advance and obtain all necessary approvals and work permits from concerned authorities having jurisdiction for crossing underground utilities/ pipelines wherever encountered along the pipeline route. Contractor shall be required to carry out all the works as mentioned in the work permit. The scope of Contractor would include implementation of all the conditions of statutory approvals, permissions, NOCs etc.

Company may, however, assist Contractor in obtaining such permissions, wherever required, by issuing recommendation letters etc. **There shall be no payment to the Contractor for liasoning work required for obtaining these permissions. However, all statutory payments required for such permissions shall be reimbursed by Company at actuals.** In case of damage to other utilities/ infrastructure, Contractor shall be responsible and the required compensation as per the directions of concerned authorities/ Company shall be paid by the Contractor. After completion of work, Contractor shall obtain a certificate from the concerned authorities that the job has been completed as per their requirement and the area/ land has been restored to their satisfaction.

5.3.7 PIPELINE COVER & ELEVATION

The underground pipeline shall be buried normally at a depth of 1.2 meter below natural ground level except at road/ water crossings where cover shall be as given below or as per the requirements of statutory/ local authorities whichever is more stringent.
The pipeline, in general shall be laid underground with minimum cover as given below:

Sl. No.	Location	Minimum Cover (m)
1	Industrial, commercial, cultivated, agricultural, residential and barren areas	1.2
2	Minor water crossing/ canal/ drain/ nala/ stream	1.5
3	Uncased road crossing	1.2
4	Along the road within its ROW	1.5
5	Road Crossing by shallow HDD	2.5
6	Drainage, ditches at roads	1.2
7	Marshy land/ Creek area	1.5

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The aboveground pipeline on T- type pipe supports shall be installed with top of pipe elevation of approx. 1.5 meter above nearest road top level or as per the requirements of statutory/ local authorities and after due approval of Engineer-in-charge. Support spacing shall be suitably reduced at direction changes/ elbows & tie-in points as per site conditions.

5.3.8 ROAD CROSSINGS

Contractor shall liaison with relevant authorities and intimate them well in advance about the schedule and methodology of crossing for all road & other crossings. It shall be obligatory on the part of the Contractor to ensure that Authorized Representative of the authority under whose jurisdiction the crossing falls should be made available at site by the Contractor at the time of executing crossing. After completion of works and complete restoration of ROU, Contractor shall obtain NOC from the relevant official pertaining to complete restoration to their satisfaction and certification in respect of no other damage caused to their property outside the earmarked ROU.

All RCC/ Asphalted roads in GIDC area shall be crossed by shallow HDD Method with 12" NB CS casing pipe. Pipeline cover at these crossings shall be minimum 2.5 m. List of crossings in scope of the Contractor are indicated as below:

S. No.	TP/IP of Crossing	Location	Road Width (m)	Length of HDD (m)
1.	TP-0 to TP-1	PLL Plant Road	9	Nil (Through Casing)
2.	TP3 to TP4	Yashaswi Rasayan Pvt Ltd Gate	8.7	24
3.	TP4 to TP5	HLE Engineer Pvt Ltd Gate	6	24
4.	TP6 to TP7	Milan Lab Pvt Ltd Gate + GIDC Road + Drains	50	60
5.	Near IP 7/2	Cart Track	8	Nil (Through Casing)

- Length of HDDs indicated herein is for information only. Contractor shall carry out detailed design & engineering for each HDD crossing & finalise length of HDDs.
- Contractor shall perform all topographic surveys, geo-technical investigation as required for design and engineering of HDDs.

5.3.9 HYDROSTATIC TESTING

The pipeline to be tested shall be fitted with metal blind flange at both ends with the help of stub end (pipe end). These blind flanges are fitted with necessary arrangement for supplying water into pipeline, air valve for air drain and pressure gauge. After filling the water into pipeline, pressurized water is supplied with the help of pressure pump. When

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the required test pressure is achieved, pressure pump is stopped and valve is closed and pressure is allowed to stabilize for a minimum of 30 minutes. This pressure will be maintained for not less than one (1) hour and there should not be any drastic drop in pressure whole pipeline route under test is inspected for checking any leakage. If there is no leakage, the test pressure will remain same and the test is believed to be satisfactory. Please note that there could be slight drop in pressure due to leakage from flange/ valve or due to expansion of HDPE pipe under pressure. This drop up to 0.5 kg/cm2 is normally not considered.

The section of carrier pipe to be placed in casing pipe shall be closed at each end, hydrostatically pre-tested preferably for at least one (1) hour. Only on successful completion of this test, shall the carrier pipe section be inserted in the casing pipe.

The pipeline shall be hydrostatically tested to the minimum test pressure as specified below:

Pipe OD Inch (mm)	Material Grade, PN Rating & SDR	Hydrostatic test Pressure (kg/cm^2 g)
6” (160 mm)	PE-100, PN 12.5, SDR-11	12.5 kg/cm^2

The highest point of the test section shall be subjected to the minimum test pressure as specified above. All materials required for the fabrication of the test headers shall be provided by the Contractor at no extra cost to Company. After successful completion of hydrostatic testing, the Contractor shall de-water the pipeline as per the directions of Engineer-in-charge. Disposal of water (hydro testing) shall be done by Contractor after seeking necessary permission from concerned authority/ land owner so that no liability on this account comes on Company.

5.3.10 COMMISSIONING OF PIPELINE

Pipeline Contractor shall be responsible for pre-commissioning & commissioning of the pipeline system being installed by him. The above shall include P&ID checks (with respect to requirement of design/ operation/ safety and interlocks of latest revision of P&ID's), flushing, tightness test, de-watering, as required and supply of manpower, materials, equipment as well as consumables required during pre-commissioning & commissioning.

6.0 LAYING/ INSTALLATION OF PIPELINE IN COMMON ROU

The following clauses outline the activities to be carried out by the Contractor involved in laying/ installation of new pipeline within common Right-of-Use (RoU) having existing operating pipeline(s). These are necessary for mitigating risks of damage to existing live

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pipeline(s), thereby ensuring safety during execution of work and for avoiding any disruption to existing pipeline operations.

i. Preparation of Safety/ HSE job procedures (including checklists) by the Contractor and duly approved by the Engineer-in-charge & pipeline operator.

ii. Ensuring that the permissions / Work Permit have been taken from O&M department of the pipeline operator/ Other utility owners.

iii. Ensure that Safety Work Permit has been obtained and there is a safety officer to oversee the requirements of safety measures / Fire Fighting equipment during execution of work.

iv. Ensuring that all the requirements of safety/ HSE procedures/ Work permit have been complied on regular basis before start of work in any section.

v. Identification of existing pipelines/OFC cables/ other utilities running along the RoU

vi. Clear working distance of between existing pipelines and new pipeline shall be maintained. Accordingly center-line for new pipeline shall be marked on the ground w.r.t existing pipeline center-line marking.

vii. At all locations wherever the new pipeline crosses the existing pipelines, adequate safety clearance shall be maintained as per directions of Engineer-in Charge.

viii. All risk regarding marking and barricading existing pipelines as enumerated above, are assessed and mitigation measures ensured.

Contractor shall liaison with authorities/ operators having jurisdiction for obtaining necessary information & permissions/ work permits required for work execution. Utmost care shall be taken during construction activity so that existing pipelines and OFC are in no way damaged during trenching or by movement of equipment, imposed loads etc. Contractor shall be liable for all direct and in-direct costs incurred by the Owner due to damage caused to existing pipelines, OFC etc by the Contractor's activities in existing RoU. Contractor shall also be responsible and liable for any injury to life or damage caused to property/ facilities of third parties due to such activities

7.0 AS BUILT DOCUMENTS

Contractor shall prepare As Built drawings / reports for entire pipeline system as specified here-in & as per requirements indicated in Specification for Documentation for Pipeline Construction No. 6-71-0059 enclosed with the bid document. All "As Built" drawings / reports shall be submitted as below:

- All documents shall be submitted in soft files in USB format in Hard Disk as well as hard spiral bound copies.
- As built alignment sheets and crossing drawings/details.
- All inspection and testing documents & records.

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- Pipe and calculation books/records.
- All purchase specification & procurement documents.
- Software used for the presentation of above documents shall be as follows:

S. No.	Type of document	Software
1	Reports	MS Office (Word / Excel)
2	Drawings	AutoCAD-2018 or above

Note: -Authorized and licensed software shall be used for preparation of all documents. Drawings prepared in trial/ educational/ unlicensed versions of AutoCAD shall not be acceptable.

8.0 DOCUMENTS TO BE SUBMITTED AT THE TIME OF BIDDING

No technical documents are required to be submitted at the time of bidding. Bidder is advised to comply with all requirements of Bid document without any deviation. Company reserves the right to reject any bid with deviation without making any reference to the Bidder.

9.0 LIST OF ATTACHMENTS

Contractor shall carry out all works strictly in accordance with the drawings/ documents/ specifications/ standards etc. indicated herein below: -

9.1 STANDARD SPECIFICATIONS

S. No.	Specification No.	Rev	Title
1.	6-71-0051	5	Standard Specification for Pipeline Construction (Onshore)
2.	6-71-0057	6	Standard Specification for Pipeline Markers.
3.	6-71-0059	6	Standard Specification for Documentation for Pipeline Construction
4.	6-71-0107	0	Standard Specification for Minor Crossings Using Shallow Horizontal Directional Drilling Method
5.	6-79-0020	1	Standard Specification for Surface Preparation and Protective Coating

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9.2 STANDARDS

S. No.	Standard No.	Rev.	Title
1.	7-71-0005	5	Typical trench dimensions for pipeline
2.	7-71-0006	5	Pipelines symbols
3.	7-71-0012	5	Pipeline warning sign
4.	7-71-0019	5	Details of casing-vent and drain off
5.	7-71-0020	5	Casing pipe details
6.	7-71-0031	1	Typical warning of warning devices (Mat / tape or mesh) for pipelines
7.	7-44-0636	6	Low support stanchion for bare and insulated CS/AS/SS pipe type-L16 and L16A
8.	7-44-0655	5	Pipe U-clamp for bare CS/AS/SS pipe size 3/4" thru 24" type-C15

9.3 DRAWINGS

S. No.	Drawing No.	Rev.	Title
1.	B862-000-83-44-10001	0	IFC Alignment Sheet (Ch. 0+000 km to Ch. 1+541.94 km)

9.4 OTHER DOCUMENTS

S. No.	Doc. No.	Rev.	Title
1.	DWG.NO.SKP/PLL/RDDPPL/RM-01	0	Survey Route Map
2.	DWG.NO.SKP/PLL/RDDPPL/ALN-01	0	Survey Alignment Sheet
3.	DWG.NO.SKP/PLL/RDDPPL/CS-01	0	Survey Crossing Drawing
4.	DOC. NO.: SKP - PLL-DSR -RDDPPL	0	Detailed Route Survey Report

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S. No.	Doc. No.	Rev.	Title
5.	DOC. NO.: SKP/PLL/DR/25-26/01	C	Corrosion Survey and Soil Stratification & Classification Survey

9.5 PROCESS DOCUMENTS

S. No.	Doc. No.	Rev.	Title
1.	B862-02-42-REP-1001	0	Steady State Hydraulic Report
2.	B862-204-17-42-1134	1	P&ID for RO Based DM Plant Effluent Disposal Tank & Pumps
3.	B862-204-17-42-SK01	B	Effluent Disposal Scheme

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BILL OF PAYMENT

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SL. NO.	DESCRIPTION	QTY	UOM
1	**SUPPLY & INSTALLATION OF UNDERGROUND HDPE PIPELINE WITHIN PLL BOUNDARY LIMITS:** Design & Detailed Engineering for installation of pipeline & associated facilities, Procurement, supply and delivery of 160 mm (6”) nominal outer diameter (OD) HDPE pipes of Standard dimension ratio (SDR) 11, material grade PE -100 & PN 12.5 conforming to IS 14333/2022 & IS - 4984/2016 and their latest version or amendments in standard lengths; Transportation including loading, unloading, handling, stacking, hauling and stringing of pipes to contractor's worksite(s)/ workshop(s)/ pipeline Right-Of-Use (ROU), including arranging all pipe trailers, cranes, arranging all necessary intermediate storage area(s) required thereof till the complete pipeline system is permanently installed; Loading, unloading, handling, stacking, storing and transportation to workshop(s)/ work site(s) of all materials (other than HDPE pipes) that may be used for the construction of pipeline system; Mobilizing and providing all equipment, manpower (skilled and unskilled), consumables and other resources etc., as required for the execution of complete work and thereafter demobilizing the same upon completion of work; Laying/ Installation of pipeline, associated fittings and accessories, etc. as per specifications, standards, drawings, other provisions of Contract and Instructions of Engineer-in-Charge; Supply & Installation of all materials whatsoever, as required for carrying out complete works; Supply of all materials, consumables, equipment, labor, etc; Staking and installation of construction markers, clearing, grubbing, grading (as required) of Standard Right-of-Use (ROU) / Right of Way (ROW); Cutting Trees, if required; Counting the number and type of trees cut in presence of DFO/ concerned authorities and keeping record thereof; Carrying out welding as per butt fusion welding using hydraulic operated HDPE welding machine to form required lengths as per tender document using low pressure fusion procedures as per ISO 21307 including testing thereof; Thorough internal cleaning of all pipes by suitable methods to remove debris, shots, grits etc.; Stringing of pipes along Standard ROU/ ROW including providing straw bags, soft padding/sand padding; Trenching to all depths and to a width to accommodate the pipeline as specified in Scope Document by excavation in all types of soil/ strata (including Normal Strata/ Hard Strata/ Hard Rock) & terrain(s), blasting, chiseling or otherwise cutting etc.; Providing Warning Devices (Mat/ Tape or Mesh), as required; Providing trench padding as required with sand/ graded earth approved by Engineer-in-Charge; Lowering the pipelines in trench, adhering to all safety norms implied by the PLL, providing required padding over and around the pipeline with sand/graded material approved by Engineer-In-Charge, backfilling with available approved excavated material and/or other suitable soil approved by Engineer-In-Charge; Carrying out hydrostatic testing including air cleaning, flushing, filling, pressurization of complete pipeline as approved by Engineer-In-Charge to the specified test pressure, providing all equipment, pumps, fittings, instruments, dead weight tester, all types of temporary flushing & cleaning devices etc., and services, supervision, labour, consumables, arranging adequate quantity of water of suitable quality required for hydrostatic testing, air, etc. as required, locating of leaks and rectification of defects, re-testing after rectification, successful completion of hydro-testing of pipeline; including all tie-in(s) with the pipeline/ piping installed by others; Carrying out all temporary, ancillary, auxiliary works and all incidental works required to make the pipeline ready for pre-commissioning; Final clean-up and restoration of right of use/ right of way including obtaining work permits/ NOCs as required and disposal of debris; Restoration of land, facilities and boundary wall etc. at associated facilities dismantled/damaged by the Contractor during construction; Obtaining work permits/ NOC from various statutory authorities having jurisdiction and complying with all stipulation/ conditions/ recommendation of the said authorities; Preparation of As-Built drawings, pipe-book and other records. SOR shall be read in conjunction with drawings, scope of work, specifications, standards and other provisions of contract document. **All above works for 160 mm (6") Nominal OD HDPE SDR-11 Pipe in Generally Flat Terrain with Normal Strata**	300	m

SL. NO.	DESCRIPTION	QTY	UOM
2	**SUPPLY & INSTALLATION OF ABOVEGROUND HDPE PIPELINE FROM PLL BOUNDARY WALL TO GIDC PUMPING STATION BOUNDARY:** Design & Detailed Engineering for installation of pipeline & associated facilities, Procurement, supply and delivery of 160 mm (6”) nominal outer diameter (OD) HDPE pipes of Standard dimension ratio (SDR) 11, material grade PE -100 & PN 12.5 conforming to IS 14333/2022 & IS - 4984/2016 and their latest version or amendments in standard lengths; Transportation including loading, unloading, handling, stacking, hauling and stringing of pipes to contractor's worksite(s)/ workshop(s)/ pipeline Right-Of-Use (ROU), including arranging all pipe trailers, cranes, arranging all necessary intermediate storage area(s) required thereof till the complete pipeline system is permanently installed; Loading, unloading, handling, stacking, storing and transportation to workshop(s)/ work site(s) of all materials (other than HDPE pipes) that may be used for the construction of pipeline system; Mobilizing and providing all equipment, manpower (skilled and unskilled), consumables and other resources etc., as required for the execution of complete work and thereafter demobilizing the same upon completion of work; Laying/ Installation of pipeline, associated fittings and accessories, etc. as per specifications, standards, drawings, other provisions of Contract and Instructions of Engineer-in-Charge; Supply & Installation of all materials whatsoever, as required for carrying out complete works; Supply of all materials, consumables, equipment, labor etc.; Staking and installation of construction markers, clearing, grubbing, grading (as required) of Standard Right-of-Use (ROU) / Right of Way (ROW); Cutting Trees, if required; Counting the number and type of trees cut in presence of DFO/ concerned authorities and keeping record thereof; Carrying out welding as per butt fusion welding using hydraulic operated HDPE welding machine to form required lengths as per tender document using low pressure fusion procedures as per ISO 21307 including testing thereof; Carrying out repairs of pipe and coating defects; Thorough internal cleaning of all pipes by suitable methods to remove debris, shots, grits etc.; Stringing of pipes along Standard ROU/ ROW including providing straw bags, soft padding/sand padding; Carrying out hydrostatic testing including air cleaning, flushing, filling, pressurization of complete pipeline as approved by Engineer-In-Charge to the specified test pressure, providing all equipment, pumps, fittings, instruments, dead weight tester, all types of pigs etc., and services, supervision, labour, consumables, arranging adequate quantity of water of suitable quality required for hydrostatic testing including, air, etc. as required, locating of leaks and rectification of defects, re-testing after rectification, successful completion of hydro-testing of pipeline; including all tie-in(s) with the pipeline/ piping installed by others; Carrying out all temporary, ancillary, auxiliary works and all incidental works required to make the pipeline ready for pre-commissioning; Final clean-up and restoration of right of use/ right of way including obtaining work permits/ NOCs as required and disposal of debris; Restoration of land, facilities and boundary wall etc. at associated facilities dismantled/damaged by the Contractor during construction; Obtaining work permits/ NOC from various statutory authorities having jurisdiction and complying with all stipulation/ conditions/ recommendation of the said authorities; Preparation of As-Built drawings, pipe-book and other records. SOR shall be read in conjunction with drawings, scope of work, specifications, standards and other provisions of contract document. **All above works for 160 mm (6") Nominal OD HDPE SDR-11 Pipe in Generally Flat Terrain with Normal Strata**	1250	m
3	**ABOVE GROUND PIPE SUPPORT WORKS** Carrying out piping support design for above ground pipeline along with generation of piping support drawings, Supply of all materials required for fabrication of pipe supports & special supports including supply of bolts, nuts, washers, U Clamps, Neoprene Pads, Insert Plates (as required) etc. as mentioned in the drawing/ standards and as defined in scope of work document, fabrication and erection of pipe/ equipment supports (for all sizes/ thickness) including shoes, pipes, cradles, turn buckles, T-posts for all types of guides, anchors etc. if applicable, all necessary equipment, consumables, labour etc. for completing all works. All structural and mechanical works including supply of all required materials required, including construction of foundations (PCC/ RCC works) for pipe supports and sleepers, fabrication and erection of supporting structural elements for piping such as shoes, pipes, T posts, cradles, clamps, anchors, guides, insert plates etc.; Providing T-Type pipe supports, based on EIL Std. 7-44-0636 at a maximum spacing of 3.0 m along the aboveground pipeline route for supporting the HDPE pipeline without sagging including clamp type guides (without restraining axial movement) as per EIL Std. 7-44-0655 with minimum 6 mm thick neoprene rubber liner between the HDPE pipe and the support to avoid point loading, abrasion and local flattening; Providing additional supports near valves, fittings, and changes in direction; Providing anchors near pumps & structures. , supply and application of paints and primers suitable for painting environment as defined in contract document and as per standard specification for Surface preparation and protective coating and completing the work as per drawings, scope of work, specifications, standards, other provisions of Contract and instruction of Engineer-in-Charge. All works as defined below:		
3.1	**PCC WORKS:** Providing and laying PLAIN CEMENT CONCRETE for all depths below and up to plinth level in foundations, drains, fillings, non-suspended floors, pavements & ramps or any other works etc. including shuttering, tamping, ramming, vibrating, curing etc. all as specified in any shape, position, thickness and finishing the top surface rough or smooth as specified and directed all complete for concrete of nominal mix 1:5:10 by mass (1 Cement: 5 Coarse Sand: 10 Crushed Stone Aggregates/Gravels) with 40mm and down size graded crushed stone aggregates/Gravels. ALL MATERIALS INCLUDING CEMENT SUPPLIED BY THE CONTRACTOR.	12	m^3
3.2	**RCC WORKS:** Providing and laying REINFORCED CEMENT CONCRETE OF M-30 GRADE with 20 mm and down size graded crushed stone aggregates/ gravel in SUB-STRUCTURE, applying cement wash on concrete surface (wherever no other surface application is specified), providing pockets, openings, recesses, chamfering, etc., wherever required, vibrating, tamping, curing and rendering if required to give a smooth and even surface etc. (EXCLUDING THE COST OF REINFORCEMENT, SHUTTERING & SPECIFIED ADMIXTURES) for all depths below and up to plinth level in any shape, position and thickness etc. all complete as specified, shown and directed. ALL MATERIALS INCLUDING CEMENT SUPPLIED BY THE CONTRACTOR.	40	m^3

SL. NO.	DESCRIPTION	QTY	UOM
3.3	**RCC REINFORCEMENT:** Supplying and placing in position HIGH YIELD-STRENGTH DEFORMED STEEL BARS REINFORCEMENT of Grade Fe550D (TMT) conforming to IS:1786, for RCC work including transporting the Steel, straightening, cleaning, decoiling, cutting, bending to required shapes and lengths as per details, binding with 18 SWG black soft annealed binding wire at every intersection, supplying and placing with proper cover blocks, supports, chairs, overlaps, welding, spacers, fan hooks etc. for all heights and depths etc. all complete as directed. SUPPLY OF ALL MATERIAL IN CONTRACTOR'S SCOPE.	1	MT
3.4	**SHUTTERING WORKS:** Providing and fixing CENTERING AND SHUTTERING in foundations, pedestals, pipe sleepers, columns etc. for all depths below and up to & inclusive of plinth level including shuttering for single pour concreting, strutting, bracing, propping etc., keeping the same in position during concreting and removal of the same after specified period etc. for Straight/ Inclined Shuttering, keeping necessary provision for inserts, projecting dowels, anchor bolts or any other fixture etc. all complete and as specified and directed.	300	m^2
3.5	**STRUCTURAL STEEL:** Supplying, transporting, storing, fabricating & erecting in position and testing/ examining bolted and/ or welded STRUCTURAL STEEL WORKS of Grade E250A / E250BR / E250B0 (confirming to per IS:2062) at all locations and levels including all built-up sections/ compound sections made out of rolled sections and/or plates/ bent plates in all types of structural frameworks or any other structural items or accessories to support equipment, piping, etc., cutting to required size, straightening/ bending if required, edge preparation, cleaning, preheating, bolting/ welding of joints, (including sealing the joints of box sections with continuous welding and plugging any open ends & holes of box sections), finishing edges by grinding, fixing in line and level with temporary staging & bracing and removal of the same after erection, grouting with Ordinary Grout or premix free flow Non-shrink Grout as specified, including preparation and submission of detailed fabrication drawings, preparing the surface for painting (SSPC-SP-10) and applying pre-erection/ shop primer (1 coat of F-9 @ 65-75 micron DFT) & all final painting works as per EIL Specification No. 6-79-0020 (or as per Job Specification, wherever applicable) after fabrication etc., all complete. SUPPLY OF ALL MATERIAL IN CONTRACTOR'S SCOPE.	15	MT
3.6	**ANCHOR BOLTS:** Supplying, fabricating, fixing and keeping in position at all levels and locations THREADED ANCHOR BOLTS of all diameters and nomenclature including nuts, washers, anchor plates, pipe sleeves etc. in foundations, columns, pedestals, slabs, beams, walls etc. or any other place as directed including handling & transporting, straightening if required, turning from relevant size M.S. rounds to required diameter, threading, welding, providing necessary templates and auxiliary dummy structures, if any, necessary tying and welding with reinforcement, adjustment of shuttering & reinforcement/any other fixture, greasing exposed metal surfaces, covering bolts and packing the sleeves with jute cloth etc. all complete as specified and directed.(SUPPLY OF ALL MATERIALS IN CONTRACTOR'S SCOPE).	3	MT
3.7	**EARTHWORK EXCAVATION IN SOIL** Earth work in EXCAVATION below ground level for all kinds of works in ALL TYPES OF SOILS for a depth up to 1.5m including removal of vegetation, shrubs and debris, cutting and dressing of sides in slopes, levelling, grading and ramming of bottoms, dewatering of accumulated water from any source and keeping the surface dry for subsequent works and disposal or stacking of excavated material within a lead of 100m, as directed including providing temporary supports to existing service lines like water pipes, sewage pipes, electric overhead and underground cables etc. all complete.	100	m^3
3.8	**BACKFILLING AFTER EXECUTION OF WORK** BACKFILLING after execution of the WORK to proper grade and level with selected materials from available excavated soil from spoil heaps within a lead of 100m, including re- excavating the deposited soil excavated earlier, breaking clods, laying at all depths and heights in layers of thickness not exceeding 15 cm watering, rolling and ramming by manual methods/ mechanical compactors to achieve 90% laboratory maximum dry density, dressing, trimming etc. in foundations, plinths, trenches, pits etc. all complete.	50	m^3
3.9	**BI-POLAR CONCRETE PENETRATING CORROSION INHIBITING ADMIXTURE** Supplying and mixing of approved brand of bi-polar concrete penetrating corrosion inhibiting admixture (confirming to EIL Specification No. 6-68-0017) in concrete as per manufacturer's specification for protection of reinforcement against corrosion. Supply of admixture in Contractor's scope.	130	kg

SL. NO.	DESCRIPTION	QTY	UOM
4	**SHALLOW HDD WORKS:** Complete work for crossings by shallow Horizontal Directional Drilling method in accordance with specifications, SCOPE OF WORK and as per approved Horizontal Directional Drilling Design & Methodology, in concurrence with Site/ Owner; Installation of 12" CARBON STEEL CASING PIPE FOR SUBDUCTING 6" HDPE pipeline across canal/ drain/ road/ other crossings by shallow horizontal directional drilling method in Normal Strata (Soft Soil/ Sand/ Clay/ Silty Sand/ Silty Clay etc.), including all additional drilled lengths necessitated by Contractor's engineering, design & based on site conditions; Mobilization and demobilization; Trial pit(s) for underground utility identification, Preparation of ramps and temporary launching and receiving pit(s) at entry & exit side of rig & restoration of the same after completion of work, Engineering, Preparation of crossing drawings and detailed construction method statement; supply of all materials (including casing insulators and casing end seals, materials for casing vents and drain assemblies etc.), all consumables, equipment, machinery, manpower and other resources; acquiring all additional land required for Contractor's storage, fabrication & construction; Carrying out inspection and repairs including supply of all repair materials; Handling, transportation and unloading of pipes; Preparation of string including BUTT FUSION welding, pre-post hydro-testing of completed string; Cutting of pipes, if required; Installation of pipeline as required by shallow horizontal directional drilling to the specified depth as per approved methodology; Disposal of corrosion inhibited water & bentonite as directed by Engineer In charge; Restoration and clean-up etc.; Preparation of as-built drawings, documents and other records etc.; Obtaining NOCs from relevant authorities & owners; Obtaining approval from Company for the design, engineering, calculations, drawings & documents; Carrying out all works in accordance with Scope of Work/ Standard/ Job specifications, drawings, in compliance to statutory authorities requirement & all provisions of the tender document and as per instructions of Company/ Engineer-In-charge. All above defined works for **Shallow HDD of 323.9 mm (12.75") OD x 6.35 mm WT (min) IS 3589 Gr FE 410, EW Carbon Steel Casing Pipe (Excluding supply of Casing Pipe covered under item sl. no. 7 below)**	108	m
5	**CASED CROSSING WORKS:** **Installation of 323.9 mm (12.75") OD x 6.35 mm WT (min) IS 3589 Gr FE 410, EW Carbon Steel Casing Pipe for subducting 6" HDPE pipe by Jacking/ Boring (Excluding supply of Casing Pipe covered under item sl. no. 7 below)** for road/ drain/nala/ canal crossings wherever required (as defined in SOW/ Alignment sheet) (including 500µm of Epoxy coating on Casing Pipes, vent & drain pipes) including design & detailed engineering in all types of soil/ strata (including Normal Strata/ Hard Strata/ Hard Rock, as defined subsequently) & terrain(s), supply of all other Contractor supplied materials viz. casing insulators and casing end seals, materials for casing vents and drain assemblies etc., including transportation, supply of all other materials, equipment, consumables, man-power, welding including visual inspection of all weld joints, installation of casing insulators, end seals, vents and drain- off pipes, backfilling and restoration as original of the facility crossed and performing all works as per drawings, scope of work, specifications, standards and instructions of Engineer-in-Charge and provisions of Contract document.	24	m
6	**INSTALLATION OF CASING PIPE BY OPEN CUT:** **Installation of 323.9 mm (12.75") OD x 6.35 mm WT (min) IS 3589 Gr FE 410, EW Carbon Steel Casing Pipe for subducting 6" HDPE pipe by Open Cut (Excluding supply of Casing Pipe covered under item sl. no. 7 below)** for road/ drain/nala/ canal crossings wherever required (as defined in SOW/ Alignment sheet) (including 500µm of Epoxy coating on Casing Pipes, vent & drain pipes) including design & detailed engineering in all types of soil/ strata (including Normal Strata/ Hard Strata/ Hard Rock, as defined subsequently) & terrain(s), supply of all other Contractor supplied materials viz. casing insulators and casing end seals, materials for casing vents and drain assemblies etc., including transportation, supply of all other materials, equipment, consumables, man-power, welding including visual inspection of all weld joints, installation of casing insulators, end seals, vents and drain- off pipes, backfilling and restoration as original of the facility crossed and performing all works as per drawings, scope of work, specifications, standards and instructions of Engineer-in-Charge and provisions of Contract document.	24	m
7	**SUPPLY OF CARBON STEEL PIPE:** Supply, procurement and transportation to worksite(s)/workshop(s) including loading, unloading and handling of Carbon Steel Casing Pipes as per, scope of work, specifications and standards, instructions of Owner/ Engineer-in-Charge and other provisions of Contract for **323.9 mm (12.75") OD x 6.35 mm WT (min) IS 3589 Gr FE 410, EW Carbon Steel Casing Pipe**	156	m
8	**WARNING MARKERS:** Supply, fabrication and installation of **Pipeline Warning Markers** along the route including all associated civil works such as excavation in all types of soil, construction of pedestals and grouting with concrete, clearing, supply and application of approved color & text and quality of primer and paint, stencil letter cutting for numbers, direction, chainage etc., restoration of area to original condition and performing all works as per drawings, scope of work, specifications, standards and instructions of Engineer-in-Charge. The painting of all markers shall conform to environments specified as per scope of work and protective coating specification.	10	nos.
9	Supply and installation of one(1) nos. HDPE Tank suitable for storage of treated effluent with storage volume of 5KL; Construction of RCC platform for the tank including supply of all required materials and manpower etc; Provision of one (1) nos. 1" dia. HDPE sampling connection with gate valve, as per P&ID, on the outlet line from the tank, including supply of all materials, as required.	LS	1

पाइपलाईन निर्माण (तटीय) के लिए मानक विनिर्देश

STANDARD SPECIFICATION FOR PIPELINE CONSTRUCTION (ONSHORE)

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
5	02.03.21	REVISED & REISSUED AS STANDARD SPECIFICATION	MT	RK	MSG	SM
4	22.06.15	REVISED & REISSUED AS STANDARD SPECIFICATION	NS	RK	VM	SC
3	27.03.09	REVISED & REISSUED AS STANDARD SPECIFICATION	NKS	RK	VM	ND
2	09.09.05	REVISED & REISSUED AS STANDARD SPECIFICATION	MKM	SK	AS	VJN
1	15.09.98	REVISED & REISSUED AS STANDARD SPECIFICATION	KKS	RK	VC	AS

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Abbreviations:

AFC	Approved for Construction
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing & Materials
DPT	Dye Penetration Test
FOS	Factor of Safety
GPRS	Ground Penetrating Radar System
HDD	Horizontal Directional Drilling
HSE	Health, Safety and Environment
MPT	Magnetic Particle Testing
NB	Nominal Bore
OD	Outside Diameter
OFC	Optical Fiber Cable
OISD	Oil Industry Safety Directorate
RoU	Right of Use
RoW	Right of Way
U/G	Under Ground
US DOT	United States Department of Transportation

Pipeline Engineering Standards Committee

Convenor : Mr. M. S. Gunjiyal

Members :
Mr. Raj Kishore
Mr. Gagan Deep Singh
Mr. Neeraj Rai
Mr. Ramandeep Singh Bains
Mr. Prabhakar Chowdhary (Process-1)
Mr. Neeraj Mathur (PDD)
Mr. Ravi Kumar Singh (Inspection)
Mr. Dipanjan Jana (Projects)
Mr. Divyajyot Singh (Constn.)

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1.0 SCOPE

1.1 This specification covers the minimum requirements for the various activities to be carried out by Contractor for or about the construction of cross-country onshore pipelines.

1.2 The various activities covered in this specification include the following works of pipeline construction:

- Clearing, grubbing and grading of Right-of-Use;
- Construction of all temporary facilities required in connection with the WORKS;
- Staking of the pipeline route;
- Handling, hauling, stringing and storing of all materials;
- Trenching;
- Field bending of line pipe;
- Lining-up and Welding;
- Pipeline laying;
- Backfilling;
- Tieing-in;
- Installation of auxiliary facilities and appurtenances forming a part of pipeline construction;
- Clean-up and restoration of Right-of-Use;
- Maintenance during defects liability period.

1.3 This specification shall be read in conjunction with Scope of Work and requirements indicated in specifications and documents included in the CONTRACT between Company and Contractor.

1.4 Contractor shall, with due care and diligence, execute the WORK in compliance with all laws, by laws, ordinances, regulations etc. of the land and provide all services and labour, inclusive of supervision thereof, all materials, excluding the materials indicated as "Company Supplied Materials" in the CONTRACT, equipment, appliances or other things of whatsoever nature required for the execution of the WORK, whether of a temporary or permanent nature.

1.5 Contractor shall take full responsibility for the stability, suitability and safety of all operations and methods involved in the WORK. Contractor shall deploy a qualified HSE Inspector at site before the start of field activities. The deployed HSE Inspector shall prepare the safety manual/ procedure to be followed during the execution of WORK. The safety manual/ procedure shall be submitted for approval to the Company's Representative. HSE Inspector shall ensure approved safety manual/ procedure are administered and enforced during the execution of WORK. He shall also ensure that field operations personnel are aware of and practice the policies & procedures set out in the safety manual.

1.6 Contractor shall be deemed to have inspected, examined and independently obtained all necessary information of WORK area(s) and its surroundings and shall have satisfied himself as practicable to the form and nature thereof, including sub-surface conditions, hydrological and climatic conditions, the extent and nature of the WORK and materials necessary for the completion of the WORK, and the means of access to the WORK area(s).

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1.7 Contractor shall be deemed to have obtained and understood all necessary information with respect to risks, contingencies and all other circumstances, which may influence the WORK. Any neglect/omission/failure on the part of Contractor in obtaining necessary and reliable information for performance of WORK shall not relieve him from any liabilities or responsibilities for completion of WORK.

1.8 Contractor shall, in connection with the WORK, provide and maintain at his own costs, all lights, guards, fencing, watching etc., when and where necessary or required by Company or by any duly constituted authority and/or by the authorities having jurisdiction thereof for the protection of the WORK and properties or for the safety and the convenience of public and/or others.

1.9 Unless otherwise specified, all sections of this specification shall apply to all the specifications referred in this specification.

2.0 REFERENCE CODES, STANDARDS AND SPECIFICATIONS

2.1 Reference has been made in this specification to the latest edition of the following codes, standards and specifications:

a.	API Standard 1104	:	Welding of Pipelines and Related facilities
b.	API 1105	:	Bulletin on Construction Practices for Oil and Products Pipelines
c.	ASME B 31.4	:	Pipeline Transportation Systems for Liquids and Slurries
d.	ASME B 31.8	:	Gas Transmission and Distribution Piping Systems
e.	BS OHSAS 18001	:	Occupational health and safety management systems – Requirements
f.	BS OHSAS 18002	:	Occupational health and safety management systems – Guidelines for the implementation of OHSAS 18001
g.	OISD STD 141	:	Design, construction and inspection requirements for cross -country liquid hydrocarbon pipelines
h.	OISD STD 214	:	Cross-country LPG Pipelines
i.	OISD STD 226	:	Natural Gas Transmission Pipelines and City Gas Distribution Networks
j.	Part 192, Title 49	:	Transportation of Natural and other Gases by Pipe Line (US DOT – Pipe Line Safety Standards)
k.	Part 195	:	Transportation of liquids by Pipe Line (US DOT - Pipe Line Safety Standards)
l.	PNGRB (T4S)	:	PNGRB Regulations GSR 808(E) Nov'2009
m.	PNGRB (T4S)	:	PNGRB Regulations GSR Infra/T4S/P&PPPL/01/2014
n.	Petroleum Rules 2002	:	Petroleum and Explosive Safety Organization

In case of conflict between the requirements of above mentioned codes, standards and practices, the most stringent requirement shall govern. In case of conflict between the

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requirements of this specification and that of the above referred codes, standards and practices, the requirements of this specification shall govern.

2.2 For the purpose of this specification the following definitions shall hold:

- the words `Shall' and `Must' are mandatory.
- the words `Should', `May' and `Will' are non-mandatory, advisory or recommended.

3.0 REQUIREMENT OF RIGHT OF USE AND ACCESS THERETO

Contractor shall, before starting and clearing operations, familiarize himself with all the requirements of the Authorities having jurisdiction over the Right of Use (RoU) for WORK along the pipeline route or in connection with the use of other lands or roads for construction purposes.

Contractor shall notify Company well in advance during WORK progress, the method of construction for crossing road, railway, pipeline, cable, canal, river and other existing obstacles.

Contractor shall not commence WORK on such crossings before having obtained approval from the Authorities and landowners concerned to the satisfaction of Company. The crossings shall be installed to meet at all times, the requirements and conditions of the permit(s) issued by the Authorities concerned. In the absence of any specific requirements by Authorities, Contractor shall comply with Company's instructions.

The right of ingress and egress to the RoU shall be limited to points where such RoU intersects ROW of public roads/ railways etc. Arrangements for other access required by the Contractor shall be made by him (at his own cost and responsibility) and for such accesses the requirements of this specification shall also apply.

Where the RoU comes within 30 meters of an existing line or facility, Contractor shall propose and provide methods to safeguard the existing line or facility (e.g. a demarcation fence). No work is allowed in such areas without Company's prior approval.

Where the RoU comes within the area of influence of high voltage electrical installations, the following instructions shall be followed:

3.1 Instructions concerning high voltage influencing Safety measures during construction of pipelines inside the area influenced by high voltage lines.

3.1.1 General

Pipelines, which are constructed inside the area of high voltage lines, may be electrically influenced by these high voltage lines. The voltage caused by the influence may at times be so high as to pose a danger to personnel working on the pipeline. It is imperative therefore, that the instructions given below shall be accurately followed:

3.1.1.1 Personnel doing WORK inside the area influenced by the high voltage system must wear electrically insulating foot-wear (e.g. rubber knee boots) and wear insulating rubber or plastic gloves.

3.1.1.2 It is a prerequisite that all personnel involved in construction of the pipeline, which is being constructed in the area influenced by the high voltage system, must be given clear instructions on safety measures to be taken while execution of WORK.

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3.1.1.3 Vehicles and equipment must be earth-connected. This may be effected by attaching an uninsulated cable or chain (which touches the ground) of adequate length to the underside of the vehicle.

3.1.1.4 If it is not impossible for plant and/or materials to come to within 50m of the centre of the high voltage system, special measures must be taken to prevent any approach beyond that distance, unless Clause 3.1.2 is complied with.

3.1.1.5 DURING THUNDERSTORMS OR WHEN DISCHARGES ARE OBSERVED ON INSULATORS ALL PERSONNEL MUST LEAVE THE AREA OF THE HIGH VOLTAGE LINE AND PIPELINE.

3.1.1.6 To prevent electrical voltages in a non-buried section of the pipeline from rising to dangerous values, the length of the pipeline section which has been welded together before burial must not exceed the length at which the maximum admissible voltage may be induced. This length shall be calculated using an approved calculation method.

3.1.1.7 Before a pipeline section is lowered into the trench the structure's earth electrodes indicated in the drawings or determined with calculation method must have been installed and connected both to the pipeline section already buried and to the section, which is about to be buried. The electrical connections, which serve the purpose of preventing dangerous voltages, must have a min. area of $35mm^2$.

Said connections must not be interrupted until after the permanent safety earth connections have been installed and connected to the entire uninterrupted pipeline.

3.1.1.8 The welded connection between the pipeline section and the section already buried must be installed at a distance of at least 50m from the nearest point of a pylon base.

3.1.2 **Additional measures for WORK to be done at a distance less than 50m from the centre of the high voltage system.**

If WORK is to be done at a distance less than 50m from the centre of the high voltage system, the measures indicated below must be complied with, in addition to the instructions specified in clause 3.1.1.

3.1.2.1 The WORK must not be started until agreement has been reached with the Authorities, which control the high voltage system, about the implementation of the safety measures specified in this section.

3.1.2.2 Measures must be taken to prevent excavating and hoisting equipment from approaching high voltage lines to within any of the following distances.

This distance depends on the voltage carried. For individual connections the distance must be:

0	-	50 KV	:	3m
50	-	200KV	:	5m
200	-	380KV	:	8m

The measures taken may be as follows:

1. Special selection of equipment, or limiting or blocking certain directions of movement, or limiting the operational area, thereby making it definitely impossible for any WORK to be done at a distance from the high voltage line of less than the accepted minimum.

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2. In case the measures recommended in 1. above are not feasible, installation of clearly visible markers of sufficient height or laying out a `no passage beyond this point' line of drums painted bright red and white must prevent any WORK being done inside the danger area. Furthermore, an inspector must be present all the time.

3.1.2.3 In the event that a vehicle, crane etc. should accidentally come into contact with a live cable of a high voltage system or flash-over of electrical charge occurs, the driver must not leave his vehicle because this will pose a serious threat to his life.

The vehicle or crane must break the contact WITHOUT ANY HELP FROM OUTSIDE.

The driver must not leave his vehicle until he has managed to leave the dangerous area, or alternatively, when the Electricity Authorities have given notice that the cable(s) have been put out of circuit. In case a serious fire starts in the vehicle, he is permitted to jump from the vehicle, clearing it as far as possible, while the jump should possibly be to a dry spot. Drivers of vehicle or crane working inside the area influenced by high voltage lines shall be aware regarding the emergency action plan.

4.0 RIGHT-OF-USE

The Contractor is required to perform his construction activities within the width of Right-of-Use (RoU) set aside for construction of pipeline, unless he has made other arrangements with the land owner and/or tenant for using extra land. Variation in this width caused by local conditions or installation of associated pipeline facilities or existing pipelines will be identified in the field or instructed to the Contractor by Company.

The Right-of-Use boundary lines shall be accurately staked by the Contractor, so as to prepare the strip for laying the pipeline.

4.1 Stakings

Prior to clearing operations Contractor shall:

1. Install Bench Marks, Intersection Points and other required survey monuments.

2. Stake markers in the centerline of the pipeline at distances of maximum 100 metres for straight line sections and maximum 10 metres of horizontal bends. Wherever RoU centerline has been staked on ground, Contractor shall exercise care in accurately staking the pipeline centerline, in consultation with Company.

3. Stake two RoU markers at least at every 100 metres.

4. Set out a reference line with respect to pipeline centerline at a convenient location. Markers on reference line shall be at a distance of maximum 100 metres for straight line sections and maximum 10 metres for horizontal bends.

5. Install distinct markers location and indicating special points, such as but not limited to:

   Contract limits, obstacle crossings, change of wall thickness, including corresponding chainage, etc.

6. Chainage markers shall be installed at every 250 meter.

RoU Markers shall be staked out at the boundary limits of Right-of-Use wherever possible. RoU Markers shall be painted red with numbers painted in white. Number shall be identical to centerline marker number with letters A (left side) and B(right side) added, (looking to

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flow direction). Reference markers shall also carry the same information as its corresponding centerline markers.

Markers shall be of suitable material so as to serve their purpose and shall be coloured distinctly for easy identification. Contractor shall be responsible for the maintenance and replacement of the reference line markers until the permanent pipeline markers are placed and the as-built drawings are submitted and approved.

Any deviation from the approved alignment shall be executed by Contractor after seeking Company approval in writing prior to clearing operations.

4.2 Monuments

All shrines, monuments, border stones, stone walls and the like shall be protected and when required, removed for safe keeping and replaced in original condition after construction as directed by Company.

4.3 Fencing

Prior to clearing and grading of the Right-of-Use or stringing of pipe, Contractor shall open fences on or crossing the construction Right-of-Use and install temporary gates of sound construction made of similar materials and suitable quality to serve purpose of original fence. Adjacent posts shall be adequately braced to prevent slackening of the remainder of the fence. Before such fences are cut and opened, Contractor shall notify the land owner or tenant, and where practicable, the opening of the fences shall be in accordance with the wishes of said owner and tenant. In all cases where Contractor removes fences to obtain WORK room, Contractor shall provide and install temporary fencing, and on completion of construction shall restore such fencing to its original condition.

Contractor shall install temporary fencing on either side of RoU where in Company's opinion, it is considered essential to ensure safety and non-interference, especially in areas like grazing lands, villages etc.

Fencing shall be removable type wherever necessary, to permit crossing of traffic. The type of fencing must be suitable for the situation in accordance with user. The pole distance shall not be greater than 6m. The minimum height of the fencing shall be 1.2 m above grade. Fencing can consist of one or more rows of smooth wire and/or of barbed wire.

Fencing shall be continuously maintained and the thorough-ways inspected to be shut during the execution of the WORK.

4.4 RoU Clearing and Grading

Any obstacle, which may hinder the construction and laying of the pipeline all along the pipeline route and for a strip of land of the size provided, shall be removed.

4.4.1 All stumps shall be grubbed on a continuous strip, with a width equal to trench top width plus two meters on either side centered on the pipeline centerline. Further, all stumps will be grubbed from areas of the construction Right-of-Use, where Right-of-Use grading will be required. Outside of these areas to be graded and the mentioned trench strip, and at the option of Contractor, the stumps may either be grubbed or cut off to ground level. Any stump cut off must be left in a condition suitable for rubber-tyred pipeline equipment traffic.

4.4.2 All grubbed stumps, timber, bush, undergrowth and roots cut or removed from the Right-of-Use shall be disposed off in a manner and method satisfactory to Company, land-owner and/or tenant, and Government Authorities having jurisdiction and as soon as practical after

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the initial removal. In no case shall it be left to interfere with the grading and laying operations. Whenever stumps are grubbed and a hole is left in the ground, Contractor shall back-fill the hole and compact it to prevent water from gathering in it and making a big hole.

4.4.3 Contractor shall grade the pipeline Right-of-Use as required for proper installation of the pipeline, for providing access to the pipeline during construction, and for ensuring that the pipeline is constructed in accordance with the most up-to-date engineering and construction practices.

4.4.4 Contractor shall grade sharp points or low points, without prejudice to section 6.0 (trenching) of this specification, to allow the pipe to be bent and laid within the limits set forth in these specifications and drawings as regards the minimum elastic curvature permitted, and shall drill, blast or excavate any rock or other material which cannot be graded off with ordinary grading equipment in order to make an adequate working space along the pipeline.

4.4.5 No temporary or permanent deposit of any kind of material resulting from clearing and grading shall be permitted in the approach to roads, railways, streams, ditches, drainage ditches and any other position which may hinder the passage and/or the natural water drainage.

4.4.6 The Right-of-Use clearing and grading operations shall in no case involve embankment structures of any type and class without prior approval of the authorities having jurisdiction over the same.

4.4.7 In the case of natural or artificial deposits of loose soil, sand, heaps of earth, or other fill materials, these shall be removed till stable natural ground level is reached so as to ensure the construction of the pipeline ditch in stable ground.

4.4.8 In the case of Right-of-Use clearing and grading on the hillside or in steep slope areas, proper barriers or other arrangement/structures shall be provided to prevent the removed materials from rolling downhill. The Right-of-Use cross fall shall not exceed 10%. Slope of side hill faces shall be stabilised to prevent landslides.

4.4.9 Wherever the pipeline Right-of-Use runs across, through or alongside farmyards, built-up areas, groups of trees, forests, groves, horticultural spreads, gardens, grass-fields, ditches, dikes, roads, paths, railways or any other area with restrictions of some kind, Contractor shall grade only the width of the Right-of-Use necessary for digging the pipeline trench and constructing the pipeline. In the said places Contractor shall carry out the works in such a way that damage resulting from the pipeline construction is kept to a minimum.

4.5 Provision of Detours

Contractor shall do all necessary grading and bridging at road, water and other crossings and at other locations where needed, to permit the passage of its men and equipment. It is understood that the Contractor has recognised such restrictive features of the Right-of-Use and shall provide the necessary detours and execute the works without any extra cost to Company. Public travel shall not be inconvenienced nor shall it be wholly obstructed at any point.

Contractor at his own cost shall furnish and maintain watchman detours, lanterns, traffic lights, barricades, signs, wherever necessary to fully protect the public.

Contractor shall be responsible for moving its equipment and men across or around watercourses. This may require the construction of temporary bridges or culverts. Temporary bridging required for Right-of-Use crossing water courses shall be constructed in consultation with concerned Authorities. Contractor shall ensure that such temporary works

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shall not interfere with normal water flow, avoid overflows, keep the existing morphology unchanged and shall not unduly damage the banks of water courses. No public ditches or drains shall be filled or bridged for passage of equipment until Contractor has secured written approval of the Authorities having jurisdiction over the same. Contractor shall furnish Company a copy of such approval.

4.6 Steep and Rocky Terrain

Grading operations could normally be carried out along the Right-of-Use with mechanical excavators or manually. In certain areas, grading may have to be resorted to exclusively by blasting.

In rough or steep terrain, Contractor may have to grade access roads and temporary bypass roads for its own use. Where such access roads do not fall on the Right-of-Use, Contractor shall obtain necessary written permission from land owners and tenants and be responsible for all damages caused by the construction and use of such roads, and at no extra cost to Company.

Wherever rocky terrain is encountered, grading shall be carried out in all types of solid rocks which cannot be removed until loosened by blasting, drilling, wedging or by other recognized methods of querrying solid rocks.

Where use of explosives is required in connection with Right-of-Use grading and trenching, Contractor shall comply fully with requirements of the use of explosives as provided under clause 6.3 of this Specification and as provided under "Rules for Blasting", Specification No. 6-71-0061 issued for this purpose.

4.7 High water table location

In the location parallel or perpendicular to river, canals or marshy areas or any other such areas, Contractor shall ensure the stability of the trench by step cutting or by increasing the angle of inclination of the trench. Pumps shall be deployed to dewater the trench before lowering of the pipeline, to maintain the trench in dry condition. In case, water cannot be removed from the bottom of the trench, then concrete coated pipes shall be used to avoid floatation of the pipe string in the trench.

4.8 Off Right-of-Use Damages

Contractor shall confine all its operations within limits of the Right-of-Use. Any damage to property outside RoU shall be restored or settled to the Contractor's account.

Contractor shall promptly settle all off Right-of-Use damage claims. Should Contractor fail to do so, Company shall give written notice to Contractor that if Contractor does not settle such claims within seven days after such notice, Company shall have the authority to settle claims from the account of Contractor.

5.0 HANDLING, HAULING, STRINGING AND STORING OF MATERIALS

5.1 General

The Contractor shall exercise utmost care in handling line pipe and other materials. Contractor shall be fully responsible for all materials and their identification until such time that the pipes and other materials are installed in permanent installation. Contractor shall be fully responsible for arranging and paying for temporary storage areas for the pipeline materials, however, method of storage shall be approved by Company. Contractor shall

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submit a procedure to be followed at site for storage of pipes and other materials including their identification for Company's approval.

Contractor shall reimburse the Company for the cost of replacement of all Company supplied materials damaged during the period in which such materials are in the custody of the Contractor. It shall be Contractor's responsibility to unpack any packings for the materials supplied by Company.

Pipe bevel protectors shall always be kept in position during all handling, transportation and stringing operations and shall be removed only prior to fit-up for welding. After fabrication and welding, the Contractor shall arrange to return all such bevel protectors at Company's designated storage yard and as instructed by Company.

5.2 "Taking-over" of Line Pipe

The following stipulations shall apply in case CONTRACT provides for supply of line pipe, bare and/or corrosion coated, by Company.

Contractor shall receive and 'take over' against requisition, line pipe from the Company's designated place(s) of delivery as defined in the CONTRACT. Contractor shall perform visual inspection of the bare pipes and coating of the corrosion coated pipes, as the case may be, in the presence of Company and all damages shall be recorded. In the case of corrosion coated pipes, Contractor at his option may carry out holiday detection at a prescribed set voltage and record such holidays, in the presence of Company, at the time of 'taking over'. However, if Contractor proposes to perform only visual inspection of coating at the time of 'taking over', then repair of all holidays found at the time of laying the pipeline shall be carried out by the Contractor at no extra cost to Company.

The Contractor shall be entitled to extra compensation for repair and rectification of defects recorded at the time of 'taking over' as per the rate set forth in the "CONTRACT". Repair of all damages occurring after taking over the delivery of the materials shall be to the Contractor's cost. In case of delays in handing over of Company supplied materials, Contractor shall be fully responsible for stopping and rearranging means of transportation at no extra cost to Company.

5.3 Handling and Hauling of Line Pipe

5.3.1 Bare pipes

Contractor shall unload, load, stockpile and transport the bare pipes using suitable means and in a manner to avoid denting, flattening, or other damages to pipes. Pipe shall not be allowed to drop or strike objects, which will damage the pipe but shall be lifted or lowered from one level to another by suitable equipment. Lifting hooks when used, shall be equipped with a plate curved to fit the curvature of the pipe. In loading pipe on trucks each length shall be lowered to position without dropping and each succeeding length shall rest on special supports on the truck and shall be separated from the adjacent pipes. After loading, suitable chains and padding shall be used to tie the load securely to each bolster. Pipe, when stock piled, shall be placed on suitable skid to keep it clear of the ground and flood water. Care shall be exercised in handling or stock-piling pipes in order to avoid distortion, flattening, denting or other damages. The Contractor shall provide all necessary timber or other materials required for the stock-piling. While stacking, the number of allowable layers of bare pipes shall be calculated as per API RP 5L1 and shall be agreed with Company. The stacks must be properly secured against sliding and shall consist of pipes of the same diameter and wall thickness. Adjacent stacks of pipes having different dimensional characteristics shall be clearly separated.

Pipes which are damaged at the time of delivery or 'taking-over' (when line pipe is supplied

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by Company), particularly those which are dented, buckled, or otherwise permanently deformed, must be stacked separately and may be transported to the sites only when these defects have been repaired or eliminated.

5.3.2 **Corrosion coated pipes**

The Contractor shall load, unload, transport and stockpile the coated pipes using approved suitable means and in a manner to avoid damage to the pipe and coating. Contractor shall submit to Company a complete procedure indicating the manner and arrangement used for handling and stacking of coated pipes for Company approval prior to commencement of handling operations.

Use of vacuum lifting equipments is preferred. Hooks may also be used for handling the pipes provided they have sufficient width and depth to fit the inside of the pipe and covered with soft material like rubber, Teflon or equivalent, so as not to cause damages to bevel or pipe ends. During hoisting cables/wire ropes shall have sufficient inclination compared to pipe axis so that they do not come into contact with external coating.

Coated pipes may be handled by means of slings and belts of proper width (minimum 60 mm) made of non-metallic/non-abrasive materials. In this case, pipes to be stacked shall be separated row by row to avoid damages by rubbing the coated surface in the process of taking off the slings. Use of round sectional slings is prohibited.

During handling, suitable handling equipments with proper length of booms shall be used. Forklifts may be used provided that the arms of the forklifts are covered by suitable pads preferably rubber. Before lifting operations, it is essential to ensure that the pipe surface is free from foreign materials with sharp edges. Belts/slings when used shall be cleaned to remove hard materials such as stone, gravel etc. Coated pipes shall not be bumped against any other pipe or any other objects. Rolling, skidding or dragging shall be strictly forbidden.

Coated pipes at all times shall be stacked completely clear from the ground so that the bottom row of pipes remains free from any surface water. The pipes shall be stacked at a slope so that driving rain does not collect inside the pipe.

The coated pipes may be stacked by placing them on ridges of sand free from stones and covered with a plastic film or on wooden supports provided with suitable cover. This cover can, for example, consist of dry, germ free straw with a plastic film, otherwise foam rubber may be used. The supports shall be spaced in such a manner as to avoid permanent bending of the pipes, particularly in case of small diameter pipes with low wall thickness. The pipes shall be stacked so that the uncoated bevelled ends are in line at one end, thus making differences in lengths clearly noticeable.

Stacks shall consist of limited number of layers so that the pressure exercised by the pipes own weight does not cause damages to the coating. Each pipe section shall be separated by means of spacers suitably spaced for this purpose. Stacks shall be suitably secured against falling down and shall consist of pipe sections having the same diameter and wall thickness. The weld bead of pipes shall be positioned in such a manner so as not to touch the adjacent pipes.

The ends of the pipes during handling and stacking shall always be protected with bevel protectors.

The trailers/rail wagons shall be equipped with adequate pipe supports having as many round hollow beds as the number of pipes to be placed on the bottom of the trailer bed. Supports shall be provided for at least 10% of the pipe length. These supports shall be lined with a rubber protection and shall be spaced in a manner as to support equal load from the pipes. The rubber protection shall be free from all nails and staples where pipes are in

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contact. The second layer and all subsequent layers shall be separated from each other with adequate number of separating layers of protective material such as straw in plastic covers or mineral wool strips or equivalent, to avoid direct touch between the coated pipes.

All stanchions of trailers/rail wagons used for transportation shall be covered by non-abrasive material like rubber belts or equivalent. Care shall be exercised to properly cover the top of the stanchions and convex portions such as reinforcement of the truck/rail wagon body, rivets etc. to prevent damage to the coated surface.

5.4 Stringing of Pipe

Pipes shall be unloaded from the stringing trucks and lowered to the ground by means of Side boom/Hydra crane tractor or swinging crane or other suitable equipment using lifting devices as mentioned earlier. Dragging or sliding of pipe shall not be permitted. Special precaution shall be taken during stringing of corrosion coated pipes as per the special requirements of previous Para. Stringing of pipe shall only be carried out in daylight and after clearing and grading operations have been completed. Pipe shall not be strung on the Right-of-Use in rocky areas where blasting may be required, until all blasting is complete and the area cleared of all debris.

The stringing of the pipe on the Right-of-Use shall be done in such a manner as to cause the least interference with the normal use of the land crossed and to avoid damage to or interference with the pipes. The sequence of pipes must be interrupted at suitable intervals, spaced to coincide with passages, roads, railways and water-courses crossings as well as at other places if requested by land Owner or tenants to permit use of the land. Also care shall be taken to provide safe working space between trench edge and the pipe. Pipe shall be strung on approved soft earth / sand filled bags and wedge. Bottom of pipe shall in no way touch the ground. There shall be sufficient clearance from bottom of pipe & the ground level. The pipe shall be supported at minimum two locations.

In case line pipe supply is by different Manufacturers, Contractor shall string all line pipe of one Manufacturer before commencing the stringing of the line pipe of another Manufacturer.

When parallel pipelines are being constructed, bumping against and contact with the strung sections of pipe shall be avoided, whether the stringing of the pipes for the individual lines is carried out separately or simultaneously. When parallel pipes of different sizes are to be laid, the pipe stringing shall suit the respective location of pipes in the trench.

The pipe lengths must be properly spaced in order to make easier the handling during the welding phase.

It shall be the responsibility of the Contractor to see that pipe is strung in accordance with the approved drawings for the proper placement of pipe by size, thickness, grade and other specifications. Any additional handling of pipes resulting from failure to, comply with these requirements shall be at the Contractor's expense.

5.5 Repair of Damaged Pipes

After the pipe has been strung on the Right-of-Use, it shall be inspected by the Contractor and the Company and all defective pipe ends repaired. Defective pipes shall be repaired or rejected as the Company may direct as per the requirements of clause 5.2 of this Specification.

5.6 Materials other than line pipe

Contractor shall receive and take over against requisition all Company supplied materials from Company's designated place(s) of delivery as defined in the CONTRACT. Contractor

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shall perform visual inspection and defects, if any noted, shall be recorded separately. The Contractor shall be entitled to extra compensation for repair and rectification of such defects at the rates set forth in the "CONTRACT".

The Contractor shall perform the necessary loading, unloading, hauling from points designated by the Company and storing, if necessary, of all materials. The Contractor shall exercise care in handling, hauling, storing and distribution of materials in order to avoid damage and deterioration of these materials and prevent their theft or loss.

Materials excluding line pipe shall be stored in sheltered storage. Such materials shall not be strung on the Right-of-Use but shall be transported in covered conveyances for use only at the time of installation.

Contractor shall ensure that all valves and other materials, wherever applicable, are fitted with suitable end covers of the type approved by Company. Materials with worked surfaces such as flanges, pipe fittings, etc. must be stacked and handled so as to avoid contact with the ground or with substances that could damage them.

The Manufacturer's instructions regarding temperature and procedure for storing materials, which are subject to alteration of the original properties and characteristics due to unsuitable storage, must be strictly complied with and, if required, an adequate heat conditioning shall be provided for these materials.

When material is supplied in containers and packages, it must not be thrown or dropped or handled using hooks which could damage the container or the materials, either during loading/unloading or during successive handling, until their final use.

Coating materials, which are susceptible of deteriorating or suffering from damages especially due to humidity, exposure to high thermal excursions or other adverse weather conditions, shall be suitably stored and protected. These materials shall be kept permanently in store, supported above the ground in a dry place protected against the weather and transported for use only at the time and in the quantities necessary for immediate application. Deteriorated materials shall not be used and replaced with no extra cost to Company.

5.7 Identification

Contractor shall provide all pipes, bends etc. greater than 50mm NB with serial numbers as soon as possible upon the receipt of such materials at site and measure their length and state it on the pipes, etc. Pipes to be bent shall be measured prior to bending. Identification (i.e. letter, number and length) shall be indelible.

All serial numbers shall be recorded in a list, which shall also state appurtenant pipe numbers.

Besides recording the stamped pipe numbers, length of pipe and painted-on serial numbers, the stamped-in numbers of T-pieces, bends, valves, etc. and the batch numbers of bends, T-pieces, valves, etc and the make of valves, shall also be recorded in said list.

Before a pipe length, pipe end, etc is cut, the painted serial number and stamped-in pipe number shall be transferred by Contractor in the presence of Company to either side of the joint, which is to be made by cutting, and the changes shall be recorded in the above mentioned list stating the (new) length. The result shall be such that all pipes, pups, etc. of diameter greater than 50mm NB bear clear marks painted on.

Contractor shall explicitly instruct his staff that parts which cannot be identified must not be removed, except after permission by Company.

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As a general rule parts shall be marked as described above before being moved. In no conditions may unmarked parts be incorporated into the WORK.

6.0 TRENCHING

6.1 Location

Contractor shall excavate and maintain the pipeline trench on the staked centerline of the pipeline taking into account the curves of the pipeline.

In case of common RoU, the centerline of the trench shall be established from the location of existing pipeline. In case of independent RoU, the centerline of the trench shall be established from the edge of RoU.

6.2 Excavation

6.2.1 Contractor shall, by the method approved by Company, dig the pipeline trench on the cleared and graded Right-of-Use. In cultivable land and other areas specifically designated by the Company, top 300mm of the arable soil on the pipeline trench top width shall be excavated and stored separately, to be replaced in original position, after backfilling and compacting rest of the trench.

Suitable crossings shall be provided and maintained over the open RoU, where necessary, to permit general public, property owners or his tenants to cross or move stock or equipment from one side of the trench to the other.

Care shall be exercised to see that fresh soil recovered from trenching operation, intended to be used for backfilling over the laid pipe in the trench, is not mixed with loose debris or foreign material. The excavated material shall never be deposited over or against the strung pipe.

6.2.2 In steep slope areas or on the hillside, before commencing the works, proper barriers or other protection shall be provided to prevent the removed materials from rolling downhill. Equipments shall also be tied-up suitably to prevent rolling/ toppling of man and material during trenching activity in steep slopes.

6.2.3 On slopes wherever there is danger of landslide, the pipeline trench shall be maintained open only for the time strictly necessary. Moreover, the Company may require manual excavation of trench, local route detouring and limiting the period of execution of the works. The Contractor shall make adequate arrangements for safe working of the personnel involved in manual excavation of trench. Wherever trench depth exceeds 2m, Contractor shall take preventive measures such as shoring & strutting by wooden planks to ensure safety to the personnel.

6.2.4 In certain sloppy sections, before the trench cuts through the water table, proper drainage shall be ensured both near the ditch and the Right-of-Use in order to guarantee soil stability.

6.2.5 All sewers drain, ditches and other natural waterways involved in the execution of the works shall be maintained open and functional. The same applies to canals, irrigation canals, and pipelines and buried facilities crossed by the ditch for which temporary installations such as Hume pipes shall be provided as required for passage of water.

6.2.6 Trench in populated areas shall be provided with all protection measures/ barricading with proper sign boards to avoid possibility of human/ livestock falling in the trench accidently.

6.2.7 Wherever, OFC is to be laid along the pipeline in a common trench, as per Contract, trench width shall be sufficient to accommodate optical fiber cable (OFC). Trench dimension shall be as per Standard No. 7-71-0005 (Trench Dimensions for Pipeline).

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6.3 Blasting

Blasting for trenching and the related removal of scattered rock and debris caused by the blasting from the Right-of-Use and/or adjacent property, shall be performed by Contractor as part of his WORK.

Every possible precaution shall be taken to prevent injuries and damages to persons and properties during blasting operations, which shall be performed in accordance with Rules for Blasting, Specification no. 6- 71-0061 issued for the purpose.

6.3.1 All necessary precautions shall be taken to prevent stones from falling outside the Right-of-Use and in cultivated areas and to avoid any damage to the installations and properties existing nearby.

6.3.2 Blasting and removal of debris shall be carried out prior to stringing of the pipes.

6.3.3 Company reserves the right to refuse blasting where possible danger exists to property, existing utilities or other structures. In such locations other methods of excavating rock shall be proposed by Contractor and shall be approved by Company.

6.4 Normal Cover and Trench Dimensions

The trench shall be excavated to a minimum width so as to provide, on both sides of the installed pipeline, a clearance as indicated in the job standards/drawings and to a depth sufficient to provide the minimum cover as indicated below. The dimensions in the table below shall govern except as noted herein or as shown on the job standards or detailed construction documents/drawings or as required by authorities having jurisdiction, whichever is greatest. Minimum depth of cover shall be measured from the top of pipe corrosion/concrete weight coating (as applicable) to the top of undisturbed surface of the soil or top of graded working strip or top of road or top of rail whichever is lower. Fill material in working strip shall not be considered to add to the depth of cover. However, surface of fill material placed to fill hollows may be used to determine the depth of cover subject to prior approval by Company.

Location		Minimum Cover in meters
a)	Industrial, Commercial & Residential Area	1.0/ 1.2 (Note-1)
b)	Rocky Terrain	1.0
c)	Minor water crossing/canals/drain/nala/stream	1.5
d)	River crossings for which scour depth is defined (below scour)	1.5
e)	River crossings (Bank width < 50m) (below lowest bed level)	1.5
f)	Other River crossings (Bank width > 50m) (below lowest bed level)	2.5 (for normal soil) 1.5 (for rocky strata)
g)	Water crossing by HDD (below scour level)	2.5
h)	Uncased/Cased Road Crossings/Station approach	1.2
i)	Railways crossing	1.7

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Location		Minimum Cover in meters
j)	Drainage, ditches at roads/railway crossings	1.0/ 1.2 (Note-1)
k)	Marshy land and creek area	1.5

Notes:

1. Cover is 1.0 meter for pipelines designed as per ASME B31.8 and 1.2 meters for pipelines as per ASME B31.4.
2. In case pipeline is located within 15 m from any dwelling unit, the cover shall be increased by 300 mm over and above that specified.

6.5 Cutting and Removal of Paving

Whenever it is permitted by Authorities and/or Company to open cut a paved road crossing, or where the line is routed within the road pavement, Contractor shall remove the paving in accordance with the restrictions and requirements of the Authorities having jurisdiction thereof or as directed by Company. The open cut for the road crossing shall be carried out only when the section of pipeline to be laid is complete. After laying the pipeline, backfilling shall be immediately performed and all the area connected with the works shall be temporarily restored.

Throughout the period of execution of such works, Contractor shall provide and use warning signs, traffic lights or lanterns, barricades, fencing, watchman, etc. as required by the local authorities having jurisdiction and/or Company.

For all roads, paths, walkways etc., which are open-cut, Contractor shall provide temporary diversions properly constructed to allow the passage of normal traffic with the minimum of inconvenience and interruptions.

The paving shall be restored to its original condition after the pipeline is installed.

6.6 Extra Depth and Clearance

At points where the contour of the earth may require extra depth to fit the minimum radius of the bend as specified or to eliminate unnecessary bending of the pipe according to customary good pipeline practice, or where a deep trench is required at the approaches to crossings of roadways, railroads, rivers, streams, drainage ditches, and the like, Contractor shall excavate such additional depth as may be necessary at no extra cost to the Company.

Contractor shall excavate to additional depth where the pipeline approaches and crosses other pipelines, sewers, drain pipes, water mains, telephone conduits, and other underground structures, so that the pipeline may be laid with at least 50 centimeters free clearance from the obstacle or as specified in the drawings, or such greater minimum distances as may be required by authorities having jurisdiction.

Where the pipeline crosses areas, whose easements specifically require greater than normal depths of cover, the trench shall be excavated to extra depth in accordance with the Right-of-Use Agreements or as required.

Contractor shall excavate all such additional depths as may be necessary at no extra cost to the Company.

6.7 Grades, Bends and Finish of Trench

The trench is to be cut to a grade that will provide a firm, uniform and continuous support for the pipe. Bends shall be made in the pipe at significant changes in grade of the trench. Company reserves the right to set the grade of the trench and locate the bends if so desired,

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in which case Contractor shall excavate, at no extra cost, the trench and bend the pipe to such a grade. Company desires reduce to a minimum the required number of cold field bends to lay the pipe to conform to the general contour of the ground and maintain a normal cover. This can be accomplished by cutting the trench slightly deeper at the crest of ridges and by gradually deepening the trench in approaches to crossings. Such trenching WORK shall be done by Contractor at no extra cost to the Company.

Company intends that there will be a minimum of hand grading of the trench bottom. However, to achieve this, Contractor will have to dig as square a bottom of the trench as possible with the equipment. This in part can be obtained by adjusting and adopting the crumbing shoe and digging teeth of the trenching machines and by use of a drag behind the trenching machines or manually dressing-up the same. Contractor shall do such hand WORK in the trench as is necessary to free the bottom of the trench from loose rock and hard clay and to trim protruding roots from the bottom and side walls of the trench.

6.8 Padding

In all cases where rock or gravel or murum/hard soil is encountered in the bottom of the trench, Company will decide the exact extent of trench padding that may be required. The thickness of the compacted padding shall not be less than 150mm. In those areas that are to be padded, the trench shall be at least 150mm deeper than otherwise required, and evenly and sufficiently padded to keep the pipe, when in place, at least 150mm above bottom of excavated trench.

Acceptable padding shall be placed under the pipeline before its installation, and around after installation to establish at both sides and on top of the pipe a permanent layer of padding. The thickness of compacted padding on top of pipe corrosion coating shall be at least 150mm. Padding materials that are approved by Company shall be graded soil/sand and/or other materials containing no gravel, rock, or lumps of hard soil. Suitable sand approved by Engineer-in-Charge shall be used for padding.

When specified in the CONTRACT, rock shield may be used in place of or in addition to sand padding as indicated above. Such rock shield shall be in accordance with the specification issued for the purpose and shall be subject to Company approval.

6.9 Protection of Trench

Contractor shall keep the trench in good condition until the pipe is laid, and no claim is to be made to the Company by reason of its caving either before or after pipe is laid.

All lumber, sheet-piling jacks or other materials that may be necessary to shore the trench, in order to prevent caving are to be furnished and removed by Contractor.

Contractor shall dewater if necessary, using well point system/concrete grouting for stabilization of trench wall or other suitable systems, shore or do what else might be required to excavate the trench, install the pipe in it and backfill the trench in accordance with the specifications at no extra cost to Company.

6.10 Protection of Underground Utilities and Special Methods

Available details of underground utilities, as far as acquired by Company, shall be indicated in the Drawings. However, Contractor shall obtain plans and full details of all existing and planned underground services from the relevant Local Authorities and shall follow these plans closely at all times during the performance of WORK. Contractor shall be responsible for location and protection of all underground lines and structures. In special locations the use of trenching machine/backhoe may result in damage to property and subsurface

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structures likely to be encountered during excavation. At such places, Contractor shall excavate the trench manually to same specification at no extra cost.

Where the pipeline crosses other underground utilities/structures, the Contractor shall first manually excavate to a depth and in such a manner that the utilities/structures are located.

Temporary under pinning or any other type of supports and other protective devices necessary to keep the interfering structure intact shall be provided by the Contractor at his own cost and shall be of such design as to ensure stability & safety against their possible failure.

All underground facilities, pipelines, cables shall be located by pipeline locator/ GPRS prior to excavation.

Despite all precautions, should any damage to any structure/utility etc., occur, the Owner/Authority concerned shall be contacted by the Contractor and repair shall forthwith be carried out by the Contractor at his expense under the direction and to the satisfaction of Company and the concerned Owner/Authority. If Contractor fails to repair in reasonable time, Company reserves the right to have the repair executed at the cost of the Contractor.

6.11 Encroachments and Working near other Utilities

In locations, where pipeline has to be laid in the body of a road, canal, dyke or other locations under jurisdiction of Government/Public Bodies, the Contractor shall perform such WORK without extra compensation, according to the requirement of concerned Authorities. When it becomes necessary that Contractor has to resort to hand digging, well point, erection of sheet piling or any other special construction method in these areas, no extra compensation shall be paid. Contractor shall contact the Authorities concerned in order to become familiar with their requirements. The facilities damaged during construction shall be restored to their original condition to the satisfaction of Company/Authority.

In locations, where the pipeline has to be laid more or less parallel to an existing pipeline, cable and/or other utilities in the Right-of-Use, Contractor shall perform the WORK to the satisfaction of the Owner/Authority of the existing pipeline/cable/utility. In such locations Contractor shall perform WORK in such a way that even under the worst weather and flooding conditions, the existing pipeline/utilities remain stable and shall neither become undermined nor have the tendency to slide towards the trench.

Contractor shall be liable for any damage occurring to, or resulting from damage to other pipelines, underground structures/utilities, as laid down in clause 6.10 of this specification.

6.12 Provisions for Anti Buoyancy to the Pipe

Contractor shall check if up-floating danger is present in open trench and then shall take appropriate measures to prevent up-floating such as applying soil dams and dewatering of trench or temporary filling of water into the line (in exceptional cases).

In the case of water on the ditch bottom when the pipeline is being laid, the ditch shall be drained to the extent and for the time required to make a visual inspection of the ditch bottom. After this inspection, the presence of water will be allowed provided its level does not cause sliding of the ditch sides and pipe floating before backfilling when no concrete weighing is provided.

The water pumped out of the ditch shall be discharged into a natural water course.

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Whenever up-floating of the pipeline after backfilling is to be reckoned with, anti-buoyancy measures shall be provided by Contractor for such areas of construction, using one or a combination of the following methods:

- weighing by applying a continuous concrete coating around the pipe;
- weighing by installing gravel filled Geotextile bags/Saddle weight;
- installing metal anchors screwed into the subsoil in pairs;
- deeper burial of pipeline;
- provision of select backfill material.

The above provisions shall be in accordance with the relevant specifications and/or job standards/drawings.

Contractor shall indicate the option(s) selected to Company for review and approval along with calculations, wherever applicable.

7.0 BENDING

Contractor shall preferably provide for changes of vertical and horizontal alignment in pipeline by making elastic bends. Contractor may provide cold field bends, at its option for change of direction and change of slope. Company at its option, may authorise fabricated bends for installation at points where in Company's judgment the use of such bends is unavoidable.

Overbends shall be made in such a manner that the centre of the bend clears the high points of the trench bottom. Sag bends shall fit the bottom of the trench and side bends shall conform and leave specified clearance to the outside wall of the trench.

7.1 Elastic Bends

The minimum allowable radius for elastic bends in the buried pipeline including that for continuous concrete weight coated pipe shall be in accordance with relevant job standards. The elastic bend shall be continuously supported over its full length. A radius smaller than permitted in elastic bending shall require a cold bend.

7.2 Cold Field Bends

7.2.1 The radius of cold field bends shall not be less than 40 times the pipe specified outside diameter for pipe diameters 18 inch and above and shall not be less than 30 times the pipe specified diameter for pipe diameter less than 18 inch.

7.2.2 Contractor shall use a pipe bending machine of adequate capacity and employ recognized and accepted methods of bending of coated pipe in accordance with good pipeline construction practice. However, bending machines shall be capable of making bends without wrinkles, buckles, stretching and with minimum damage to the coating.

7.2.3 Contractor shall, before the start of the WORK, submit and demonstrate to Company a bending procedure, which shall conform to the recommendations of the manufacturer of the bending machine. The procedure shall include amongst other steps- lengths, maximum degree per pull and method and accuracy of measurement during pulling of the bend. The bending procedure and the equipment used shall be subject to Company's approval.

7.2.4 Pipes with longitudinal welds shall be bent in such a way that the weld lies in the plane passing through the neutral axis of the bend, which shall be installed positioning the

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longitudinal weld in the upper quadrants. If horizontal deviations are to be achieved by joining more adjacent bends, the bending of the pipe lengths shall be made by positioning the longitudinal welds alternatively 70mm above and below the plane passing through the neutral axis in such a way that the bends are welded with the longitudinal welds displaced by about 150mm and situated in the upper quadrants. In case of vertical bends formed from a number of pipe lengths, the longitudinal welds shall be positioned on the plane passing through the neutral axis of the bend to the right and left alternatively.

For pipes with helical weld the above requirements are not applicable.

7.2.5 The pads, dies and rolls of the bending equipment shall have relatively soft surfaces to avoid damage to the pipe coating. Where applicable, fully retaining bending shoes shall be used. Roller type bending machines are preferred.

7.2.6 The ends of each bent length shall be straight and not involved anyway in the bending. The length of the straight section shall permit easy joining. In no case shall the end of the bend be closer than 1.5m from the end of a pipe or within one meter of a girth weld.

7.2.7 The ovalization caused on each pipe by bending shall be less than 2.5% of the specified diameter at any point. Ovalization is defined as the reduction or increase in the internal diameter of the pipe compared with the nominal internal diameter. A check shall be performed on all bends in the presence of Company Representative by passing a gauge consisting of two metallic discs with a diameter equal to 95% of the nominal internal diameter of the pipe connected rigidly together at a distance equal to 300mm.

7.2.8 The wall thickness of finished bends, taking into account wall thinning at the outer radius, should not be less than the specified thickness. An indication of wall thinning as a percentage is given by the following empirical formula:

$$\text{Wall Thinning} = \frac{50}{n+1}$$

Where 'n' is the inner bend radius divided by pipe diameter. Pipes with measured wall thickness greater than the nominal wall thickness (i.e. with +ve tolerance) shall normally be used for making cold field bends.

7.2.9 Cold bend pipes on site shall have the corrosion coating carefully checked with the aid of a holiday detector for cracks in the coating down to the pipe wall. It must also be checked whether the coating has disbonded from the pipe wall during bending by beating with a wooden mallet along the outer radius. Any defects or disbonding of the coating caused during bending (also forced ridges in the coating) shall be repaired at the Contractor's expense in accordance with Company approved procedures.

7.2.10 When pipelines are laid in parallel, the horizontal bends shall be concentric.

7.3 Miter and Unsatisfactory Bends

All bends showing buckling, wrinkles, cracks or other visible defects or which are in any way in disagreement, in whole or in part, with this specification shall be rejected.

No miter bends shall be permitted in the construction of the pipe line. Contractor shall cut out and remove any bend or bends, which do not meet the specifications and shall replace the same with bends complying with specification at no additional cost to the Company. In the event the CONTRACT provides for supply of line pipe by Company, the pipes required for replacement will be furnished by Company, but the cost of replacement of such pipes shall be borne by Contractor.

Cutting of factory made bends and cold field bends for any purpose are not permitted.

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8.0 LINING UP & WELDING

Each length of pipe shall be thoroughly examined internally and externally to make sure that it is free from visual defects, damage, sever corrosion (sea water pitting), dirt, animals or any other foreign objects. Each length of the pipe shall be adequately swabbed, either by use of canvas belt disc of proper diameter, or compressed air blowing or by other methods approved by the Company. Damaged/corroded pipes shall be kept separate. Each length of pipe shall be pulled through just before being welded.

All rust and foreign matters shall be removed from the beveled ends by power operated brush. This shall be affected inside & out side and for a minimum distance of 25 mm from edge of bevel. The bevel shall be thoroughly inspected at this stage. Should laminations, split ends or manufacturing defects in the pipe observed, the length of the pipe containing such defects shall be removed from the line in accordance with relevant specification.

Contractor shall align and weld together the Joints of pipe so as to construct a continuous pipeline. All welds in the pipeline made by Contractor shall be of strength equal or higher to that of pipe. All welding shall conform to Company's welding specifications and welding charts enclosed with the Contract.

8.1 Pipe Defects and Repairs

It is Contractor's responsibility to rectify all internal and/or external defects.

8.1.1 Acceptability of defects in the pipe detected during inspection at the WORK site shall be determined in accordance with latest edition of Company's own material specification or code ASME B31.8/B 31.4 whichever is more stringent.

8.1.2 The maximum permissible depth of dents in pipes shall be as per applicable linepipe specification issued by Company.

8.1.3 Dents, which contain a stress concentrator such as scratch, gauge, arc burn or groove, and dents located at the longitudinal, spiral or circumferential weld shall be removed by cutting out the damaged portion of pipe as a cylinder.

8.1.4 Repair on line pipe shall be executed as specified in Company's material specification or Code ASME B 31.8/B 31.4, whichever is more stringent. A record of all repairs shall be maintained by Contractor. This record, provided with the pipe identification number shall be submitted to the Company.

8.1.5 If due to cutting or repairs, the pipe identification number is removed, it shall be reprinted immediately by Contractor in the presence of Company. In the event, the CONTRACT provides for supply of line pipe by Company, Contractor shall be charged for any pipe length due to loss of identification number. No pipe without identification number shall be transported and/or welded into the pipeline.

8.1.6 Repair of damaged pipe ends by hammering and/or heating is not allowed. If the dented area is minor and at least 200mm away from the pipe end, and the steel is not stretched, severed, or split in the Company's opinion, the pipe may be straightened with a proper jack.

8.2 Pipe Handling and Skid Spacing

8.2.1 When lifting pipe, care must be taken not to kink or overstress it. Proper pipe slings approved by Company shall be used. Contractor shall submit his method of skidding and skid spacing for Company's approval. A strip of soft material shall be placed in between skid

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and pipe to protect the external coating of the pipe. The material shall be approved by the Company.

8.2.2 The maximum skid spacing is not allowed before the stringer bead and the top and bottom reinforcements are completed, provided that the distance between the incomplete weld and the skid shall not exceed 9 (nine) percent of the skid spacing.

8.2.3 Skids shall be at least 1.20 meter long. For pipe with an O.D. of 324 mm and larger the skids in contact with the pipe shall have a width of at least 200mm. For pipe with an O.D. of less than 324 mm the skids in contact with the pipe shall have a width of at least 150mm. Pipe supports shall be stable, so that pipe movement will not cause the supports to move. Skids shall not be removed under a string before lowering in. The welded pipe shall be maintained on skids at the minimum distance of 500mm above ground. Crotches shall be installed at frequent intervals (at least every 10th support) with a greater number required at bends and undulating grounds.

8.3 Night Caps

At the end of each day's WORK or every time when joining and welding operations are interrupted, the open ends on the welded strings of pipes shall be capped with a securely closed metal cap or plug as approved by Company so as to prevent the entry of dirt, water, or any foreign matter into the pipeline. These covers shall not be removed until the WORK is to be resumed. The caps/plugs used shall be mechanical type and attached to pipe by tack welding.

8.4 Temporary Caps

Whenever the welded strings of pipes are left open at intervals to be tied in later after an appreciable time lag, under roads, railroads, rivers, marshy crossings, etc., temporary caps approved by Company shall be welded to the ends of the pipe.

9.0 LAYING

9.1 Lowering in Trench

9.1.1 Lowering can start after removal from ditch bottom of all off cuts, pipe supports, stones, roots, debris, stakes, rock projections upto 150 mm below underside of pipe and any other rigid materials which could lead to perforation or tearing of the coating. Sand padding, graded soil and/or other materials containing no gravel, rock shall be provided as required in accordance with clause 6.8 of this specification in such a way to get an even surface for pipe laying.

9.1.2 Lowering shall follow as soon as possible, after the completion of the joint coating of the welded pipe string In the case of parallel pipelines, laying shall be carried out by means of successive operations, if possible without interruption.

Lowering shall be carried-out during daylight only. Lowering is not permitted during night. In exceptional cases wherein lowering is carried out in night time, sufficient lighting arrangements shall be made by Contractor. Sufficiency of lighting shall be to the satisfaction of Engineer-in-Charge.

9.1.3 Before lowering in, a complete check by a full circle holiday detector for pipe coating and for field joint coating shall be carried out and all damages repaired at Contractor's cost. All points on the pipeline where the coating has been in contact with either the skids or with the lifting equipment during laying, shall be carefully inspected for damages, denting or other defects and shall be completely repaired. If, after checking, it becomes necessary to place

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the pipeline again on supports at the bottom of the trench, these must be padded in such a way as to prevent damage to the coating, thus avoiding necessity for further repairs when the pipe is finally raised and laid. Before the last operation, a check must be made of the coating at points of contact with the supports.

9.1.4 Before lowering in, short completed sections of the pipeline shall be cleaned with compressed air driven cup Pig or Foam pig in order to remove all dirt, etc. from the inside of pipe sections. In case such cleaning is proposed by Contractor after lowering, the Contractor shall obtain approval from the Company.

9.1.5 The pipeline shall be lifted and laid using, for all movements necessary, suitable equipment of non-abrasive material having adequate width for the fragility of the coating. Care shall be exercised while removing the slings from around the coated pipe after it has been lowered into the trench. Any damage caused to the coating shall be promptly repaired. Lowering-in utilizing standard pipe cradles shall be permitted if Contractor demonstrates that pipe coating is not damaged. No sling shall be put around field joint coating.

9.1.6 Wherever the pipeline is laid under tension, as a result of an assembly error (for example, incorrect positioning of bends, either horizontal or vertical), the trench shall be rectified or in exceptional cases a new assembly shall be carried out, to be approved by Company, so that it fits the excavation and the laying bed.

9.1.7 Laying shall be carried out under safe conditions so as to avoid stresses and temporary deformations of the equipments, which may cause damage to the pipeline itself and to the coating. In case of localised points where the right-of-use is restricted to the minimum necessary for the transit of mechanical equipment, the laying shall be carried out using other suitable means. The pipe shall be placed on the floor of the excavation, without jerking, falling, impact or other similar stresses. In particular, care must be taken that the deformation caused during the raising of the pipe from the supports, does not exceed the values for the minimum allowable radius of elastic curvature, so as to keep the stresses on the steel and on the coating within safe limits. The portion of the pipeline between trench and bank shall be supported by as many side-booms as required and approved by Company for holding the line in gentle S-curve maintaining minimum elastic bend radius as specified in job standard. Lowering in and back-filling shall preferably be carried out at the highest ambient temperature.

9.1.8 The pipeline must be laid without interruption for the whole or the length of section available. Where water is present, no laying shall be permitted until the ditch has been drained to the extent and for the time necessary to make visual inspection possible of the bed on which the pipe is to be laid. Following such inspections, the presence of water will be permitted, provided that it is not so high as to cause cave-in of the walls of the trench or floating of the pipeline before backfilling, when weighing is not provided for the pipe.

9.1.9 Contractor shall take precautions immediately after lowering in to prevent the movement of the pipe in trench.

9.1.10 Contractor shall close the two ends of the lowered section with night caps against ingress of water/mud or any foreign material in the section.

9.1.11 In laying parallel pipelines in the same trench, the minimum distances between the pipelines indicated in the approved drawings shall be observed. Once the first pipeline has been positioned, it shall in no way be disturbed by laying of the subsequent pipelines.
At every seven meters along the trench sand/earth filled bags shall be placed between the parallel pipelines so as to ensure maintenance of the minimum stipulated distance between the parallel lines.

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9.2 Overhead Sections and Sections in Tunnel

9.2.1 The following works shall be completed before proceeding with the assembly and laying of overhead pipelines:

- Construction of the pipe support structures.
- Paints and/or coating of the pipe WORK, as indicated in the engineering specification.

9.2.2 The erection of the supports shall be carried out taking care that the elevation and alignment is in accordance with the drawings.

In the case of metal work supports, pre-fabrication and/or assembly shall take into account the maximum allowed free span and the supports shall not interfere with the pipeline welds.

9.2.3 In case roller supports are used, the rollers shall be lubricated, then checked for smooth rotation and, in case of seizure, the defect shall be repaired or roller shall be replaced. In the case of overhead section where the pipeline is slanting, the alignment of the end supports shall be made after placing the pipeline in position. Before installation of the pipe section, all the rollers shall be perfectly centered acting on the seat of the supports plates.

The above alignment operations shall be carried out before connecting the overhead section with the end of the buried section.

9.2.4 Lifting, moving and laying of the pipeline shall be carried out in accordance with the provisions of clause 9.1.5.

An insulation sheet shall be installed to isolate the pipe from the support or support from the earth. The sheet shall be hard polyethylene/ neoprene/ Teflon pads at least 5 mm thick. It shall extend at least to 10 mm outside the saddles or clamps.

9.2.5 Moving supports, if any, shall be centered on their support and allow for a movement of at least 300mm in both directions.

9.2.6 A comprehensive report/method statement on the laying operation to be used shall be submitted to the Company well in advance for approval. The report as a minimum shall include, but not limited to the following:

a. Method of installation by lifting (as a preferred method).

b. Pulling method and related calculations, whenever lifting method cannot be used.

c. Pulling device and its characteristics including available pull force and FOS/margin available w.r.t. calculated pulling load.

d. Method of anchoring the pulling device

e. Characteristics of the pulling rope

f. Braking device, if any

g. Pipeline assembly system.

10.0 BACK-FILLING

10.1 Backfilling shall not be done until the pipe and appurtenances have the proper fit and the pipe is following the ditch profile at the required depth that will provide the required cover

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and has a bed which is free of extraneous material and which allows the pipe to rest smoothly and evenly.

Before any such WORK is done, it shall be Contractor's responsibility to first secure the approval of Company. If any backfilling is done without Company's approval, Company will have the right to require removal of the backfill for examination, and the cost of such uncovering and refilling shall be borne by Contractor. Backfilling of trench in water courses shall be carried out as per the relevant specifications issued for the purpose.

10.2 Backfilling shall be carried out immediately after the pipeline has been laid in the trench, inspected and approved by the Company, so as to provide a natural anchorage for the pipeline, thus avoiding long exposure of coating to high temperature, damaging actions of adverse weather conditions, sliding down of trench sides and pipe movement in the trench. If immediate back filling is not possible, a covering of at least 200mm of earth, free of rock and hard lumps shall be placed over and around the pipe and coating. On no account the top soil from the RoU shall be used for this purpose. In general, the trench shall be dry during backfilling. Deviations thereof must have prior approval of the Company. The backfill material shall contain no extraneous material and/or hard lumps of soil, which could damage the pipe and/or coating or leave voids in the backfield trench. After the initial backfill has been placed into the trench to a level slightly above the surrounding ground, Contractor shall compact the backfill material. The surplus material shall be neatly crowned directly over the trench and the adjacent excavated areas on both sides of the trench as per clause 6.2.1, to such a height, which will, in Company's opinion, provide adequately for future settlement of the trench backfill during the maintenance period and thereafter. The crown shall be high enough to prevent the formation of a depression in the soil when backfill has settled into its permanent position. Should depression occur after backfill, Contractor shall be responsible for remedial WORK at no extra cost to Company. Surplus material, including rock, left from this operation shall be disposed of to the satisfaction of land owner or authority having jurisdiction at no extra cost to the Company.

A warning mat/ tape (Type-I) or mesh (Type-II) as per Company standard (No. 7-71-0031) shall be laid 500 mm below the natural ground level on the pipeline partial backfilling. For Further requirements reference shall be made to section 14.0 "Clean-up and Restoration of Right-of-Use" of this specification.

10.3 Rock, gravel, lumps of hard soil or like materials shall not be backfield directly onto the pipe unless padding and/or rock-shield has been provided as per Section 6.8 of this specification. When "Padding" as described in Section 6.8 of this specification is to be used, the following shall be applicable.

Where rock, gravel, lumps of hard soil or like materials are encountered at the time of trench excavation, sufficient earth, sand or select backfill materials shall be placed around and over the pipe to form a protective cushion extending at least to a compacted height of 150mm above the top of the pipe. Select backfill materials for padding that are acceptable to Company shall be soil, sand, clay or other material containing no gravel, rock or lumps of hard soil. Whether such padding material would be taken from the adjacent spoil bank or imported from elsewhere shall be directed by Company. All these works shall be carried out by Contractor at no extra cost to Company. Loose rock may be returned to the trench after the required selected backfill material has been placed, provided the rock placed in the ditch will not interfere with the use of the land by landowner, or tenant.

10.4 When the trench has been dug through drive ways or roads, all backfills shall be executed with sand or a suitable material as approved by Company and shall be thoroughly compacted. In certain cases, special compaction methods, such as moistening or ramming of the backfill in layers may be required by Company. Company and any public or private authority having jurisdiction over a road, street or drive way may require that the surface of

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the backfill be gravelled with crushed rock or some other purchased material and the road shall be repaved. In such instances, Contractor shall comply with said requirements at no extra cost to Company.

10.5 Trenches excavated in dikes which are the property of railways or which are parts of main roads shall be graded and backfield in their original profile and condition. If necessary, new and/or special backfill materials shall be supplied and worked-up. The materials required may include gravel, special stabilization materials or stabilized mixtures. Moreover, special processing and/or compacting methods shall require the approval of Company and/or competent authorities.

Stone-pitching/cement lining of Dyke walls, if dismantled during excavation shall be restored to its original condition after backfilling and compaction to the entire satisfaction of Company and concerned Authorities.

10.6 The trench in irrigated and paddy fields shall be backfield to within 300mm of the top, then rammed and further backfield until the trench is completely backfield. Surplus material remaining after the operation shall be spread over the RoU as specified in Section 14.0 "Clean-up and Restoration of Right-of- Use", of this specification.

10.7 At the end of each day's WORK, backfilling shall not be more than 500 meters behind the head end of lowered-in pipe, which has been padded and approved for backfill. The backfill shall be maintained by Contractor against washouts and spreading etc., until the completion and final acceptance of the WORK by Company.

10.8 Contractor shall furnish materials and install slope breakers/ trench plugs in the trench in steep areas (slope generally 10% and more) including cross drains for the purpose of preventing erosion of the back fill. The type of breakers installed shall be as per the approved drawings. Breakers shall be constructed of grout bags filled with a mixture of 10:1 Sand: Portland cement at Company's direction. Contractor may propose other methods such as foam dams etc. which shall be subject to approval by Company. Such works shall be at no extra cost to Company. Contractor shall pay attention to the direction of backfilling in such steep areas.

10.9 When backfilling the trenches in sloping terrains or steep areas, where in the opinion of the Company the backfill may be washed out of the trench, sheet piling or other effective water breakers across the trench shall be provided by Contractor. This is to divert the flow of water away from the trench into normal drainage followed before laying of the line. In no case, the water is to be drained via the trench or via channels other than those followed before the line was laid.

10.10 Contractor shall leave the pipe uncovered at certain locations to allow Company to survey the top of the pipe and the level of the pipeline in the backfield trench. Within 48 hours after backfilling, Company shall have carried out such survey and informed Contractor of any realigning, if required. Thereafter Contractor shall compact the backfill.

The maximum allowable deviation from the centerline for land sections as staked out by Company and as referenced by Contractor after backfilling is limited to following:

Pipeline dia upto and including 600 NB	:	200mm
Pipeline dia greater than 600 NB	:	300mm

10.11 Before backfilling of the trench, Contractor shall comply with the requirements of Clause 6.12 of this specification.

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10.12 Stabilization of backfill shall be carried out by the Contractor in sandy areas and other such places, as directed by the Company. Contractor shall carry out the stabilization to have a consolidated cover over the pipeline at no extra cost to Company.

The backfill shall be stabilized preferably with 150mm layer of marl, mattresses of gatch other than straw or other stable materials. The width of stablisation shall be at least 3.0 meters on either side of the pipeline, plus one meter for every 10 meters height of dune (where the line passes through the dune areas).

10.13 Temporary markers shall be installed during backfilling and the survey as per clause 10.10 to locate the pipeline axis. These markers shall then be replaced with permanent pipeline markers.

10.14 Backfilling shall be preferably carried out at the highest ambient temperature. Backfilling in station approach area shall be by select soil as per drawings.

10.15 In certain areas like U/G pipeline crossings, overhead power cable crossings etc, special care to be taken by putting concrete slab before backfilling. Size and thickness of concrete slab/plastic grating shall comply applicable job standard and approved by Company.

10.16 For areas prone to seismic activities, special backfill shall be provided as per contract requirements.

11.0 TIEING-IN

11.1 The unconnected sections of the pipeline at various locations have to be tied in after the sections are coated, lowered and backfield. The sections to be connected shall have at the ends, sections of over lapping, uncovered pipe of sufficient length to absorb, without inducing excessive stresses in the steel, small displacements necessary for perfect alignment and connection of the ends.

11.2 Tie-in shall preferably be carried out at ambient temperatures corresponding to the average operating temperature in the case of a pipeline conveying fluids at normal temperatures and at the maximum ambient temperature in the case where the pipeline is carrying fluids at high temperature.

11.3 Contractor shall carry out tie-in-welding (including necessary cutting, bevelling, grinding of pipe weld seams and line-up etc.) cleaning, priming, coating and backfilling for the tie-in portion as per relevant specifications. Contractor shall also excavate the required bell-holes for the welding. Bell holes made to facilitate welding shall provide adequate clearance to enable the welders to exercise normal welding ability and skill. All tie-in welds shall be radiographically examined. If the depth of bell hole exceeds 2.0 m, then either step cutting or shoring and strutting shall be carried out to avoid caving/ collapse of soil into the bell hole.

11.4 The tie-in should be done in such a way as to leave a minimum of strain in the pipe. If necessary, with respect to the trench, realigning of the pipe shall be done to eliminate force or strain in the pipe by the Contractor at no extra cost to Company.

11.5 If a pup end cannot be avoided for tie-in, the minimum length that shall be added is 1.0 meter and two or more such pups shall not be welded together. All cut-off lengths greater than 1.0 meter shall be moved ahead in order to be welded into the pipeline at a suitable location. Tie-in with two or more pups may be used provided that they each have minimum length of 1.0 meter and are separated by an entire length of pipe. In no case more than three (3) welds shall be permitted on a 10 meter length of pipeline.

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11.6 In connecting pipes, special items, fittings and equipment where different wall thicknesses are to be welded, Contractor shall weld transition piece as per procedures indicated in ASME B31.8/ ASME B31.4, as applicable. The required tapering shall be done by Contractor at no extra cost to Company.

11.7 For tie-in of adjacent sections of pipeline already pressure tested, the pup used for tie-in shall be of single length or off-cuts of pipe, which have already been hydrostatically tested. Contractor shall take care that sufficient number of pretested pipes with different wall thicknesses are readily available.

12.0 SPECIAL INSTALLATIONS ON THE PIPELINE

12.1 General

12.1.1 In addition to constructing the pipeline, Contractor shall also install certain other auxiliary facilities and appurtenances.

Contractor shall do all WORK necessary at each of the installations to provide facilities, which are complete in all respects and ready for operations.

Without limiting the generality thereof, the WORK required to complete the installations shall, where applicable, include all site surveys, site preparation, filling, grading, fencing, foundations, installation of block valves, side valves, pipe work, pipe supports, pressure gauges, mechanical facilities, civil work, painting, installation of all electrical equipments, motors, cables, conduit, wiring and fixtures and hooking up of same; installation of all instruments, piping, valves and fittings; mounting of all instruments and making all piping and electronic connections, etc.

On completion, all elements of each entire installation shall be checked out and tested for full and correct operation in the presence of, and to the satisfaction of Company. All WORK shall be carried out strictly in accordance with the appropriate codes, the approved drawings, and this and other related specifications.

Contractor shall fabricate all piping and install valves and fittings as required by the detailed engineering fabrication drawings prepared by him and approved by Company. Piping fabrication drawings shall be prepared by Contractor based on AFC drawings and approved by Engineer In charge at site.

Stainless steel lines will he "swaged" using permanent fittings installed with a hydraulic device.

Cold bending for the fitting of 12 mm NB and 6 mm NB pipes is allowed when special bending tools are used with guides to prevent flattening. The minimum radius allowed shall not be less than R=10 D, where D = outside diameter of pipe.

The bending tools shall be subject to Company's approval.

Contractor shall ensure that the piping assemblies are not in a strain prior to the final bolting or welding. Contractor shall also ensure that all equipment and piping are thoroughly swabbed clean of all dust, refuse, welding-spatter, scale, or any potentially detachable matter prior to the tie-in or final bolting.

12.1.2 **Dimensional tolerances**

These tolerances apply to inline items and corrections for other lines. These tolerances can be exceeded on items such as vents, drains, dummy supports, field supports, temperature and pressure connections, where the deviation will not affect another spool.

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a. General dimensions such as face to face, face or end to end, face or end to centre, and center to centre: ± 3mm.

b. Inclination of flange face from true in any direction: 4mm per meter.

c. Displacement of branch connection from indicated location: ± 1.6mm. When multiple branches are involved, the displacement of the branches shall not exceed 3mm from a common point.

d. Rotation of flange bolt holes shall not exceed 1.6mm.

12.1.3 **Flanged connections**

Contractor shall ensure that prior to final bolting, all flange faces are parallel and centered, according to standard practice. Contractor shall not use bolting forces as a means for attaining alignment. A gasket of required size and quality shall be installed between the flanges at each joint.

Bolts shall be tightened in diagonal sequence and shall be centered with equal amounts of thread visible on both sides. Bolts shall be uniformly tightened to produce a leak-proof joint. Bolts that yield during tightening shall be removed and discarded. It is mandatory that a torque wrench is used for bolt tightening. Bolt tensioning, wherever applicable, shall be carried out.

12.1.4 **Threaded connections**

Damaged threads shall be cut from the end of a run and the pipe shall be rethreaded.

Contractor shall properly align all threaded joints. Pipe entering unions shall be true to centerline so the union will not be forced during make-up. The threaded pipe shall not project through fittings to cause interference with valves or other operating mechanisms. PTFE tape shall be used for threaded joints.

Except for the threaded connections of instruments, which will require periodic testing and maintenance, all threaded joints shall be seal welded. The latter joints shall be made up without pipe joint compound and with a minimum of oil from the thread cutter. Seal welds should taper into the pipe with as little discontinuity as possible, and should cover all threads. All seal welds shall be tested with DP, MP testing.

12.1.5 **Welded connections**

Where the ends of the piping components being welded have an internal surface misalignment exceeding 1.6mm, the wall of the component extending internally shall be trimmed by machining so that the adjoining internal surfaces will be approximately flush. All welding shall be performed in accordance with EIL Specification No. 6- 77-0006 (Welding specification for onshore pipeline for transportation of hydrocarbon liquid and Gas) and other applicable Jobs Specifications and Welding Specification Chart.

Tie-ins between fixed points shall be made at maximum ambient temperature.

12.1.6 **Civil work**

Civil work shall be performed in accordance with Specifications issued for the purpose.

12.1.7 **Painting**

All exposed surfaces like piping, valves, structures, and miscellaneous appurtenances shall

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be painted in accordance with the specifications issued for this purpose. The corrosion coating on pipe surface will end approximately 300 mm above the finish grade and it will be necessary for Contractor to provide a clean interface at the junction of the protective coating and the paint.

12.1.8 **Coating of buried installations, etc.**

All buried valves, insulating joints, flow tees, elbow other in-line fittings and appurtenances shall be coated with 100% solid high build epoxy (minimum 500 micron thk) or 1.5 mm thick polyurethane coating or any other equivalent suitable Company approved coating at no extra cost to Company. For buried pipes and LR bends, heat shrink sleeves/cold applied tapes conforming to Company's specification for Field Joint Coating (Specification No. 6-71-0044), shall be used. Contractor shall submit to Company a report regarding the method of application and the materials used along with all test certificates. Only after obtaining written approval from the Company, Contractor shall commence the work of coating.

12.1.9 **Clean-up**

After all required tests have been concluded satisfactorily, Contractor shall clean up the Site as laid down in the specifications issued for the purpose. The Site shall be graded in accordance with the approved drawings.

12.2 Installation of Valves and Valve Stations

12.2.1 Block and sectionalising valve stations shall be installed as shown on the approved drawings. It is Contractor's responsibility to have the units completely assembled, tested and made fully functional including all related instruments etc.

12.2.2 The civil and structural work shall be carried out in accordance with the relevant specifications issued for the purpose and in accordance with the approved drawings as directed by Company. This work as a minimum shall include clearing, grading, fencing, foundations etc. as required. All above ground structures shall be painted as per the specification and color code given by the Company.

12.2.3 Suitable concrete foundation as directed by Company shall be constructed on which the valve shall be firmly installed, after embedding an insulating sheet of hard polyethylene/ neoprene/ teflon with a thickness of at least 5mm or equivalent. Such insulating sheet is also to be installed under pipe clamps, etc.

12.2.4 Valves with flow arrows shall be installed according to the normal flow in the pipeline. During welding, the valves shall be in fully open position. In addition, all instructions of the manufacturer shall be followed.

Care shall be taken to avoid entry of sand particles etc. to valve body, seals etc. during transportation, storage, assembly and installation.

12.2.5 For valves and piping installed below ground and/or above ground the anti-corrosion coating/painting shall be as per the requirements of the relevant specifications issued for the purpose. The anti-corrosion below ground coating shall extend upto 300mm above grade at the lowest point.

12.2.6 Sectionalising valves shall be installed on sections of the pipeline in the horizontal position only or with an inclination not greater than that allowed by the valve manufacturer. Installation shall be done in such a way that there is no strain in the welded joint while the pipeline at upstream and downstream side is straight.

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12.2.7 All valves shall always be handled using appropriate equipment and methods so as to avoid impact, shaking and other stresses. In particular, the equipment and tools used for lifting and handling shall never be hooked through hand wheel, valve stem, flange joints and other parts, which may suffer damage/misalignment.

12.2.8 All sectionalising valve and any other inline assemblies shall be prefabricated and tested hydrostatically ex-situ as per applicable specification. All such assemblies shall be installed at the locations shown in the drawings only after successful completion of the hydrostatic test and dewatering. Thereafter the ends of the assembly shall be closed off. Contractor shall carry out necessary excavation, cutting, beveling of pipe ends and welding of the tie-ins required for the installation of such assembly. The tie-in joints shall be radiographically examined over 100% length and also 100% ultrasonically examined prior to backfilling. All works shall be executed in accordance with the relevant specifications issued for the purpose.

12.3 Installation of Scraper Launchers and Receivers

12.3.1 Scraper stations shall be fabricated and installed as per the approved drawings and whenever applicable as per the requirements of clause 12.2 of this specification. It is Contractor's responsibility to have the units completely assembled tested and made fully functional including all instruments and related piping.

12.3.2 The Civil and structural works for the scraper stations shall be carried out as per the relevant specifications, in accordance with the drawings and as directed by the Company. The WORK as a minimum shall include site survey, site preparation, clearing, grading, fencing, foundations, etc. as required.

12.3.3 It shall be Contractor's responsibility to maintain elevations shown on the approved drawings and to carry out any pipe work adjustments, necessary for this purpose. Field cuts shall be square and accurate and field welds shall not be performed under stress of pipe ends.

12.3.4 The painting for the scraper stations shall be carried out as per "Specifications for Painting". The underground sections shall be coated as specified for the pipeline upto at least 300mm above grade.

12.3.5 The hydrostatic testing of the scraper stations shall be executed after installation in accordance with the relevant specifications issued for the purpose.

12.4 Installation of Insulating Joints

12.4.1 Insulating joints shall be installed at the locations shown in the drawings. Contractor shall obtain approval from the Company before installation of the insulating joints.

12.4.2 Handling and installation of the insulating joints shall be carried out with all precautions required to avoid damage and excessive stresses and that the original pup length is not reduced.

12.4.3 The insulating joints and the welded joints shall be protected by external coating as per relevant specifications issued for the purpose.

12.4.4 When the in-line inserting is made on the buried pipeline, care shall be taken to weld at an external temperature as close as possible to the pipeline operating temperature.

The joint shall be inserted on straight sections and laid on a fine sand bed.

12.4.5 During the execution of the in-line connection welding, the propagation of heat shall be avoided. To achieve this, the joint shall be kept cold by means of rags continuously wetted.

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12.4.6 Insulating joints shall be electrically tested before welding into the pipeline. The electrical resistance/conductance test shall be carried out using a Megger. Measurement of the insulation resistance across the joint shall be approx. one (1) Mega Ohm. The tests shall be repeated after installation and welding of the joint into the pipeline to verify that the assembly is undamaged.

13.0 WORKING SPREAD LIMITATIONS

Contractor shall, in general, observe the following maximum distances between the working mainline spread:

Between RoU grading, clearing and backfilling	:	25 km
Between backfilling and final clean-up	:	05 km

The spread limitations do not apply to point spreads such as rock blasting, river crossing and bored crossings of roads, railways and canals and HDD crossings.

Any deviations from the above shall meet prior approval of Company. Company reserves the right to stop the WORK, in case the approved spread limitations are exceeded and Contractor shall not be paid any compensation for stoppage of WORK.

14.0 CLEAN-UP AND RESTORATION OF RIGHT OF USE

14.1 Contractor shall restore the RoU and all sites used for the construction of pipelines, water crossings and other structures in accordance with Company's instructions, and deliver them to the satisfaction of Company.

14.2 Surplus Materials

For Company supplied materials, after completion of WORK, the Contractor shall return all surplus materials at Company's designated areas.

The reconciliation of surplus free issue line pipes shall be as per the requirement of commercial condition of contract.

14.3 Disposal

14.3.1 All surplus and defective materials supplied by Contractor and all trash, refuse and spoiled materials shall be collected and disposed off by Contractor.

14.3.2 The RoU shall be cleared of all rubbish, broken skids, empty cans, card board, sacks, stumps, trash, and leftover construction material. All burnable matter shall be burned, but only after obtaining appropriate permits for such burning. If burning is not allowed, Contractor shall haul the clean-up material to an approved dumping area. All scrap metal and unburnable material shall be disposed of, in an appropriate manner, but never be buried in the RoU.

14.3.3 Surplus soil can only be removed from the Owner's plot after authorisation by Company.

14.3.4 All dumping fees connected with the disposal of materials shall be to the account of Contractor.

14.3.5 All loose stones and rock exposed by the construction operations and scattered over the RoU or adjacent grounds shall be removed by Contractor and be transported to a location considered suitable by the land-owner and/or tenant, or by authorities have jurisdiction, for satisfactory disposal. For stones, gravel or other hard material, which may be buried in the

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trench the provisions of the specifications shall apply with the understanding that the use of the land by the land-owner and/or tenant will not be interfered with.

14.4 Temporary Structures

All auxiliary structures such as bridges, culverts, sheet piling, posts, signs, etc., which were erected or installed by Contractor as temporary measure, shall be removed. However, it may be necessary to remove the fence of RoU during the maintenance period.

14.5 Repair of Damages

Damages to roads, bridges, and private property shall be repaired by Contractor. All fences and other structures, which are damaged during construction, shall be restored to original.

Slopes, water course sides or banks which have been partially or totally demolished during the execution of the works shall be properly consolidated and restored (without waiting for their natural consolidation and settling) complying the requirement of the concerned Authorities. The bed of water-courses shall be restored to the original level. The banks and any excavated areas shall be restored to the original levels and contours. The banks shall also be stabilized.

All boundary stones, which have been moved or removed during the WORK must be reset in their original location to the satisfaction of the landowner concerned.

14.6 On completion of clean-up, the RoU shall be restored to such stable and usable condition as may be reasonably consistent with the condition of the RoU prior to laying the pipeline. The Company shall be completely indemnified and held harmless by Contractor from any and against all claims, demands, losses, expenses etc. that may arise in this behalf or the Company may anyway suffer or sustain, relative to, arising out of, or in connection with same. The Company may require from the Contractor signed Releases from landowners regarding satisfactory indemnification and restoration of their lands.

14.7 Special precautions shall be taken near steep slopes prone to erosions and landslides. All necessary steps shall be taken to ensure the rapid growth of grass by providing wicker barriers and by regulating the drainage of surface waters.

14.8 All cadastral or geodetic markers, which may have been removed during the execution of the WORKs, shall be restored in their exact position.

14.9 Ditches for which no instructions for their restoration have been issued, or restoration cannot be done due to absence of banks, shall be restored as instructed by Company. The bed of ditches crossed by the pipeline shall be cleaned over the full width of the RoU, also outside the RoU if necessary. This restoration might contain but is not limited to the supply and installation of proper materials for backfill and protection, the sodding or other precautions to prevent erosion or guarantee the stability. All work has to be done after deliberation and acceptance of the authorities and Company. Other field drains have to be restored over full width of RoU and if necessary also outside the RoU by hand and/or special equipment as soon as possible.

14.10 Any subsidence, cave-ins, wash-outs, which have been caused during the pipeline construction and maintenance, caused by whatever reason within the edge of ditches and open drains, shall be repaired by Contractor immediately or at first notice given by Company.

14.11 After the clean-up, the RoU of pastures has to remain fenced considered suitable by the tenant and to be removed during the maintenance period. When agricultural and other traffic (requested by tenant) have to cross the RoU the cross-overs have to be fenced with the same

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material as the RoU. If necessary, special materials have to be used to allow traffic on the cross-over. Fencing of the right-of-use as specified shall not be removed until Contractor has obtained written permission by Company. In general this has to be done during the maintenance period.

14.12 All openings in or damage to the fences or enclosures shall be repaired by installing new fencing of a quality, which shall be at least equal to the parts damaged or removed. Provisional gates shall be removed and replaced with new fencing. All repairs to fences and enclosures shall be carried out by Contractor to the complete satisfaction of Company, landowner and/or tenant.

14.13 If, in the opinion of Company, the sod in pasture land has been damaged by vehicles and wheel tracks are visible, the RoU shall be tilled with a disc-harrow or rotary cultivator several times. The damaged sod shall be firmly cut up and thoroughly mixed through the top-soil. In general, the RoU has also to be ripped. After this procedure no closed-in layers must be found and sufficiently loose top-soil 250 mm to 300 mm thick must be present. The whole procedure must be approved by Company. Subsequently, the entire RoU, which is part of pasture land, shall be prepared for seeding and fertilized by Contractor according to the instructions of Company.

14.14 In crop fields the tillage shall consist of passing over the land several times with a disc harrow, cultivating with a spading machine, or plow, to a depth of approx. 200 mm. In general the RoU has also to be ripped. After this cultivation process no closed-in layers must be found any more in the RoU. The equipment used and methods adopted shall require the approval of Company. Ripping has to be done with rippers with a distance of 500 mm between the ripper blades. The type to be used shall be approved by Company.

14.15 Adequate numbers of saplings of any plant/tree uprooted or cut during construction shall be planted along the route as per the direction of the Company and in accordance with the requirement of Authorities. The cost of sapling and its plantation shall be to Contractor's account.

14.16 The RoU and the backfilled trench in particular has to be finished in such a way that after settlement of the soil the fields are at their original level.

If during the maintenance period certain parts of the RoU are lower than the original level, Company can order Contractor to bring these parts to the original level.

In cases where heavy damage has occurred to the structure of the subsoil as a result of adverse circumstances, Company reserves the right to order Contractor to carry out special restoration work. Said special work can include:

- Spading with dragline (depth 300-800 mm);
- Spading with dragline (depth 800-1000 mm);
- fertilizing;
- cover with sand.

If during clean-up operations soil shortages become apparent outside the trench, Contractor shall supplement said soil shortage using suitable materials, approved by Company.

If site and/or climatic conditions should render this necessary, Company shall have the right to order Contractor to suspend certain parts of the work related to the clean-up and postpone it to a later date.

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14.17 Soil Surplus

If on site, as a result of the WORK and after careful backfilling and compacting, a sub-soil surplus exists, this shall be worked up by grading and compacting below the sub-soil top layer and as a rule this shall be done in the same plot of land. It shall not be permitted to remove the surplus from the plot concerned, unless it concerns rejected soil, which has to be removed. Working up surplus soil or removal of rejected soil shall be considered to pertain to the WORK.

To work a soil surplus into the ground, Contractor shall remove an additional strip of top soil beside the trench. Next, the upper layer of sub-soil shall also be removed. Both soil types shall be stored separately across a width depending on the size of the soil surplus. The soil surplus shall then be distributed across the trench thus widened, after which it shall be graded and compacted and subsequently the top layer of sub-soil and the top-soil shall be replaced in the correct order, in accordance with the Specifications.

In case Company has given prior permission for mixed excavation of the sub-soil as well as in cases where Company deems mixed excavation permissible, the above provision of separate storage of the upper layer of sub- soil shall not apply to the working up to the soil surplus.

In cases where the soil surplus can be worked up in others plots where soil shortages have arisen due to the WORK, this shall only be done after prior permission by land-owner, land-user and Company.

14.18 Soil Shortages

If due to unforeseen circumstances during backfilling and compacting there should not be enough soil to fill the trench properly, or to install the crown height as stipulated, Contractor shall supply the necessary backfill material.

Soil shortages shall be supplemented and applied before the top-soil is replaced.

The soil to be supplied shall be worked up in those locations and into those layers where a soil shortage has been established. The quality of the supplemented soil shall be equal to that of the shortage.

15.0 MAINTENANCE DURING DEFECTS LIABILITY PERIOD

Defects Liability Period (defined as period of liability in the CONTRACT) means the period calculated from the date certified in the Completion Certificate.

Company reserves the right to carry out instrumented pigging survey of the completed pipeline.
Contractor shall be responsible for making good with all possible speed at his expense any defect in or damage to any portion of the Work which may appear or occur during the Defects Liability Period and which arises either:

a. From any defective material (other than supplied by Company), Workmanship or design (other than a design made, furnished or specified by Company and for which Contractor has disclaimed responsibility in writing), or

b. From any act or omission of Contractor done or omitted during the said period.

If such defect shall appear or damage occur, Company shall forthwith inform Contractor thereof stating in writing the nature of the defect or damage.

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If any such defect or damage be not remedied within a reasonable time, Company may proceed to execute the WORK at Contractor's risk and expense provided that he does so in a reasonable manner. Such defect or damage can be, but is not limited to:

- Clean-up of RoU, including water courses
- Sagging or sinking of site level or pipe supports
- Sliding of ditch banks
- Repair of fencing or removal of construction fencing
- Repaving of pavements, repair of pavements, repair of Roads
- Repair of coating, painting
- Realigning markers, signs
- Leak/burst of pipe, leaking of flanges, washouts
- Short-circuit in casings
- Construction defects such as dents, ovality, welding offsets/defects, etc. detected during intelligent pigging survey, etc.

Company reserves the right to have the required Computerised Potential Logging Test executed during the DEFECTS LIABILITY PERIOD and whenever weather conditions are more favorable for this job. The work shall (at or as soon as practicable after the expiration of the Defects Liability Period) be delivered to Company in the conditions required by the CONTRACT, fair wear and tear excepted, to the satisfaction of Company. Contractor shall finish the work, if any outstanding, at the date of completion as soon as possible after such date and shall execute all such work.

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STANDARD SPECIFICATION FOR PIPELINE MARKERS

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
6	31-01-22	REAFFIRMED & REISSUED AS STANDARD SPECIFICATION	SRG	RSB	MSG	SM
5	10.02.17	REVISED & REISSUED AS STANDARD SPECIFICATION	MT	RK	VM	RN
4	09.02.12	REVISED & REISSUED AS STANDARD SPECIFICATION	NR	MSG	VM	DM
3	21.11.06	REVISED & REISSUED AS STANDARD SPECIFICATION	MKM	VM	AS	VC
2	29.10.01	REVISED & REISSUED AS STANDARD SPECIFICATION	MKM	KKS	SJ	GRR

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Abbreviations:

API	**American Petroleum Institute**
LPG	**Liquefied Petroleum Gas**
RoU	**Right of Use**

Pipeline Engineering Standards Committee

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REFERENCE DRAWINGS

EIL STANDARD DRAWINGS

7-71-0008	K.M. POST
7-71-0009	TYPICAL ROW BOUNDARY MARKER
7-71-0010	AERIAL MARKER
7-71-0011	DIRECTION MARKER
7-71-0012	PIPELINE WARNING SIGN
7-71-0014	NAVIGABLE WATERWAY PIPELINE CROSSING WARNING SIGN

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1.0 SCOPE

1.1 This specification covers the minimum requirements for supply, fabrication and erection of pipeline markers to be installed by Contractor at various locations along the route of a cross-country pipeline.

1.2 This specification shall be read in conjunction with the conditions of all specifications and documents included in the CONTRACT between Company and Contractor.

2.0 REFERENCES

Reference has been made in this specification to the latest edition (edition enforce at the time of issue of enquiry) of the following codes:

API RP 1109 : Recommended Practice for Marking Liquid Petroleum Pipeline Facilities.

Company's Standard Specifications:

6-79-0020 : Standard Specification for Surface Preparation and Protective Coating (new construction)

Note: In case any Particular Job Specification for Painting is included in the Project Tender Document, the same shall be applicable in place of Painting specification mentioned above.

Company's Standards:

7-71-0008 : K.M. POST

7-71-0009 : TYPICAL ROW BOUNDARY MARKER

7-71-0010 : AERIAL MARKER

7-71-0011 : DIRECTION MARKER

7-71-0012 : PIPELINE WARNING SIGN

7-71-0014 : NAVIGABLE WATERWAY PIPELINE CROSSING WARNING SIGN

3.0 GENERAL

3.1 Contractor shall supply, fabricate and install the Pipeline Markers along the pipeline route. The location of markers as indicated in the approved drawings shall be treated for guidance purpose only and the exact location of the markers shall be based on AS BUILT drawings and as directed by Company.

3.2 The pipeline markers shall be fabricated and installed in accordance with the EIL standard drawings included herein. Before start of fabrication of the markers, the Contractor shall prepare and submit for Company's approval, the detailed scheme for the marker plates as applicable for the project. All the markers shall be painted in accordance with the requirements of Standard Specification for Surface Preparation and Protective Coating (new construction) (Specification No. 6-79-0020). In case of coastal areas the painting on markers shall be suitable for highly corrosive environment as per Table 10.0 Sr.No. 10.2 of

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specification no. 6-79-0020 and for all other areas painting shall be suitable for normal corrosive environment as per Table 9.0, Sr. No. 9.2 of specification no. 6-79-0020.

3.3 The pipeline markers shall be installed, as far as possible, at locations such that they do not cause any hindrance to the regular use of the land or to the traffic.

4.0 AERIAL MARKERS

Aerial Markers shall in general be installed along the pipeline at every five (5) kilometers intervals and at places specified by Company.

Refer EIL Standard Drawing No. 7-71-0010 for details.

5.0 KILOMETER MARKERS

Kilometer Markers shall in general be installed along the pipeline at every one (1) kilometer interval. Markers shall indicate cumulative distance in kilometers from the reference station, as directed by Company. A kilometer marker is not required, if the relative distance between its location and any pipeline warning sign is less than 200 meters.

Refer EIL Standard Drawing no. 7-71-0008 for details.

6.0 PIPELINE WARNING SIGN

Pipeline Warning Sign shall in general be installed at:

-	National and State Highway crossings	2 Nos. min.
-	Other Road crossings	1 No. min.
-	Railway Crossings	2 Nos. min.
-	Minor Water Crossings (less than 15 m width)	1 No. min.
-	Minor Water Crossings (above 15 m width)	2 Nos. min.
-	Major Water crossings	2 Nos. min.
-	Valve Station	1 No. min.
-	And or any other location as shown in the approved drawings and as directed by the Company.	

Pipeline Warning Sign shall identify the existence of the pipeline and display the name of the Company, with an emergency telephone number.

Refer EIL Standard Drawing No. 7-71-0012 for details.

7.0 RoU BOUNDARY MARKER

Right-of-Use boundary markers shall be fabricated as per the drawings and shall be installed at every 250 meters interval along the entire pipeline route. These shall be installed on either side of the pipeline alignment to define the RoU boundary limits. These shall also be installed at pipeline turning points to maintain the continuity of the RoU limits. In addition, the boundary pillars shall also be installed on either side limits of RoU at major rail / road / river crossings.

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Refer EIL Standard Drawing No. 7-71-0009 for details.

8.0 DIRECTION MARKERS

Direction Markers shall be installed to identify the significant Turning Points of the pipeline during aerial traverse. One direction marker shall be installed at each Turning Point, two more direction markers shall be installed along the pipeline alignment, one on either side of the Turning Point at 200 m from the Turning Point.

Refer EIL Standard Drawing No. 7-71-0011 for details.

9.0 NAVIGABLE WATERWAY PIPELINE CROSSING WARNING SIGN

The Navigable Waterway Pipeline Crossing Warning Sign shall be fabricated and installed one on each bank of navigable water courses at the pipeline crossing location, in lieu of the Pipeline Warning Sign described in Clause 6.0 of this specification.

Refer EIL Standard Drawing No. 7-71-0014 for details.

10.0 SPECIAL MARKERS

As directed by Company, special markers shall be installed at location where following changes take place:

- Change in pipeline diameter and wall thickness.
- Change in type of pipe
- Change in class locations for pipelines conveying gas.

The above data may be provided on other types of marker (except RoU boundary marker), if the relative distance between the two does not exceed 100 m.

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STANDARD SPECIFICATION FOR DOCUMENTATION FOR PIPELINE CONSTRUCTION

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
6	22-02-2022	REVISED & REISSUED AS STANDARD SPECIFICATION	DM	RK	MSG	SM
5	10-02-2017	REVISED & REISSUED AS STANDARD SPECIFICATION	MT	RK	VM	RN
4	09-02-2012	REVISED & REISSUED AS STANDARD SPECIFICATION	NR	MSG	VM	DM
3	21-11-2006	REVISED & REISSUED AS STANDARD SPECIFICATION	MKM	VM	AS	VC
2	29-10-2001	REVISED & REISSUED AS STANDARD SPECIFICATION	MKM	KKS	SJ	GRR

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Abbreviations:

RoU	Right of Use

Pipeline Engineering Standards Committee

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Mr. Dipanjan Jana (Projects)
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1.0 SCOPE

1.1 This specification covers the minimum requirements of various records, reports and drawings for all aspects of pipeline construction to be prepared by the Contractor and submitted to the Company at intervals as described in this specification and as directed by the Company.

1.2 All documents required to be prepared and submitted by the Contractor as per this specification shall be in addition to the various reports, records, methodology statements, calculations, drawings etc. to be submitted by the Contractor for Company's record, review or approval as per the requirements of all other specifications included in the CONTRACT between the Company and the Contractor.

1.3 This specification shall be read in conjunction with the conditions of all specifications and documents included in the CONTRACT between Company and Contractor.

1.4 Documentation to be submitted by Contractor to Company is summarized below. Number of Copies (Hard copies / soft copies etc.) shall be as indicated in CONTRACT document.

2.0 RECORDS

The Contractor shall submit to the Company the daily, weekly, monthly reports and after completion, various other records and reports, for Company's documentation purpose. The documentation (scheduled reports) shall be submitted progressively during construction. All 'as-built' records shall be submitted immediately after the construction. This shall as a minimum include, but not limited to the following:

2.1 Daily

- Separate progress reports of all crews.
- Daily welding results and repairs.
- Actual weather conditions.
- Application for deviations, if any.
- Accidents.
- Damages.
- Activities / approvals required from Company.
- Materials Receipts.
- List of urgently required materials.

2.2 Weekly

- Up-to-date list of all pipeline data in PIMS.
- Up-to-date list of confirmed Site Instructions issued by Company
- Materials 'taken over' by Contractor.
- Materials defects and repairs.
- Outstanding activities of Company.
- List of installed markers, chainage.
- Required approval form Company.
- Progress planned.

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- Reports of manning of all crews, equipment and plant.
- Reports of equipment and plant.
- Reports of accidents.
- Reports of damages.
- Reports of Acquired Releases, Permits etc.
- Prices variations.
- Required materials for next month.

2.3 Monthly

- Project Progress Report, report of payment, safety report, report of accidents, security reports, health and environment report, material balance, approved deviations.

2.4 Further, Contractor shall apply for approval, if required, to the Company with document such as but not limited to:

- Organogram for construction of work.
- Bio-data of key personnel (including foremen).
- List of address of personnel in particular of medical staff, safety and security officers.
- List of approved coaters.
- List of approved sub-Contractors.
- Time schedule.
- Acquired permits and/or approval from Authorities, if any.
- Minutes of meeting with Company with comments, if any.
- Material certificates, material receipt.
- Guarantees from Vendors and sub-Contractors.
- Calculations for temporary works, buoyancy, blasting, pipe pulling etc.
- Drawings issued by Contractor.
- Vendor drawings.
- As-built drawing of route maps, alignment sheets, detail drawings and isometric drawings.
- Procedures such as surveying, stacking, fencing.
- Welding procedure qualification record, Non-destructive testing (including radiography) procedure qualification, welder qualification.
- Coating procedure.
- Installation of crossings.
- Hydrostatic testing Procedure.
- Blasting Procedure.
- Radiographic report along with original radiographs.
- Pipe and welding book.
- Material records and Accounting book.
- Reports.

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- Material tests (coating, welding, painting).
- Computerized Potential Logging Test.
- Water samples.
- Cleaning, Pigging Report before hydrostatic test.
- Hydrostatic test.
- Calibration test.
- Blasting trials.
- Equipment certificates (dead weight tester, instruments, vessels, equipment).
- Manuals.
- Major water crossings.
- Water disposal.
- Disposal of water after hydrostatic test.
- EGP & Pre-Commissioning works.

2.5 The Contractor shall submit to Company, colour photographs (hard copy as well as digital format) taken through digital camera (having resolution >10 mega pixels) of various construction activities / operations at regular intervals. Size, number and frequency of the photographs shall be mutually agreed upon between the Contractor and the Company. The Contractor shall make high definition video recordings (in full HD) of all operations right from the start of construction till the completion of the work, covering to the extent as instructed by Company and submit to Company. The recordings shall be made progressively as construction advances. Upon completion of the work, the Contractor shall submit the recordings in CD / DVD or any other format specified by the Company. The duration of each video recording shall be of ½ hour (unless specified otherwise) and shall cover all major aspects of the job.

3.0 AS-BUILT DRAWING AND PIPE BOOK

3.1 General

The Contractor shall prepare "As-built' drawings of all the drawings, whether issued by Company or prepared by Contractor including vendor drawings, such as but not limited to:

For pipeline section:

- Route maps.
- Alignment sheets.
- Detail drawings (road, railway, minor water crossings, major water crossing, valley crossings, utility crossings, cable crossings).
- Isometric drawings of installations.
- Special installation.

Further Contractor shall prepare a pipe book.

If required by the Company, the Contractor shall update the drawings issued for construction of the job.

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3.2 "As-built" Drawings

The Contractor shall prepare a complete set of "As-built" drawings. From the start of construction, the Contractor shall, on daily basis, process any changes in two sets of drawings. Deleted parts shall be indicated in red, new parts in blue, remarks in green and unchanged parts in yellow. Said drawings shall be kept at site and shall be available to Company at all times. The Contractor shall prepare "As-built" drawings based on these data. On completion of the work, revised drawings made "As-built" by Contractor shall be handed over to Company. The Hard Prints shall be submitted in As-Built Dossier and Soft Copies shall be submitted in CD / DVD format or any other format specified by the Company.

The Contractor shall prepare and submit a specimen of the layout of the drawings for Company's approval.

The required measurement for "As-built" drawings shall be executed by the Contractor by experienced and qualified surveyors.

The surveyors shall daily take care of all measurements required such as but not limited to:

- Horizontal location of pipeline with regard to deviation and Permanent Grid Pillars.
- Vertical level with regard to Mean Sea Level of pipeline and grade.
- Location and type of bends, fittings etc. and grades, points of intersection.
- Changes of wall thickness, materials.
- Location and details of valves, flow tee, insulating joints, fencing.
- Location and details of road, railway, water crossing, suspension bridges.
- Location and details of crossing pipes, vents.
- Location and type of coating.
- Location and type of weighing, anchoring.
- Location and type of markers.
- Location of further appurtenances (Pig-signallers).
- Location of RoU and of pipeline with respect of RoU.
- Type of soil.
- Type of rock.
- Type of blasting and ripping
- Sand padding.
- Type of road pavement.
- Details of bank protection, number of insulators, seals.

The Contractor shall also prepare isometric drawings of installation (facilities) etc. for which the data as mentioned in or required for the Pipe and Welding Book can be identified and these drawings can also be used for material accounting.

3.3 Name plates of Equipment

All permanent equipment supplied and installed by Contractor shall be provided with plates by Contractor. All texts shall be submitted to Company for approval before plates may be manufactured.

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3.4 Pipe Book

Every page of the Pipe and Welding Book shall mention:

- Data relevant to the project and section thereof.
- Sequential number.
- Length brought forward (for pipes and other materials).
- Length to bring forward (for pipes and other materials).
- Alignment sheet number and at least the location thereon of two welds on every page of the Pipe Book.

Further, following shall be specified:

- Diameter of pipeline.
- Length of each pipe.
- Wall thickness.
- Pipe number.
- Heat number.
- Cut and re-numbered pipe ends.
- Coating number.
- Date of stringing.
- Data of welding.
- Weld number.
- Welder number.
- Type of welding, electrodes, diameter of electrodes etc.
- Equipment used for radiography.
- Date of field joint coating.
- Date of lowering.
- Date of OFC laying (if applicable).
- Date of backfilling.
- Date of hydrotest.
- Date of Temporary cathodic protection work.
- Date of markers installation.
- Limits of water crossings.
- Date of sectionalizing valve installation.

In order to achieve this, the Contractor shall identify all pipe elements. Sample format of Pipe Book shall be submitted for Company approval.

3.5 As-Built Documents

The Contractor shall prepare all documents in the prescribed format as indicated below. In addition to the hard copy, soft copies of final documents shall also be submitted in electronic media i.e. CD / DVD format or any other format specified by the Company.

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Software used for the preparation of these documents shall be as follows:

Type of document		Software
a)	Reports	MS Word (Office 2010 or above)
b)	Drawings	AutoCAD (Release 2015 or above)

For the purpose of preparation of As-built drawings, Contractor shall update the "Issued for Construction" drawings issued by the Company. It shall be the Contractor's responsibility to convert the drawings furnished by the Company in hard copy into AutoCAD drawings including scanning, digitizing and converting the drawings into a suitable format compatible with the AutoCAD Release 2015 or above. As-built drawings shall be prepared only on AutoCAD Release 2015 or above.

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उथली क्षैतिज दिशात्मक ड्रिलिंग पद्धति का उपयोग करके क्रॉसिगं हेतु मानक विनिर्देश

STANDARD SPECIFICATION FOR MINOR CROSSINGS USING SHALLOW HORIZONTAL DIRECTIONAL DRILLING METHOD

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by: Standards Committee Convenor	Approved by: Standards Bureau Chairman
0	01.12.23	ISSUED AS STANDARD SPECIFICATION	RP/ SRG	RK	MSG	MN

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Abbreviations

ASME	American Society of Mechanical Engineers
LPG	Liquefied Petroleum Gas
API	American Petroleum Institute
OISD	Oil Industry Safety Directorate
RoU	Right of Use
PNGRB	Petroleum and Natural Gas Regulatory Board
SMYS	Specified Minimum Yield Strength
SHDD	Shallow Horizontal Directional drilling
ODR	Other District Road
EIC	Engineer-In-charge

Pipeline Engineering Standards Committee

Convenor : Mr. M. S. Gunjiyal

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1.0 SCOPE

1.1 This specification covers the minimum requirements for the various activities to be performed by the Contractor for the engineering and construction of minor pipeline crossings such as Roads, ODR etc using shallow horizontal directional drilling (SHDD) method, wherein entry and exit angles shall be minimized so that drilled profile across crossing shall be nearly a straight line.

1.2 This specification shall be read in conjunction with the requirements of all specifications and documents included in the CONTRACT between Company and Contractor.

1.3 Contractor shall take full responsibility for the suitability and safety of all operations and methods involved in the work.

1.4 Contractor shall be deemed to have obtained all necessary information with regards to risks, contingencies and all other circumstances, which may influence the work.

1.5 For the purpose of this specification, the following definitions shall hold:

- The words 'Shall' and 'Must' are mandatory.
- The words 'Should', 'May' and 'Will' are non-mandatory, advisory or recommended.

2.0 REFERENCE DOCUMENTS

2.1 Reference has been made in this specification to the latest edition (edition enforce at the time of issue of enquiry) of the following codes, standards and specifications:

a)	ASME B 31.4	-	Pipeline Transportation Systems for Liquids and Slurries
b)	ASME B 31.8	-	Gas Transmission and Distribution Piping Systems
c)	OISD STD 141	-	Design and construction and Inspection requirements for cross-country Liquid hydrocarbon pipelines
d)	OISD STD 214	-	Cross Country LPG Pipelines
e)	OISD STD 226	-	Natural Gas Transmission Pipelines and City Gas Distribution Networks
f)	PNGRB Notification G.S.R. 808(E)	-	Technical Standards and Specifications including Safety Standards (TS4) for Natural Gas Pipelines Regulations, 2009 and all Amendments thereof.
g)	PNGRB Notification G.S.R. Infra/T4S P&PPPL/01/2014	-	Technical Standards and Specifications including Safety Standards for Petroleum and Petroleum Products Pipelines Regulations, 2016 and all Amendments thereof.
h)	EIL's Specification 6-71-0044		Standard specification for field joint coating (onshore pipelines)
i)	EIL's Specification 6-71-0051	-	Standard Specification for Pipeline Construction (Onshore)
j)	EIL's Standard 7-71-0012-	-	Pipeline Warning Sign

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2.2 In case of conflict between the requirements of above-mentioned codes, standards, specifications and practices, the most stringent requirement shall govern. In case of conflict between the requirements of this specification and that of the above referred codes, standards, specifications and practices, the requirements of this specification shall govern.

3.0 GENERAL

3.1 All Civil and Mechanical works associated with or incidental to the installation of pipeline crossings shall be carried out in accordance with EIL Specification no. 6-71-0051 **"Standard Specification for Pipeline Construction (Onshore)".**

3.2 Company reserves the right to demand for individual crossings from the Contractor a separate detailed report for approval, containing following without any extra cost to Company:

- Approval letter from concerned authorities
- Time Schedule
- Execution methodology with details of equipment
- Test procedure
- Manpower deployment
- Description of temporary works
- Soil investigations, etc.

3.3 Pipeline crossings string shall be hydrostatically pretested ex-situ, prior to joint coating as described subsequently in this specification.

4.0 DESIGN AND ENGINEERING

Contractor to note the following for design and engineering of any SHDD crossing:

a) SHDD shall be carried out for only for minor roads, ODRs etc. SHDD shall not be carried out in MDR/SH/NH/Railway, water bodies, nala, canals, rivers etc.

b) Maximum length of SHDD crossing shall be limited to 60 m only.

c) SHDD shall be carried out only in soft soil strata. SHDD shall be avoided in hard/rocky strata.

d) SHDD profile design shall ensure containment of bentonite inside the downhole.

e) All the drawings of SHDD profile, must be submitted to EIC at site for approval prior to execution of work.

f) Separate SHDDs shall be carried out for carrier pipe & CS Conduit. However, Bundle pulling of CS conduit may be allowed as per site constraints/ conditions as per directions of EIC.

g) Pipe string shall be subjected minimum bending loads during installation.

h) Within the entire limits of crossing, the cover to top of corrosion coated pipe shall be at least 2.5 meter from NGL.

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5.0 CONSTRUCTION

The work under crossings shall include necessary clearing, grading and trenching to required depths and widths, stringing & welding of carrier pipes, hydrostatic testing, joint coating, drilling, reaming, pull back & installation, clean-up, restoration to the original condition and further strengthening and protective works, etc.

Before the installation work of crossings is started, the Contractor shall provide suitable barricades at entry and exit side of drilling as directed by Company/Authority having jurisdiction over these areas.

Prior approval from the statutory authorities shall be obtained by the contractor to lay the pipeline across the crossing by SHDD.

Prior to start of the SHDD operation, Contractor shall carry out soil investigations. Based on these investigations, Contractor shall prepare a construction drawing and submit to EIC for review including time schedule and soil investigation report.

Contractor shall comply with all the conditions and requirements of Authorities having jurisdiction in the area where the work is to be performed.

5.1 Installation Procedure

Contractor shall, before commencing any work at site, submit for EIC approval a detailed installation procedure for each type of crossing.

The installation procedure as a minimum shall include the following:

a) Project Organization Chart indicating Contractor's organizational set-up at site and manpower deployment.

b) Preparation of fabrication yard and launching areas.

c) Details of all equipment to be deployed for preparation of pipe string and installation of crossing. Technical characteristics and capacity of each equipment including instrumentation, monitoring and control equipment shall be furnished in details.

d) Pipeline string preparation details (hauling, stringing, welding, etc.)

e) Details of pipe and tie-in arrangements, if applicable.

f) Method of installation covering all steps of construction, viz. rig up, pilot hole, back-reaming, pulling, rig down, backfilling.

g) Calculations for maximum pulling force on the rig and recommended maximum pulling speed and rig anchoring.

h) Pre installation hydrostatic test procedure.

i) Time schedule for construction

5.2 Site Inspection

A site inspection of an area where crossing is proposed shall be done before the mobilization of rig. Site inspection will determine a precise location, Access, best orientation for the site and the location of obstacles. In order to ensure that the detailed inspection carried out is to conformity of actual site conditions, A detailed site survey shall be carried out. During this process, proper logistics inspection shall also be carried out to ensure easy access to equipment.

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5.3 **Site Survey**

The soil condition as per site inspection, technical specifications and all other relevant data shall be studied in detail. Ground level survey should be done before the execution of SHDD. Elevation difference through the center line should be surveyed from the site. Crossing details for each crossing shall be prepared and submitted to EIC for approval prior to start of execution.

5.4 **Profile Preparation**

The ground profiles, soil investigation report, technical specifications and all other relevant data shall be studied in detail and the necessary calculations, if required, shall be done to arrive at an optimum crossing profile ensuring the basic design requirements are satisfied. All SHDD drawings/ calculations/ procedures, as applicable, shall be submitted to Engineer-In-charge for review/ information.

5.5 **ROU Preparation and Grading**

The ROU at the vicinity of the entry point and exit point shall be graded as per submitted and approved Grading Procedure and instructions of the Site In-charge.

5.6 **Stringing of Line Pipes and Welding of Pipe String**

Pipes of Grade and thickness as indicated in the AFC drawings of the individual crossings / approved design shall be strung on sand bags in such a way so as to match the grade profile. The single pipe string to be pulled shall end at the anticipated exit point of pilot hole drill rod. The requisite numbers of pipe shall be string according to approved procedure in ROU limits and stringing report as per the said document shall be generated.

The pipe shall be strung and welded in the same line as the drilled hole from Entry Side to Exit side. Joint welding including necessary beveling, grinding and line up etc. shall be carried out as per approved WPS. The welding of pipes for crossing shall be carried out by approved welding procedure. Non-Destructive Testing of the welded joints shall be carried by radiography as per as applicable codes and approved procedure.

5.7 **Hydrostatic Testing**

Pre – hydro test of SHDD pipe string shall be carried out prior to field joint coating. Before installation, the pipeline shall be hydrostatically tested to a minimum test pressure equal to 1.5 times the design pressure for gas pipelines and 1.25 times the design pressure for liquid pipelines. Test pressure shall be retained in the pipeline for minimum period of four (4) hours. Test section shall be kept under surveillance during test and it shall be visually examined for leaks/defects, etc.

Post-hydro test for the SHDD shall be carried out along with adjacent mainline sections.

5.8 **Joint Coating & Corrosion Coating repair**

Field joint coating shall be carried out using fibreglass reinforced heat shrink sleeves as per EIL Specification no. 6-71-0044. The coating edges shall be suitably roughed and chamfered to

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provide smooth transition. The method of application shall be strictly as per manufacturer's recommendations and will be subject to Company approval prior to use.

After the application of Joint Coating sleeves, they shall be checked by a full circle holiday detector at a voltage of 25 kV.

5.9 Drilling Operations

Rig shall be placed on the ground or in pre- excavated pit or as per site feasibility. The Rig shall be placed suitable distance away from the limit of ROW of the subject crossing. An entry pit shall be excavated at the immediate edge of the crossing ROW limit and the carrier pipe shall be finally pulled up to the edge of entry pit.

The exit location shall provide adequate pipe string lay down space for the proposed crossing. The pipe string shall be lowered in the exit side trench and placed in the same alignment with the drilled hole from entry side to exit side.

Drilling shall be done in such a manner so that shallow arc along a prescribed bore path can be achieved. Thus, Shallow profile HDD shall be a curved line which means the angle of entry and angle of exit shall be minimal.

5.10 Reaming Operations

Proper reaming shall be carried out to ensure bored hole is of suitable diameter for pulling of carrier string. Excessive diameter reaming shall be avoided.
Back reaming shall be done separately from the pipeline pulling operation. The size of back – reamed hole shall be adequate (approximately 1.5 times the pipeline diameter for 24 inch & below size pipeline and 12-inch higher size than pipeline for more than 24-inch pipeline diameter) to allow enough clearance for smooth pullback of the pipeline.

High yield bentonite with quick gelling characteristics shall be used to preserve the integrity of the borehole during the swab pass. Pulling shall be done within 12 hours from swab pass. Contractor to ensure that proper retention/ containment of bentonite has been achieved for overall crossing length and same shall be witnessed by Engineer- In-Charge.

5.11 Carrier Pipe Pull Back and Installation

A pull head swivel assembly shall be pre welded to the carrier pipe string, which shall be in the trench. The drill string shall be attached to the pullback assembly attached to the leading end of the carrier pipe.

Once the reaming and swab passes are completed, the pipeline shall be positioned perfectly in line with the bore hole. Pullback will continue until the leading end of the carrier pipe reaches the edge of the entry pit. As the pipe string is being pulled in to the open borehole, drilling fluid is pumped to ensure that entire annular space of reamed hole is filled with bentonite slurry.

5.12 Coating integrity check

During starting of any project, for establishing the procedure, one additional complete pipe length shall be pulled through reamed hole and pipeline coating integrity of the first joint and first pipe length shall be checked through holiday test. In case damages/holidays are detected in

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the first pipe length/joint, the subsequent pipe length/joint shall be exposed and coating integrity checks shall be made. If found acceptable by Company, the first pipe length/ joint shall be repaired and/ or replaced as directed by Company. If the coating of second pipe length/ joint is also found damaged, Contractor shall propose further course of action and Company's instructions shall be followed. All works shall be done at no extra cost to Company.

5.13 Disposal of surplus soil, bentonite slurry & corrosion inhibited test water

Contractor shall arrange for safe disposal of all surplus soil and bentonite slurry & corrosion inhibited test water so as to avoid any harm to the environment/occupants at locations duly approved by authorities and pollution' control boards having jurisdiction and/or as instructed by Company without any extra cost to company.

5.14 Permanent Pipeline Marker

Permanent markers shall be installed for each crossing in accordance with EIL standard no. 7-71-0012. Contractor shall supply all materials and fabricate and install the markers as per reference drawing.

5.15 Final Cleanup and Restoration

After completion of construction, Site shall be cleared to the complete satisfaction of Company and authorities having jurisdiction. All such works shall be done at no extra cost to Company. On completion of clean-up, the RoU shall be restored to such stable and usable conditions as may be reasonably consistent with conditions of the RoU prior to laying/installation of the pipeline.

In case of any subsidence of ROU/ road surface at crossing location, all remedial measures shall be carried out by the contractor at his own cost.

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सतह तैयारी एवं जंगरोधक रंगसाजी हेतु मानक विनिर्देश

STANDARD SPECIFICATION FOR SURFACE PREPARATION AND PROTECTIVE COATING

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
1	06.06.2024	ISSUED AS STANDARD SPECIFICATION	SAHIL	SRIDHAR	P.SAHA	M NANDI
0	30.08.12	6-44-0004 REV. 3 REVISED, RE-NUMBERED & ISSUED AS STANDARD SPECIFICATION	A.SRIDHAR	R.CHAUDHURY	P.P.LAHIRI	D.MALHOTRA

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Abbreviations:

AS	:	Alloy Steel
ASTM	:	American Society for Testing and Materials
AWWA	:	American Water Works Association
CS	:	Carbon Steel
DFT	:	Dry Film Thickness
GI	:	Galvanized Iron
ID	:	Internal Diameter
ISO	:	International Organization for Standardization
LTCS	:	Low temperature Carbon Steel
MS	:	Mild Steel
MR	:	material requisition
NB	:	Nominal Bore
NA	:	Not applicable
OD	:	Outside Diameter
OEM	:	Original Equipment Manufacturer
OSHA	:	Occupational Safety and Health Act
RCC	:	Reinforced Cement Concrete
RH	:	Relative humidity
SS	:	Stainless Steel
SOR	:	Schedule of Rate
SSPC	:	Steel Structure Painting Council
WFT	:	Wet Film Thickness

Standards Committee

Convener: Mr. Prasenjit Saha

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Mr. Dipakkumar Dahyalal Panchal (Projects)
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