HARIDWAR NATURAL GAS PRIVATE LIMITED
{JV OF BHARAT PETROLEUM AND GAIL GAS}

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Behind Matrichaya Medical Centre, Ranipur More,
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TENDER DOCUMENT
FOR
LAST MILE CONNECTIVITY (LMC) WORK FOR NEW CONNECTIONS OF DOMESTIC AND INDUSTRIAL & COMMERCIAL IN HARIDWAR GA

TENDER NO.:- HNGPL/HARIDWAR/LMC WORK/NEW CONNECTIONS/23-24/01

SECTION 4: SCOPE OF WORK

(Domestic Competitive Bidding Under Single stage two envelope systems)

TECHNICAL SPECIFICATIONS

SECTION 4 OF TENDER NO.: HNGPL/HARIDWAR/LMC WORK/NEW CONNECTIONS/23-24/01

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SECTION 4 OF TENDER NO.: HNGPL/HARIDWAR/LMC WORK/NEW CONNECTIONS/23-24/01

TECHNICAL SPECIFICATION

TECHNICAL SPECIFICATION

FOR

LAYING OF MDPE MAIN PIPELINES

AND SERVICE PIPELINES

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TECHNICAL SPECIFICATION

1.0 GENERAL INFORMATION

1.1 INTRODUCTION

1.2

HARIDWAR NATURAL GAS PVT. LTD. (HNGPL), a joint venture (JV) of Bharat Petroleum Corporation Limited (BPCL), A Govt. of India Enterprise and GAIL Gas Limited, a fully owned subsidiary company of GAIL (India) Limited has been set up to provide CNG (Compressed Natural Gas) as fuel to commercial & private vehicles through filling stations and PNG (piped Natural Gas) to Industrial, household and commercial sector in Haridwar GA.

1.2 Nature of Contract

The contractor shall be paid on a Schedule of Rates basis. He shall execute the work and perform his obligations under the contract, and HNGPL shall pay the contractor for measured quantity of each item of work actually carried out under the contract. Payment shall be at the rate for the work set out in the agreed Schedule of Rates.

2.0 SCOPE OF WORK

Generally the following shall constitute the Contractor's scope of work :

2.1 Plan and prepare a schedule for execution and work implementation as per QA/QC plans to be issued by HNGPL. Contractor has to submit the Construction/ Execution procedures before commencement of work.

2.2 Assist in obtaining permissions from land owing agencies for road cutting for laying of pipelines. Liaisoning with concerned authorities during execution of the job.

2.3 Prior to start of Construction activities, Contractor shall carry out area and crossings survey and prepare drawings for proposed gas pipe line laying and submit to HNGPL for approval.

2.4 Receipt of free issue items from HNGPL's designated stores, loading, transportation, unloading at Contractor's stores near project sites.

2.5 Proper storing, stacking, identification, providing security, and insurance, during storage, laying and upto handing over of pipelines.

2.6 Making trial pits to determine the underground utilities /services such as existing pipelines, Cables (Electrical/Communication), Conduits, U/G drainage, Sewers, tunnels, Subways foundations etc, and deciding optimum routes and depths for laying the pipelines based on the route plans provided in the tender.

2.7 Obtaining the approval for optimum route and ROU from the concerned authority and EIC. Grading the ROU as per requirement for proper movement of workmen, equipment and QA/QC personnel.

2.8 Wherever required the grass/ turfing, pavement, linings, drains roads and other such 'pucca' area shall be locally removed to facilitate trenching and pipe laying works. The same is to be reinstated as original.

2.9 Supply & Installation of Safety/ Warning Signs, barricading of the entire route to be trenched. Pits to be similarly barricaded along the warning sign.

2.10 To make trenches with stable slopes but restricting minimum disturbance to above ground/underground services/ installation as per specifications and approved route plans; keep the trenches free from water and soil till placement of pipes;

2.11 Uncoiling/ stringing the PE pipes of required sizes (i.e. 20, 32, 63, 90, 125) pipes into trenches as per specification.

2.12 Joining the pipe ends with fittings and valves by approved electro fusion techniques as per specification.

2.13 Installation of pipe fittings/installation like elbow, tee, reducers, tapping saddles, joints, connectors, transition fittings, valves, sleeves etc. including construction of supports, valves pits, inspection chambers etc. as per specification.

2.14 Laying pipeline using trench less technology methods with or without casing pipes as per specification and as directed by EIC.

2.15 Supply & Laying of HDPE duct as casing pipe wherever applicable, along with MDPE Pipe.

2.16 Supply of good quality GI sleeves, MS enamel coated sleeves, concrete casing pipes, sand and other material, fittings to be supplied by the Contractor as per provisions of tender.

2.17 Back filling and compaction by jumping jack compactor using approved 'good' soil or using excavated earth or borrow earth as per requirement and specification and replacement of tiles, slabs removed during the excavation. Cleaning all unserviceable material, debris, excess earth near trenches etc to designated disposal area.

2.18 Carrying out pneumatic testing and purging as per specifications and approved procedures; providing all tools, tackles, instruments, manpower and other related accessories for carrying out the testing of pipes.

2.19 Nitrogen purging (including supply), commissioning & gas charging of tested pipeline as per approved procedure.

2.20 Restoration of existing ground features such as grass/ turfing, paving, roads, drains, concrete, floral beds, fencing, titles, flooring masonry etc. to original condition and to match with adjoining conditions- functionally and aesthetically upto the entire satisfaction of HNGPL any other third party agency designated by HNGPL and local authorities, failing which, it will be done at the risk and cost of the contractor. Obtaining satisfactory completion certificates for the restoration work done from the concerned authorities.

2.21 Installing of permanent site markers, warning signs, valve chamber etc.

2.22 Returning surplus material to HNGPL stores, reconciliation of free issue material/ consumables if supplied by HNGPL and obtaining 'no objection certificates' from HNGPL.

2.23 Handing over the completed works to HNGPL for their operation / use purposes.

2.24 Maintaining the completed pipelines/installation for any defect, failures during defect liability period.

2.25 Preparation and submission of As–built drawings, details of crossings, utility graphs, measurement sheets and deviation statements on completion / commissioning of work by way of drawing, sketches and tables.

2.26 Any other activity(ies) not mentioned/ covered explicitly above, but otherwise required for satisfactory completion/ operation/ safety/ statutory/ maintenance of the works shall also be covered under the Scope of work and has to be completed by the Contractor within specified schedule at no extra cost to HNGPL.

3.0 MATERIAL, LABOUR, PLANT AND EQUIPMENT

3.1 Owner's Scope of Supply (Free Issue Item)

Owner's scope of supply shall be limited to the following

- **MDPE Pipes of sizes from 32 mm Dia to 20 mm dia**
- **Regulators (Service, Domestic & Commercial)**
- **Meters (Domestic and Commercial**

In order to speed up the project Free Issue Materials shall be issued to the Contractor from the designated store(s) of HNGPL. Contractor shall be responsible for lifting the free issue materials from Owner's storage point(s) and transporting the same to work site(s) at his own cost.

3.2 Supplied by the Contractor

Contractor will supply all size HDPE casing pipe, GI fittings and PE fittings other materials as per SOR & scope of supply necessary to complete the laying of gas main pipelines and service pipelines.

The contractor is to procure all bought out items from approved vendors and accordingly keep HNGPL informed. The inspection of bought out items would be carried out by HNGPL / Third Party Inspection or as instruction by EIC.

In general PE pipe shall be of the following lengths indicated.

20mm/32mm	100 to 300 Mtrs. coils
63 mm	100 Mtrs. Coils
90 mm	50 Mtrs Coils
125 mm	50 Mtrs. Coils

The Contractor shall provide the skilled labour, tools, material and equipment necessary for the proper execution of the Work. This will include but not be limited to list of specialized items included in the enclosure furnished herewith.

3.2.1 Equipment & Machinery

All vehicular type machinery shall be in good working order and shall not cause spillage of oil or grease. To avoid damage to paved surfaces the Contractor will provide pads of timber or thick rubber under the hydraulic feet or outriggers of machinery.

In addition to above, the contractor must have dedicated bar coded electro- fusion (Automatically readable) machine with power generator (at any point of time minimum 2 nos.), Pipe Cutters (like circular guillotine), End Scrapers, Pipe Straightener, approved Top loading clamp for fusing saddle tapping tee, clamps of all sizes for Electro-fusion fittings, re-rounding tools and test ends etc. for pipes of following diameters 180mm, 125mm, 90mm, 63mm, 32mm & 20mm for this project. Contractor has to arrange his own all equipments for trenchless crossings such as HDD, Moling & rock cutting equipment, HDPE fusion equipment at the site whenever required.

Contractor must also have to arrange his own equipment for restoration work like water tanker and jumping jack compactor for compaction of backfilled trenches and roller and other required equipment/ machinery for asphalting/ road works.
In case there is non availability of approved equipments, tools and tackles during the work at site, suitable penalties, as per special terms and condition of the contract, will be levied and deducted from the running bills.

3.2.2 **Imported Backfill and Material**

The Contractor shall be responsible to arrange the supply of approved soft soil / Coarse Sand free from any impurities like clay, mica and soft flaky pieces as per the instruction of EIC/Owner.

For supply of sand in trench for rocky terrain, no separate charges are payable and is included in SOR item for excavation of hard rock/Morrum.
Also supply of sand in valve chambers, Normal chambers & Built up surface, if required, as per the instruction of EIC, is not separately payable.

In case specified trench depths are not achieved & if directed by Engineer-in- charge Contractor to provide concrete casing pipes/ slabs or cement concrete, without any cost implication to Owner.

3.2.3 **Other Materials**

The Contractor shall supply the following items where required.

- All materials required for form work, trench support, temporary trench crossings.
- All sign boards, barricades, tin sheets, lights and protective equipment.
- Permanent markers as shown in the drawings enclosed in the tender.
- Material required for installation of valve chambers.
- GI, Half Round concrete sleeves
- All minor items not expressly mentioned in the Contract but which are necessary for the satisfactory completion and performance of the Work under this Contract.

3.2.4 Manpower

The contractor shall provide the skilled labour, tools, materials, and equipment necessary for the proper execution.

3.2.5 Acquisition, Receipt, & Storage Of Materials

In case of material supplied by owner than the contractor shall collect all materials from HNGPL store between working hours following all documentation procedures laid down and as directed by EIC. The contractor
shall at the time of receipt of material physically examine all materials and
notify the EIC immediately of any damage. Any damage not recorded at the time of inspection done by contractor will be deemed not to have existed at the time of receipt of material. Cost of repair, rectification, replacement will be borne by the contractor. Any defective material found during the time of installation will noted and forwarded to stores for replacement immediately with P.O reference and only wit written approval of EIC. The contractor shall ensure that no defective material shall be returned to store at the time of closure of contract.

The contractor shall maintain permanent locked store preferably near site in so that all the material are stored in such a manner so as to prevent and damage to the materials from scratching, gouging, indentation, excessive heat or by contact with any sharp objects and chemicals.

The contractor shall maintain log book at their respective stores stating issue and availability of free issue material as a given day. Further the contractor is required to undertake and submit an inventory of materials every month to Owners/Owners Representative (mandatory).

4.0 PROGRESS OF WORK

The Contractor shall proceed with the Work under the Contract with due expedition and without delay.

The EIC may direct in what order and at what time the various stages or parts of the work under the Contract shall be performed.

Contractor has to regularly submit daily progress reports, weekly progress reports, graphs with utilities, testing reports, material consumption and inventory reports, deviation statements etc.

5.0 APPROVALS

Contractor has to assist in getting permissions, obtain statutory approval/ clearances for laying of pipelines. However, HNGPL will pay the departmental charges and Bank Guarantees for getting the clearances. It is the contractor's responsibility to inform and co-ordinate the concerned local authorities and also other utility agencies before commencement of work at site. To ensure smooth execution of the work on a day to day basis, the contractor has to liaison with respective authorities and obtains necessary approvals.

6.0 REFERENCE SPECIFICATION, CODES AND STANDARDS

The contractor shall carry out the work in accordance with the requirement of latest relevant applicable standards, this specification, HNGPL's Engineering Standards; relevant Oil India Safety Directorate (OISD) norms,

Latest PNGRB Guidelines, ASME B31.8 – Gas Transmission and Distribution Piping Systems; Australian Standard 3723 – Installation and Maintenance of Plastics Pipe Systems for Gas; and the American Gas Association Document – Purging Principles and Practice. ISO: 4437/ IS:14885 for underground polyethylene pipes and HNGPL's approved procedures

Should the contractor find any discrepancy, ambiguity or conflict in or between any of the Standards and the contract documents, then this should be promptly referred to the Engineer-in-Charge (EIC) for his decision, which shall be considered binding on the contractor.

7.0 SAFETY

The Contractor shall conform to the requirements outlined elsewhere in the tender document. In addition, the Contractor shall observe safe working practices in the storage and handling of cleaning fluids, flammable fluids, etc, and ensure smoking or naked flames are not permitted in the vicinity when these materials are being used.

Trench walls shall be battered with sufficient slope in order to minimize a trench collapse. Where there is a danger of an earth slide or collapse, the trench shall remain open for the minimum time possible with proper barricading.

The Contractor is to ensure that no person enters a trench, which is of a depth of 1.5 meters or greater, unless the trench has adequate shoring or the sides are battered to such an extent as to prevent a trench collapse

The Contractor shall also protect all work sites with warning signs, barricades and night lighting. The Contractor shall inspect all fenced excavations daily, and maintain them in good order.

The trenches/ pits shall not be kept open in night times. However in case the same is essential the same shall be properly barricaded with proper lighting arrangements & manned.

The Contractor shall provide all safety equipments like helmets, books, etc. to the labour which are necessary for safe working practice.

Any accident causing injury to any person or damage to property or equipment shall be reported to the EIC.

Where the EIC determines that the work is being performed by the Contractor in an unsafe manner, he may suspend the Work until corrective action is taken by the Contractor.

For further details refer Attached HSE technical specification.

8.0 ROUTE SURVEY

8.1 Plans detailing the size, operating pressure and approximate location of the proposed mains, connections and associated regulator installations will be issued to the contractor at the start of the works.

8.2 The final alignment of mains will be worked out at site in consultations with the site engineers after route survey and trial pits, at his cost, have been carried out. Any change in routing from the issued drawings due to site constraint will be notified to EIC & his specific written approval shall be obtained before carrying out the job.

8.3 Service Lines

8.3.1 A survey will be conducted jointly by HNGPL/ third party inspection and the contractor at each premises or housing colony to be supplied. The survey record will note customer details, the potential gas supply points and proposed regulator positions and estimates of material quantities. The contractor's representatives will make as sketch of the agreed pipe routes if necessary.

8.3.2 The contractor will be responsible for contacting the customer and making the necessary arrangements for access, and appointments to carry out the work. Contractor shall maintain job card and complaint books at site. HNGPL will not be responsible for any time lost due to broken appointments or disputes with customers.

9.0 ORGANIZATION OF WORK

9.1 All construction work will be carried out as per direction of EIC, and this will be the primary point of contact between the contractor and HNGPL on site. All work will be issued and sanctioned through the EIC and site control exercised by Site Engineer HNGPL. The contractor shall ensure that technical quality standards are maintained, that construction is carried out cost effectively and that a good customer and public image of HNGPL is maintained.

9.2 Contractor shall designate RCM who will be the single point coordinator to interact with EIC/Consultant/TPIA and authorized to attend review meetings, receive materials, authorized to sign documents, claims and receive payments etc. Contractor shall submit the organization chart stating that in charge of projects, store, QA/QC and take approval from the owner.

9.3 The contractor will appoint his own supervisors of minimum number instructed by EIC. These personnel will be responsible to the SE for monitoring construction standards and for ensuring that all detailed technical requirements are met on each and every job which is undertaken. The contractor's supervisor(s) will have day to day liaison with the SE, and will provide the SE with technical reports and audits, and other management information as is required on work progress and construction quality standards.

9.4 The contractor's supervisor shall have mobile telephones or pagers to ensure that they can be contacted at all times. The contractor will also nominate one person who can be contacted if necessary out of hours, for the duration of the works. The contractor's supervisor will have access to transport at all times to allow them to visit sites and attend meetings with HNGPL as is required. The normal day to day issue of work instructions, communication between HNGPL and the contractor 's supervisor and the SE.No deviation from the approved technical specification / issued construction drawings shall be undertaken without written approval of EIC.

9.5 Contractor shall maintain a Project site office, Material store with following facilities:

- Telephone, Mobile phones, Fax machine, printers/Scanning/Xerox machines, Computer with e-mail facilty.
- 1 No. four wheeler with driver for suit survey, meetings etc, with Owner/Owners representative. Also it shall be well equipped with tools and tackles for attending any emergency complaints and ongoing execution work.

On award of the contract, The contractor shall establish and submit documentary evidence for above Which will be verified by owner before of the work order. Any delay and non-compliance of above may result into the termination of contract

10.0 STRUCTURES, SERVICES AND OTHER PROPERTY

10.1 Location of Underground Utilities

The contractor shall locate all buried utility pipes, underground cables, water mains and other obstructions intersecting or adjacent to the Works, and shall make available the necessary labour to expose and record the depth of cover over all obstructions in advance of excavation. This shall be done far enough in advance of excavation to facilitate gradual change in grade or position found necessary to clear any obstructions.

In addition, the contractor shall excavate trial pits as necessary to determine the pipe route. The number of trial pits will be agreed with the EIC in advance of any excavation. In any event, trial pits shall be made at intervals of a maximum of 30 meters. Restoration of the abandoned trial pits and trenches shall be the contractor's responsibility. No payments shall be made for such type of jobs.
It is contractor's responsibility to interact with other utility agencies regarding their existing utilities and finalize the route along with these agencies and Owner/Owner's representative
There will be no additional payments in respect of abandoned trenches incurred because of insufficient or inadequate trial pits, or any associated lost time or delays.

10.2 **Protection of Structures and Utilities**

The Contractor shall at his own cost, support and protect all buildings, walls, fences or other structures and all utilities e.g. Electrical cables, Telephone Cables, Water pipelines, Sewer pipelines etc., and property which may, unless so protected, be damaged as a result of the execution of the works. He shall also comply with the requirements in the specification relating to protective measures applicable to particular operations or kind of work. Special care shall be taken while laying Pipelines near the trees.

10.3 **Interference with Traffic, Street Drainage and General Public**

The Work shall be executed in such a manner as to cause a minimum of inconvenience to persons requiring to use public or private roads, lanes, thoroughfares, walkways, rights-of use or passages through which the Works are to be executed. The trench shall be back filled, compacted, leveled and extra earth shall be removed immediately after laying of pipeline to avoid public inconvenience. Closure of roads, etc, shall not be permitted without the approval of the EIC.

The Contractor shall comply with all local Authorities requirements to traffic, and keep roads open to traffic, and maintain access to and within any private property.

Wherever the pipe route crosses driveways, access tracks or entrances to private properties, the Contractor shall give the owner, occupier or relevant authority at least 24 hours prior notice of intended commencement of excavation and shall be restricted to pass through.

The Contractor shall not, in any circumstance, use a private driveway, access track or entrance without the prior approval of the EIC.

The Contractor shall provide suitable access where necessary in the form of temporary bridges, culverts, flumes, etc, of a size and type approved by the EIC.

The Contractor shall comply with all relevant road Laws. Where limits and/or speed limits have been placed in the vicinity of the Works, the Contractor shall provide for the necessary movement of plant and equipment in accordance with the requirements of the relevant authority.

The Contractor shall not obstruct any drainage pipes or channels in any road but shall deviate them where necessary and use all proper measures to provide for the free passage of water.

The Contractor shall deliver the completed works after proper cleaning of the site.

The contractor shall conduct his operations at all times, with a view to minimizing as far as practicable noise from plant and other objectionable nuisance (e.g. oil leakage).

11.0 <u>TRENCHING</u>

The schematic diagram with the detail of trench is enclosed as Annexure.

The Contractor shall perform the excavation works so as to enable the pipe to be laid in conformity with the levels, depths, slopes, curves, dimensions and instructions shown on the Drawings, Specifications or as otherwise directed by the EIC.

Contractor shall excavate and maintain the pipeline trench on staked centerline as per approved alignment sheets taking into account the horizontal curves of the pipelines.

While trenching care shall be taken to ensure that all underground structures and utilities are disturbed to the minimum. Suitable crossing shall be provided and maintained over the ROU wherever necessary to permit general public, property owners or his tenants to cross or move stock or equipment from side of the trench or another.

Trenching shall be made with sufficient slopes on sides in order to minimize collapsing of the trench. On slopes wherever there is danger of landslides, the pipeline trench shall be maintained open only for the time strictly necessary. HNGPL may require excavation by hand tools, local rerouting and limiting the period of executing of the works. Before trench cuts through water table, proper drainage shall be ensured, both near the ditch and ROU in order to guarantee the soil stability.

The Contractor shall ensure that trench bottom is maintained in the square form as far as possible, with equipment, so as to avoid/ minimize the hand grading at the bottom of the trench. The Contractor shall do all such handwork in the trench as required to free the bottom of trench from loose rock, pebbles and to trim protruding roots from the bottom and sidewalls of the trench.

11.1 **Depth of Trench**

The minimum depth of cover shall be measured from top of pipe to the top of undisturbed surface of the soil or top of the graded working strip or top of road or top of rail, whichever is lower.

The depth of the trench will be such as to provided minimum cover as stipulated below:

* Refer PJS clause No. 17.0 SPECIAL POINTS PERTAINING TO SPECIFICATION.

The minimum depth as mentioned above may be greater than as may be required by Government/ Public authorities under jurisdictions. The Contractor shall perform such work without extra compensation, according to the requirement of concerned authorities.

In cases of Drain/ Culvert crossing through open cut where excavation cut is more than 1.5m, the extra excavation shall be paid in quantity basis. The rate shall include backfilling as specified. No separate payment is chargeable for extra excavation and includes backfilling as well.

In case the depth could not be achieved due to practical problems and the same is demonstrated, EIC after examining thoroughly and considering the codes and standards may allow the contractor to provide suitable protection by way of concrete casing pipes or slabs without extra cost to HNGPL.

11.2 **Width of Trench**

The width of the trench shall be wide enough to provide bedding around the pipe and to prevent damage to the pipe inside the trench. Unless otherwise directed by the EIC and where ground conditions permit, the minimum distance from the inside edge of the trench wall to the outside of the pipe shall be as per drawing enclosed herewith.

11.3 **Trench Base**

The trench bottom shall be cut or trimmed to provide a uniform bedding for the pipe, and shall be free of stones, metal, wood, vegetation, clods of earth or other debris before placement of the pipe.

Hard rock is defined as trench material with a single piece dimension exceeding 1.5 m in length which cannot be removed other than by the use of pneumatic chisel/drill or sledge hammer and chisel.

Excavation through soil mixed with boulders that have been used for a road base will not be considered as hard rock for the purposes of payment.

1.4 **Clearances**

Unless otherwise approved, the following clearances shall be maintained between the external wall of the gas pipe and the external surface of other underground assets in the vicinity of the Works.

- 150-300 mm where the gas pipe crosses other assets, other than electric cables, whereupon the clearance shall be 300 mm.
- 300mm where the gas pipe is on a similar alignment to the other assets. Where

the above clearances cannot be achieved, or in other special circumstances, the EIC may approve/specify protection with concrete/MS coated pipe, etc. The protective material shall be supplied and installed by the Contractor at his cost.

11.5 **Under Ground Interferences**

The Contractor shall locate and expose manually all underground facilities if any during trenching. Safety barriers, if required shall be erected to prevent any damages or accident. On locations where pipeline is laid under the existing facilities and near the approaches to the crossing, the trench shall be gradually deepened to avoid sharp bends.

All sewers, drains, ditches and other natural waterways encountered while trenching shall be maintained open and functional by providing proper temporary installations if required. Suitable dewatering pumps shall be deployed to dewater, if required.

Whenever it is permitted by Authorities and/ or HNGPL to open cut paved road crossing, or where line is routed within the road pavement, the Contractor shall remove the paving in accordance with the restrictions and requirements of the authorities having jurisdiction thereof as directed by HNGPL. After laying the pipeline, backfilling shall be immediately performed and all the areas connected with the works shall be temporarily restored.

In case of damage to any of above referred structures/ utilities the contractor shall be responsible for repairs/ replacement at his own cost, which shall be carried out to satisfaction of concerned authorities, resident and HNGPL.

11.6 **Others**

Throughout the period of execution of such work, the 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 HNGPL.

For all roads, paths, walkways etc. that are open-cut, the Contractor shall provided 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.

The Contractor shall excavate to additional depth at all the points where the contour of the earth may require extra depth, or where as deep trench is required at the approaches to crossings of roadways, railroads, rivers, streams, drainage ditches without any extra cost implication to HNGPL.

The Contractor shall excavate all such aforesaid depths as may be required at no extra cost of HNGPL.

The trench shall be cut to a grade that will provide a firm, uniform and continuous support for the pipe.

The Contractor shall take conducive measures to ensure the protection of underground utilities as per the instructions of HNGPL or relevant authorities.

Where the pipeline crosses underground utilities/ structures, Contractor shall first manually excavate to a depth and in a such a manner that the utilities/ structures are located, then proceed with the conventional methods.

The 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-way the Contractor shall maintain proper distances and perform the work to the satisfaction of HNGPL and other utility agencies. In such locations, the 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.

11.7 **Bedding**

The contractor shall ensure that the pipe when placed in the trench is supported and surrounded by a bed of screened excavated soil, which shall be stone free and have a maximum grit size of 5mm in order to ensure no damage occurs to the pipe.

However in case of rocky soil, the bedding shall be done with approved/ good quality packing sand, subject to the approval of the EIC, the size distribution of the sand/ shall be the same as per soil. The packing sand shall be placed to a minimum thickness of 150mm around the pipe in case of rocky terrain.

Unless directed by the EIC the quantity of bedding & surrounding sand shall confirm to specifications. There shall be no void space in packing sand around the pipe.

12.0 <u>LAYING</u>

Laying of MDPE pipelines shall commence only after ensuring proper dimensions and clean surface of the trench. The trench bottom shall be free from the presence of cuts, stones, roots, debris, stakes, rock projections upto 150mm below underside of pipe and any other material which could lead of perforation/ tearing of the pipe wall. After ensuring above the MDPE pipe coil shall be uncoiled smoothly through proper equipment's/ care inside the trench ensuring no damage to pipe coil during laying. The Contractor must ensure that pipe caps are provided before lowering of pipeline. The trench after this can be released for back filling leaving adequate lengths open at the ends, for jointing.

Where given specific approval by the EIC a pipe may pass through an open drain or nallah. Where this is permitted the pipe shall be installed inside a concrete or steel sleeve for protection. The sleeve material shall be procured and laid by the Contractor. In general the GI Sleeve and MS sleeves material specification shall be confirming to IS 1239 (Heavy Duty) specification of reputed make. The payment for the length of pipe in the sleeve will be made as per SOR. All other work necessary to break through the walls of the obstruction, and to seal the annulus between the pipe and

the sleeve and the sleeve and the wall, shall be deemed to be included in the rates.

Open ends of pipe placed in the trench shall be securely capped or plugged to prevent the ingress of water or other matter. The Contractor is to ensure that

nothing enters the inside of the pipe during the laying process as this could cause a future blockage or regulator malfunction due to dust, etc.

Service lines shall be installed in accordance with the drawing enclosed. Note that the service pipe rises out of the ground at the customer's premises within a GI sleeve pipe. The vertical portion of the sleeve shall be fixed to the wall of the premises in a secure manner. A bending tool shall be used to bend the GI sleeve pipe so that it has the appropriate curvature and is free of kinks. The bending of the sleeve, its fitting and clamping, and the installation of the transition fitting excluding service-isolating valve, is all included in the service connection rate**.** A rate is included in the SOR for the provision of sleeves for PE laying. Any installation without inspection and approval may lead to penalties as Special condition of contract

A bending tool shall be used to bend the GI sleeve pipe so that it has the appropriate curvature and is free of Kinks. The installation of the GI sleeve for service lines shall be done by sealing the annulus, firm fixing of the GI sleeves with concrete mix, breaking through any obstructions & their subsequent restoration to the satisfaction of the EIC.

The contractor shall supply the GI sleeves (Heavy duty OF IS:1239 reputed make) respectively for domestic & commercial / Industrial installation. The vertical portion of the sleeves shall be fixed to the wall of the premises in a secure manner. The service line shall be installed in accordance with drawing enclosed. The material test certificates / inspection reports shall be inspected by TPIA/PMC before installation.

Valves shall be installed at locations shown on the Design Plan or as directed by the EIC and joined with PE pipes by electro-fusion techniques. The valves shall be supported on a bed of fine fill of grit size not greater than 5mm to achieve equivalent support as the incoming and outgoing pipe work.

Laying graphs with details of depth, length, offsets from fixed references, other utility crossings, fittings, size of casing pipe used for the pipeline shall be prepared on daily basis and submitted to Site Engineers of the Owner for approval. These details will be further incorporated into As-Built Drawings.

14.0 JOINTING OF POLYETHYLENE PIPE

The procedure for jointing of PE pipe and fittings is enclosed. Only Bar coded electro-fusion machine (Automatically Readable) that can read the bar code of the fittings automatically shall be used for jointing of MDPE pipe / fittings. **Manual feeding electro-fusion machines are not acceptable for jointing purpose**.
The Contractor has to submit the certificate of calibration of Fusion machine at the time of start of work and at fixed intervals as per the instruction of owner. Contractor shall ensure that the machine are always available at site, no
stoppage of work due to the non availability of machines.

The contractor shall flush the Pipeline with air to remove dust, water, mud etc. before fusing the joints.

Before jointing, the Contractor shall place packing sand under the pipes on both sides of the joint to keep the pipes in line and at the correct alignment during the jointing process. Alignment clamps with the correct size shells should be used to align the pipe during the electro-fusion cycle.

The Contractor shall ensure that polyethylene pipe is only cut with an approved PE pipe cutting tool. Before fusion is attempted he shall remove the oxidized surface of the pipe to be inserted into the electro-fusion coupling. The tool must remove a layer of 0.1 mm to 0.4 mm from the outer surface of the polyethylene pipe. **It may also be noted that no fusion will be allowed without clamping device and only the approved cutting tools (Hack Saw shall not be allowed for cutting the Pipe) shall be used**.

The contractor has to supply all the consumables required for carrying fusion of the joints (like cloth/ paper napkin, acetone etc.).

If, upon inspection, the EIC determines a joint is defective, Contractor shall remove the joint by an approved method. The cost of this work shall be borne by the Contractor.

For electro-fusion jointing, the contractor must bring own tools, tackles and equipments.

Contractor shall arrange generator for power supply for fusion machine. Taking power connection from electric poles ,connections without written permission from concerned authorities or residential premises is strictly not permitted.

Only, Approved Jointers shall carry out fusion of all joints. Contractors shall provide the list of jointers to be used on the job and make arrangements for qualification Testing of the jointers in presence of Owner / Owner's representative . All approved Jointers shall bear Identity cards signed by Owner/Owner's representative**..**

Taking power connection from electric poles , connection without written permission from the concerned authorities or residential premises is strictly prohibited

15.0 BACKFILLING

Backfilling shall be done after ensuring that appurtenance have been properly fitted and the pipe is following the ditch profile at the required depth that will provide the required cover and has a bed which is free of extraneous material and which allows the pipe to rest smoothly and evenly. Dewatering shall be carried out prior to backfilling. No backfilling shall be allowed if the trench is not completely dewatered.
Prior to backfilling it should be ensured that the post padding where required of compacted thickness 150mm is put over and around the pipe immediately after lowering.

Backfilling shall be carried out immediately after the post padding where required has been completed in the trench, inspected and approved by HNGPL, so as to provide a natural anchorage for the pipe, avoiding, sliding down of trench sides and pipe moment in the trench. If immediate backfilling is not possible, a padding of at least 200mm of earth, free of rock and hard lumps shall be placed over and around the pipe and coating.

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 backfilled trench. In case, it is required and directed by EIC, screening of the backfill material shall be carried out with specified equipment before backfilling the trench.

The surplus material shall be neatly crowned directly over the trench and the adjacent excavated areas on both sides of the trench to such a height which will, in HNGPL opinion of provide adequately for future settlement of the trench backfill during the maintenance period and thereafter. The down shall be high enough to prevent the formation of the 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 off to the satisfaction of land owner or authority having jurisdiction at no extra cost to HNGPL.

Where small pieces of rock, gravel, lumps of hard soil or like materials are encountered at the time of trench excavation, sufficient earth or select backfill materials shall be placed around and over the pipe to form a protective cushion extending at least to a height of 150mm above the top of the pipe. Select backfill materials for padding that are acceptable shall be screened soil, containing no gravel. All these works shall be carried out by Contractor at no extra cost to HNGPL. 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.

In case where hard rock is encountered or as desired by EIC sand padding is to be provided upto height of 150mm around the pipe.

When the trench has been dug through drive ways or roads, all backfilling shall be executed with suitable material in layers as approved by HNGPL and shall be thoroughly compacted. Special compaction methods as specified may be adopted. All costs incurred there upon shall be borne by the Contractor.

Trenches excavated in dikes which are the properties of railways or which are parts of main roads shall be graded and backfilled in their original profile and condition. If necessary, new and/ or special backfill materials shall be supplied and worked-upto.

PE Warning Grid/Mat 1mm thick and 300mm wide will be placed on distribution main and on service lines inside premises, after backfill of the trench upto a height of 300mm on the top of the carrier pipes. The warning grid is to be unrolled centrally over the pipe section and thereafter further backfilling will commence.

Backfilling activity shall include proper compaction by jumping jack compactor and watering in layers of 150mm above the warning mat.

Proper crowning of not more than 150mm shall be done. All the excavated material required to be used during the Restoration process shall be stacked and kept separately and properly. Wherever Road cutting/ Tiles removal/ PCC cutting has been done during excavation for laying, the area shall be back filled and compacted immediately so that no inconvenience is caused to the general public.

Electro-fusion of joints is to be undertaken immediately after lowering and the activity shall not be kept pending for lack of Electro-fusion jointing. The backfilling shall be considered complete only after the joint in completed.

Debris and other surplus material shall be removed immediately after the back filling.

The contractor shall not be entitled for 30% payment on laying & backfilling till the above activities are completed.

16.0 MOLING:

The Moling shall be carried out as per the requirement specified by HNGPL, and approved procedures. The contractor has to carry out thorough survey of the under ground utilities before going for the Moling, to avoid the damage to the other utilities.

No extra payment will be made for any trial/ abandoned pits made during the survey. The supply of all equipment, power required for carrying out moling work, is in contractor's scope. The type of moling to be carried out i.e., Manual/ Machine with or without casing shall be at the discretion of HNGPL. A prior approval is to be taken before starting the Moling.

For manual Moling the contractor shall ensure that the size of the hole shall not be more than 20% of the size of the casing / carrier pipe which ever is applicable. After completion of Manual Moling the hole shall be properly compacted / filled with soil by watering and by approved procedures, the pits shall be backfilled, compacted & restored . The rate for such crossing work by using casing pipe & carrier pipe or only carrier

pipe shall be payable as per Schedule of Rates. **No separate payment shall be made for pulling the carrier pipe.**

The rates for Moling, as indicated in SOR, are payable as per the size of the casing/ carrier pipe and are inclusive of excavation of pits, backfilling, compaction, restoration, jointing and insertion of carrier pie.

Any damages occurred to other utilities during the Moling operation shall be immediately notified and rectified by the contractor without any cost implication to HNGPL.

The length of the Hole (excluding the sizes of the pits on both ends) shall be considered for the measurement of Moling length. However, intermediate pits will consider in the moling length.

17.0 BORING/RAMMING/DIRECTIONAL DRILLING

One of the above techniques is required to be carried out by the Contractor where conventional trenching/Moling is not possible viz. railways, major waterways, highways, roads etc. Details of such crossings shall be obtained by the Contractor, and construction drawings shall be prepared by the Contractor in consultation with HNGPL. Execution of the work shall be based on the HNGPL approved drawings. The contractor has do the thorough survey of the under ground utilities before commencement of BORING/ RAMMING/ DIRECTIONAL DRILLING to avoid the damage to the other utilities. No extra payment will be made for any trail/ abandoned pits made during the survey. The supply of all equipments is in Contractors scope. Work to be carried out in accordance with API - 1102.

Once the work is allotted, **Any delay in mobilizing / non – availability of HDD machines as per site requirement and conditions shall result in levying of penalties on daily basis as per SCC.**

The type of HDD to be carried out i.e. conventional (with or without casing) shall be at the discretion of HNGPL. And prior approval is to be taken before starting the HDD.

The rates for HDD, as indicated in SOR, are payable as per the size of the carrier pipe and are inclusive of excavation of pits, backfilling, compaction, jointing and insertion of carrier pipe and restoration of pits. For HDD with casing pipe no separate payment shall be made for pulling of the carrier pipe, the rate quoted by the Contractor shall be inclusive of pulling carrier pipe.

Any damages occurred to other utilities during the HDD operation shall be immediately notified and rectified by the Contractor without any cost implications to HNGPL.

The length of the HOLE (excluding the sizes of the pits on both ends) shall be considered of HDD length.

18.0 CASING PIPE

The tentative sizes of the HDPE casing pipe for Moling/ HDD shall be as follows:-

Size of MDPE pipe	Size of HDPE pipe
20 mm	75mm
32 mm	75 mm
63 mm	125 mm
90mm	180mm
125mm	250mm
180 mm	315 mm

However, size of the casing pipe may vary according to length of the carrier pipe and requirement of laying of OFC Duct.

19.0 RESTORATION

Wherever the restoration is required, the roads, footpaths (including roads and footpaths inside colonies) shall be restored to original condition, and the same shall be done as per concerned local authorities norms and to the satisfaction of the concerned local Authority. To retard curing of the installed concrete, wet sack cloth is to be placed on the finished surface and kept damp for a period of 36 hours.

Where slabs and blocks are to be restored, the level of the compacted sub- base is to be adjusted according to the slab/block thickness. The slabs or blocks should be laid on moist bedding material, which should be graded sand, mortar or mortar mix. The slabs or blocks should be tapped into position to ensure they do not rock after laying.

The restored slabs or blocks should match the surrounding surface levels. Joint widths should match the existing conditions, and be filled with a dry or wet mix of mortar.

The sketch for restoration of Road, Footpath, Channel is enclosed herewith and is indicative. However, the restoration shall be done in accordance with the norms of concerned land owning agencies.

Turf shall be replaced in highly developed grassed area. In lesser-developed grassed areas topsoil should be replaced during the restoration process.

Where permanent surface restorations cannot be completed immediately, the Contractor shall provide and maintain a suitable temporary running surface for vehicular traffic and pedestrians. The Contractor will be responsible for the maintenance of all restoration carried out, for the duration of the Contract guarantee period.

The Contractor is to ensure the restoration work is properly supervised, and that the material used is suitable for the purpose and properly compacted. Where the required standards are not achieved the Contractor will be required to replace the defective restoration work.

Note that Payment for pipe laying will only be authorized on initial-satisfactory restoration, and where the sites has been cleared of all surplus materials, etc.

Contractor has to obtain the clearance certificate from the concerned local authorities after completion of the restoration work. The restoration specification specified in the tender is only a typical specification and the contractor has to carry out restoration as per latest version of the (PWD/ IRC) specification to its original condition and also to the entire satisfaction of land owner (Private/Public).

The expenditure incurred towards testing of the material used for restoration as per applicable standards, shall be born by the contractor.

20.0 TESTING

Pressure testing will be carried out with compressed air. Compressed air will be provided by Contractor for testing purposes and is to be included in the rates.

For main pipelines work the Contractor shall perform progressive pressure testing to avoid having to find leaks in long lengths of pipe. The test pressure shall be 6.0 bar(g), and there shall be no unaccountable pressure loss during the test period.

Test procedure with sketches showing the pipeline to be tested, vent points, gauge location, and inlet pressure print is to prepared & got approved by EIC.

For main line the test duration shall be 24 hrs . With these tests the pressure should be allowed to stabilize for a period of 30 minutes after pressurization. The holding period may then commence and continue for 24 hours. Measuring instruments shall have been calibrated and their accuracy and sensitivity confirmed. For testing of Network, calibrated pressure gauges of suitable range shall be supplied by the contractor. The pressure gauges shall be calibrated from time to time as desired by Engineer-in-Charge. All testing shall be witnessed and approved by the EIC or his delegated representative. Tie-in joints may be tested at working pressure following commissioning.

For service lines in some cases testing will be carried out independently of the testing of the mains for which the test duration may be reduced to 4 hrs. The service testing in this case will be performed after the service installation is complete but before the service tee has been tapped. Also in some cases the tapping of the service tee will be delayed pending the completion and purging of the main pipelines.

21.0 PURGING

Purging shall be carried out in accordance with the principles defined in the American Gas Association publication 'Purging Principles and Practice".

Nitrogen required for purging will also be provided by the Contractor. Nitrogen shall be supplied in labeled, tested and certified cylinders, and completed with all necessary regulators, hoses and connections, which will be in good condition and working order.

In addition the Contractor shall submit and get approved a Purging Plan before commencing any purging work. The Plan shall include, but not be limited to, the provision of the following materials and equipment: Personal safety equipment, Fire extinguisher, Purging adapter, Purge stack with flame trap and gas sampling point, Gas sampling equipment (may be gas leak detector), squash-off tool, Polyethylene connecting pipe work.

The Plan shall also include the purging process along with detail on the sequence of events. The process is to also specifically mention the need to lay a wet cloth over the PE main and in contact with the ground, to disperse static electricity during the purging work.

A purge stack with flame trap shall be used when purging services. Care shall be taken to ensure that the purge outlet is so located that vent gas cannot drift into buildings.

22.0 VALVE PIT

The valve pit shall be constructed in accordance with enclosed drawing & payment shall be as per relevant SOR item.

The construction of valve chambers shall be taken up immediately after installation of valve pit.

22.1 **Workmanship**

The excavation work shall be done at a location given by Engineer–in-Charge. All care shall be taken not to damage existing facilities and surface of construction shall be restored to its original state.

Sandbags to be placed below pipeline without disturbing the layed pipe. Gunny bags and Sand should be of approved quality.

Precast RC slab shall be placed as indicated in the drawing issued to the contractor. PCC to be placed below the pipe as indicated. Once PCC is set sand is to be filled and properly rammed so that pipe and precast concrete blocks are firmly placed.

Valve will be supplied without the operating stem. Contractor has to supply the operating stem with a handle for the valves of the different sizes. The Contractor has to take prior approval for design and material specification of the stem for installation. Approved quality sand is to be placed in between area.

Surrounding area to be properly cleared and PCC to be placed around the location where precast slab with CI Manhole cover is placed. The RC precast slab to be laid in level and finished smooth.

23.0 PERMANENT MARKERS

23.1 Permanent Marker (As per typical Drawings Placed at Tender) shall be installed on the ROU at regular intervals as per the instructions of the EIC immediately after laying of the pipeline. The installation of the type of the Permanent Marker shall be decided by the EIC depending on the site condition. The Markers shall be painted before installation as per the approved procedure. The supply of the paint and painting as per the specification is in contractor's scope. Separate payment for installation of the markers shall be paid to the Contractor as per the respective Item in SOR -

23.2 The artwork shown in the drawing is typical for all the markers. The contractor must take prior approval for the artwork from EIC before installation of Markers. The artwork must have HNGPL's logo and specify the location of the pipeline from the marker.

Guidelines :

- The installation of these markers shall be such that in between two pole markers two RCC markers are installed with spacing of 50 Mtrs on either side. However, Pole markers shall be installed at all the tapping / Branching points in the mainline.
- Interval between any two RCC markers for mainline (180mm to 63mm) shall not be more than 50 m .
- Pole marker or RCC marker shall be installed near to valve chambers on mainline & inside the pockets respectively for indication.
- Pole marker with foundation shall be installed after two RCC marker as per drawings.
- The entry and exit pits for laying of pipeline by HDD/ Moiling for road crossings shall be marked by pole markers or RCC markers depending upon the site condition.

- In addition to the above, pole markers with foundation (As per drawings) shall be installed outside societies / Areas as per the instruction of the site in charge.

- For the distribution network 32 mm & 20 mm pipe, plate markers shall be installed as per the site condition and direction of the site in charge.

24.0 ASSISTANCE IN COMMISSIONING

Contractor shall provide the required personnel, Vehicles, labour, supervision, tools, equipment, instruments and technical assistance for performance tests and commissioning activities as per requirement of HNGPL.

25.0 STANDARD OF WORK

25.1 All work carried out under this contract shall be to standards, codes of practice, construction procedures and other technical requirements as defined in the technical specifications.

25.2 The manpower deployed on the respective work shall be adequately trained & shall have necessary skills to executive / supervise the work. However, the assessment on the qualification of the personal shall be at the discretion of EIC.

25.3 Fusion operators and other skilled personnel shall be approved by HNGPL and identification cards duly signed by EIC shall be issued to them. Only those personnel who are approved by EIC shall be allowed to execute the critical activities like joining of PE Pipes.

26.0 RECORDING (AS-BUILT DRAWINGS)

The Contractor will be required to submit computerized as-built drawings duly certified by EIC in A0/ A1 sheet form at 1:200 scale with six sets of prints plus soft copy. The as-built drawing shall be submitted on area wise as specified. The bill of materials used for the particular area shall be specified on the drawings. The Contractor shall use the area and crossing survey drawings prepared by them as reference. On-site sketches, picking up key reference points, shall be made during the installation of services. The lengths, depths of installed pipe work, changes in direction, major fittings, etc, shall be recorded together with appropriate references to other services crossed and in the proximity of the gas pipe.

Distance of pipeline from permanent property /structure should be provided at least every 20 meters. If there is any chance in alignment/orientation and offset distance etc. of the pipeline in between the above said 20 meters, the same shall be dearly mentioned in the as laid.
Gas objects (off valve, tees, elbows, couplers, T.F, etc shall be shown as block objects (which from a single node to connect) with respect owners
symbol and legend. The as laid drawing shall be as per the legends provided
by EIC.
Details & offset distances from other utilities present should be given in as laid drawing. If there is any change in the depth of pipeline, the same shall be clearly marked with details in the as laid drawings. The details of additional protection provided must be mentioned.

Details of the PE stop off valve and other fittings used should be shown with adequate information and orientation. Technical deviation (if any) should be provided with reference to the buildings and permanent structure around, and the same should be cited clearly with all relevant details.
Complete details of nallah crossings should be shown in a separate sketch

Name of roads, major landmarks and buildings should be mentioned appropriately for reference.
Proper Chainage shall be mentioned on all the drawings to be referred with continuation reference.

Direction of gas flow should be indicated in each drawing.

Land based features shown on the drawing shall match the exact distance as they were on real ground with respect to scale ratio (1:200)

The details shall be prepared in standard format using Map Info/AUTOCAD Map and submitted in CD ROM. Contractor shall also make the item wise material consumption report for the respective areas in a soft copy and to be submitted along with the as-built drawings.

27.0 Civil Works

The contractor has to supply the adequate materials and skilled manpower for the completion of all the civil works. The contractors shall also insure that the work carried out as per the detail mentioned in the schedule of rates.

Special care should be taken at the time of labours working in depths/lifting of the skids by hydras/ cranes considering all the safety guidelines.

The contractors has to ensure that sample of all the material shall be inspected and approved by EIC before carrying out installation or erection work. The contractor has to submit the test certificates for all the materials to be used at the site . the construction shall be carried out strictly as per the drawings provided by the HNGPL. The party shall ensure extra / Surplus / malba shall be immediately removed from the site after completion of the job. Separate payment shall be made as per the SOR.

TECHNICAL SPECIFICATION

FOR

INSTALLATION OF ABOVE GROUND GI PIPING

FOR

DOMESTIC, COMMERCIAL AND INDUSTRIAL CONSUMERS

CONTENTS

1.0 GENERAL INFORMATION

1.1 INTRODUCTION

The main intent of the specification is Supply and installation of above ground GI pipes, fittings, valves, meters and regulators, from the outlet of 'PE/GI transition fitting' up to the DOMESTIC consumers 'Appliance / stove/ oven valve' as per the Distribution Schedule.

The s cope for commercial consumer includes installation of above ground GI pipes and associated fittings, valves, regulator up to and including meter. However, the piping may have to be carried out up to Appliance valve, in case of some commercial customers.

In case of large commercials and industries completely assembled metering skids would be supplied to the contractor who would be required to install and provide inlet & outlet connection.

This technical specification defines the basic guidelines to develop an acceptable design and suitable construction methodology for carrying out different activities listed out in the schedule of rates of this tender.

Compliance with these specifications and / or approval of any of the Contractor's documents shall in no case relieve the Contractor of his contractual obligations.

2.0 SCOPE OF WORK

Generally the following shall constitute the contractor's scope of work:

2.1 Plan and prepare a detailed execution schedule and procedure for implementation based on QA / QC formats plans issued by HNGPL.

2.2 Contractor has to submit the Construction/Execution procedures before commencement of work to owner / owner's representative for approval.

2.3 Selection of route and marking on walls / floors between 'transition fitting' to 'cooking oven / stove / appliance' making openings and making provisions for fixing clamps. Making temporary but stable platforms / scaffolding / rope ladder etc., required for installation of pipes /fittings at all heights /multi storied flats and locations. Providing safety equipment to workers / plumbers.

2.4 Receipt of regulators, domestic meters, as a free issue items from Owner's Stores, loading, transportation, unloading at project site. Proper storing, stacking, identification, providing security and insurance during and before installation and commissioning of pipelines. Obtaining the approvals for optimum route and permission for work from the concerned authority and EIC.

2.5 Contractor shall procure all material, except free issue material from the outlet of PE/GI transition fitting up to the Domestic/Commercial customers "Appliance/Stove/Oven valve for satisfactory completion t o t he owner/Owner's representative.

2.6 Installation of GI pipes of ½", ¾", 1" dia. between transition fittings (installed by PE contractor) and customer's kitchen which would include NPT threading of pipes, and jointing of fittings such as elbows, tees, connectors, regulators, meters, isolation valves etc., as per laid procedures and specification including supply of GI fittings & Teflon tapes for sealing of joints. Painting of GI Pipes & fittings as per specification.

2.7 Installation of Copper pipes of ½" (12 mm) OD from the downstream of Meter upto the isolation valve prior to the customers appliance, including the installation of isolation valves, brass fitting at the downstream of meters and at the entry of isolation valves with application of lacquer paint etc. to the satisfaction of EIC.

2.8 Supply & Installation of clamps for fixing pipes, isolation valve, appliance valve, box for regulator, Sleeves wherever required, painting of steel pipes & fittings. Providing consumables grout material, repair / restoration of walls / floors / holes including the materials required for conversions along with tools and tackles etc., complete as per specification.

2.9 Conversion of all types of LPG kitchen appliances to NG based appliances inclusive of supply of nozzles. Signing of Joint Meter Records (JMRs).

2.10 To demonstrate to the customer regarding use, safety and maintenance related aspects of NG based appliances and installations.

2.11 Testing & Commissioning of installations including p urging as per specification an d handling over the installation of HNGPL / customer to the entire satisfaction of HNGPL.

2.12 Dismantling of scaffolding / temporary structures and cleaning of site.

2.13 Restoration of walls, flooring and other damages while executing the above ground installation.

2.14 Preparation and submission of above ground installation card for each house / commercial establishment indicating the list of materials used, reasons of not providing connections, testing pressure and date etc. Deviation statements, if any, on completion / commissioning of work.

2.15 Any other activity not mentioned / covered explicitly above, but otherwise required for satisfactory completion / operation / safety / statutory/ maintenance of the works shall also be covered under the Scope of work and has to be completed by the Contractor within specified schedule at no extra cost to HNGPL.

2.16 Following activities are also in contractor scope

- Receive customer's request and complaints logged
- Carry out joint technical feasibility survey for request received.
- Attend and resolve customer complaint

3.0 MATERIAL, LABOUR, PLANT AND EQUIPMENT

3.1 Owner's Scope of Supply (Free Issue Item)

In order to speed up the project Free Issue Materials shall be issued to the Contractor from the designated store(s) of HNGPL. Contractor shall be responsible for lifting the free issue materials from Owner's storage point(s) and transporting the same to work site(s) at his own cost.

3.2 Supplied by the Contractor

The contractor has to supply all GI pipes, GI Fittings, meters, regulators, flexible hose, suraksha hose, Valves, Fittings, Clamps, Cu pipes, GI Pipes, Appliance Valves ½" and isolation Valves ½", ¾", sleeves, etc. and other materials required for said works.

The contractor shall provide the labour, tools (such as Hammer Drill, Piston Drill, Pipe cutters, Dies for threading, Pipe wrenches, spanners, all types of clamps, Plant and equipment necessary for the proper execution of the work. This will include but not be limited to list of specialized tools & tackles enclosed herewith. Contractor shall submit the specification of all the material to be supplied by him to EIC for approval and get the material checked & approved by him before commencement of execution.

The contractor is to be procure all bought out items from approved vendors and accordingly keep GAIL GAS LTD. informed. The inspection of bought out items would be carried out by

HNGPL/ Third Party Inspection or as instruction by EIC.

3.2.1 Plant and Equipment

All vehicular type machinery shall being working order and shall not cause spillage of oil or grease. To avoid damage to paved surfaces the contractor will provide pads of timber or thick rubber under the hydraulic feet or outriggers of machinery.

3.2.2 Sealant, grout

The contractor shall be responsible to arrange the supply of any consumable sealant or ready mi x g rout material required for execution of work. The sealant / grout supplied by the contractor shall be compatible with the area to be restored / rectified. No separate payment for the supply of sealant and grout shall be made to the contractor.

3.2.3 Clamps, Rawal Plugs, Screws, Nozzles etc.

The Clamps, Rawal Plugs, Screws, Nozzles, etc shall be approved lot wise by EIC prior to installation. Re-drilling of existing appliance nozzles is strictly not permitted.

The indicative sketch of the Brackets for Meter and GI Pipe Clamps is enclosed herewith.

3.2.4 Consumable Items

Special consumables such as Teflon Tapes, Solder wire, Flux, lacquer, thinner, shall be supplied by the contractor and are included for within the rates.

These consumables shall be of reputed companies and required grades / class and duly approved by EIC.

3.2.5. Other Materials

The contractor shall supply the following items where required. All

materials required for formwork, NPT threading, testing etc.
All signs, barricades, lights and protective equipment.
All material required for working at higher floor levels (i.e., scaffolding, Ladder, safety belts etc.).
Special consumable such as grease for maintenance of domestic appliances an d al l paints or painting o f G.I pipes, clamps, sleeves, brackets for meters, consumables
such as Teflon Tapes, Petrol, diesel, fuels and oils required are to be supplied by the contractor and are included for within the rates.
All minor items not expressly mentioned in the contract but which are necessary for the satisfactory completion and performance of the work under this contract.

4. Acquisition, Receipt, & Storage Of Materials

In case of materials supplied by owner, than the contractor shall collect all materials from HNGPL store between working hours following all documentation procedures laid down and as directed by EIC. The contractor shall at the time of receipt of material physically examine all materials and notify the EIC immediately of any damage. Any damage not recorded at the time of inspection done by contractor will be deemed not to have existed at the time of receipt of material. Cost of repair, rectification, replacement will be borne by the contractor. Any defective material found during the time of installation will noted and forwarded to stores for replacement immediately with P.O reference and only wit written approval of EIC. The contractor shall ensure that no defective materials hall be returned t o s tore a t the time of closure of contract .

The contractor shall maintain permanent locked store preferably near site in so that all the material are stored in such a manner so as to prevent and damage to the materials from scratching, gouging, indentation, excessive heat or by contact with any sharp objects and chemicals.

The contractor shall maintain log book at their respective stores stating issue and availability of free issue material as a given day. Further the contractor is required to undertake and submit an inventory of materials every month to Owners/Owners Representative (mandatory).

5.0 ISSUE OF WORK INSTRUCTIONS

5.1 The contractor will be required to carry out GI installation in the areas where MDPE laying is under progress. However, testing of GI installation shall be done in conjunction with laying of MDPE Service Lines to respective premises. A general scheme of distribution to domestic consumer is indicated in the sketch enclosed herewith, for reference. It may vary in case of individual and multistoried flats. A general scheme of distribution to small commercials consumers is indicated in the sketch enclosed herewith for reference.

5.2 All skilled personnel like plumbers, conversion technicians shall be approved and certified by EIC. Those who are certified and possess the identify cards duly signed by EIC shall only be authorized to take up respective jobs. The contractor has to arrange the identify cards. **In case it is found that contractor personnel other than authorized are carrying out these works, applicable penalty will be levied to the contractor as per contract**.

5.3 The rates to be quoted by contractor shall be inclusive of all preparatory / bye works, platforms, materials, labour, skills , supervision, tools , taxes, duties, levies, salaries, wages, overheads, profits, escalations, fluctuations in exchange rates and no change in the rates shall be admissible during tenancy of the contract.

5.4 The schedule of items of SOR have been described in brief and shall be held to be complete in all respect including safety requirements as per clause 9.0, tests, inspection, QA/ QC works, enabling and sundry works. The payment shall be made against completed and measured works only. No extra works whatsoever shall be considered in execution of these items.

5.5 A general scheme of distribution to domestic consumer is indicated in enclosed drawing .It may vary in case of individual and multistoried flats.

6.0 PROGRESS OF WORK

The contractor shall proceed with the work under the contract with due expedition and without delay.

The EIC may direct in what order and at what time the various stages or parts of the work under the contract shall be performed.

Weekly progress reports shall be submitted in the formats approved by HNGPL, indicating broadly the laying, testing, RFC, conversions and extra piping.

Material consumption statement to be submitted at least once a month.

7.0 WORK SHEETS

7.1 The quantities and other details will be checked by HNGPL's site engineer and the same shall be incorporated in measurement cards, signed & dated as certified on site. The cards will then be approved by the EIC.

7.2 Measurement sheets shall be prepared based on the measurement cards and checked and certified by the site engineers for billing purpose.

7.3 If measurement sheets submitted are illegible, incomplete or incorrectly booked, they will be returned to the contractor.

7.0 PERMISSIONS / APPROVALS

Contractor shall be responsible for obtaining approval from authorities like ADA / LDA and any other concerned authority, if required for completion of the work. Contractor must take the prior appointment from the resident for carrying out the work.

8.0 REFERENCE SPECIFICATION, CODES AND STANDARDS

The contractor shall carry out the work in accordance with this specification, HNGPL's Engineering Standards: ASME B31.8 - Gas Transmission and distribution piping systems; Australian standard 3723 - Installation and Maintenance of Plastics Pipe Systems for Gas; Oil India Safety Directorate Norms (OISD), Latest PNGRB guidelines and the American Gas Association Document -Purging Principles and Practice.

Should the contractor find any discrepancy, ambiguity or conflict in or between any of the Standards and the contract documents, then this should be promptly referred to the Engineer - in- charge(EIC) for his decision, which shall be considered binding on the contractor.

9.0 SAFETY

The contractor shall take care of all safety norms applicable for such works at site. Contractor shall provide all safety appliances e.g., safety helmets, gloves, safety belts, ladders, staging, shoes, goggles etc.

All necessary care shall be taken while working at heights and workmen with proper skills and work permits only shall be deployed. Proper barricading and warning signs shall be installed. Adequate care shall be taken while taking supports from balconies, chajjas / protection parapets and like structures to be sure of strength and adequacy of the same.

No night working shall be permitted, without proper lighting and prior approval of EIC.

10.0 RIGHT-OF-USE SURVEY AND MARKING

The route of the pipeline to be installed shall be decided with consent of the consumer and SE / EIC. Contractor must ensure that the persons/ workers/ supervisors/workers at site shall have proper identity cards prior to entering the premises of the consumer.

No temporary or permanent deposit of any kind of material resulting from the work shall be permitted in the approach and any other position which might hinder the passage and / or natural water drainage or any area where there is objection from consumer.

The contractor shall obtain necessary permissions from landowners and tenants and shall be responsible for all damages caused by the construction and use of such approaches, pavements, gardens, rooms, walls, roof etc., at no extra cost to HNGPL.

A survey will be conducted jointly by HNGPL and the contractor at each premises or housing colony to be supplied. The survey record will note customer details, the potential gas supply points and proposed meter positions and estimates of material quantities. The contractor's representatives will make as sketch of the agreed pipe routes, if necessary.

The contractor will be responsible for contacting the customer and making the necessary arrangements for access, and appointments to carry out the work. HNGPL will not be responsible for any time lost due to broken appointments or disputes with customers.

The contractor shall confine its operations within limits of the Right-in-use. The contractor shall restore any damage to property outside ROU, attributable to him.

The contractor shall also carryout all necessary preparatory work if needed to permit the passage of men and equipment. Lights, curbs, signs shall be provided wherever and / or required by the HNGPL necessary to protect the public.

11.0 PROTECTION OF STRUCTURES AND UTILITIES

The contractor shall at his own cost, support and protect all buildings, walls, fences or other structures and all utilities and property which may, unless so protected, be damaged as a result of the execution of the works. He shall also comply with the requirements in the specification relating to protective measures applicable to particular operations or kind of work.

While painting contractor must take care of the consumer premises while carrying out the job/ such as spillage on floor, walls, ceilings, sun shades etc. if the same does occur, the contractor is to immediately make good to original.

12.0 G.I ABOVE GROUND SERVICE PIPE

The GI service pipe installation work includes all work necessary to connect from the PE / GI transition fitting on the down-stream of the PE service, to the customers appliance, including the installation of appliance valve and isolation valves, except, Suraksha hose, Meters, Regulator for which separate rate shall be paid as per SOR Item of this document. The contractor shall be required to provide all equipment, tools and materials necessary to execute the work in an efficient and effective manner. Amongst other things he will be required to provide ladders, scaffolding pipe, dies, tripods, vices, fittings and teflon tape, drills for concrete and other masonry, drills for timber and laminated surfaces inside customers property, bending tools, clamps, sleeves to facilitate the pipe passing through floors and walls, paint for pipe marking etc. GI pipes, fittings, valves and regulator shall be provided by HNGPL.

All GI risers on the outside of buildings shall be fully supported to carry the weight of piping. Risers shall be supported by a flanged foot, or similar device, capable of supporting the total weight of the riser. The riser shall rise in a vertical line from its point of support to its highest point with a minimum of changes in direction. The threading of GI pipe shall be NPT and conforming to ASME / ANSI B1. 20.1.

Contractor has to supply different types / sizes of approved clamps (Mild Steel) for fixing G I pipes suiting to the site conditions and the same shall be painted before fixing, as per the painting specifications. Every fresh lot of the clamps, brackets, regulators boxes and other consumables shall be approved by the EIC prior to start of installation. All riser and lateral pipe shall be clamped to the building at intervals not exceeding two meters.

All riser and lateral pipe shall be clamped to the building at intervals not exceeding 1.5 meter. Maximum distance between clamps shall be 1.0-1.5m when pipe goes to the straight, if any tee or fittings lies in between the pipe then clamp shall be placed 150 mm far away from center line of fittings at every sides. However, the same may be changed as per site conditions/as directed by E IC. Minimum gap between pipe and wall shall be 25 mm. The joints/fittings of the GI installations shall be painted only after carrying out testing of the installation.

Where pipe passes through a balcony floor, the floor surface shall be made slightly elevated around the service pipe or its surrounding sleeve to prevent the accumulation of water at that point. Where a short piece of sleeve is used around the gas pipe, the sleeve should be embedded in the concrete with a mix of mortar and the void between the pipe

and sleeve filled with a suitable sealant. The sealant should be beveled such as to prevent an accumulation of water. Supply of clamps for all sizes of the GI pipes are in contractor's scope. Contractor has to take prior approval for design of clamps, paintings etc.

Pipe shall preferably enter a building aboveground and remain in a ventilated location. The location for entry s hall be such that it can be routed to the usage points by the shortest practicable route.

The rates are to be paid in bands as shown in SOR e.g., the ground floor to 2nd floor band c overs pipe work laid from the ground floor level to ceiling level on the 2 nd floor. Payment will be in incremental stages. e.g., if a pipe is laid from the ground floor to the 9th floor of a building, the length of pipe laid up to the 2 nd floor will be paid in the first band, The length of pipe laid between 3rd and 5th floor will be paid in second band and the length of pipe from the 6th floor and above will be paid for in the third b and. However, it may be noted that all the piping done inside the premises shall be considered as ground floor piping, the payment for such work shall be as per first band. The Pipe installation includes all fittings, Flexible hoses, clamps, Regulators etc.
The contractor shall ensure that gas supply shall not be provided to the customer in any concealed piping.

13.0 COPPER ABOVE GROUND SERVICES PIPE

The Copper service pipe installation work includes all work necessary to connect from the downstream of Meter upto the isolation valve and flexible hose prior to the customers appliance, including the installation of valves, including application of lacquer paint etc. The contractor shall be required to provide all equipment, tools and material necessary to execute the work in an efficient and effective manner. Amongst other things he will be required to provide ladders, scaffolding pipe, drills for concrete and other masonry, drills for timber and laminated surfaces inside customers property, bending tools, clamps, sleeves to facilitate the pipe passing through floors and walls, etc. Copper pipes, fittings, valves and regulator shall be provided by HNGPL.

During installation the COPPER pipe is to be cut to proper length with a t ube cutter, the burrs removed with a file, cleaning of outside surface of pipe & inside surface of fitting, applying flux to the tube and fitting around the outer / inner ends, inserting the t ube in t o t he fitting, applying h eat t o t he assembled joints using conventional Blow torch to melt Solder wire and lacquering.

Lacquer is to be applied to the copper tubes by mixing lacquer with thinner in approved proportions and applied by dipping method or with brush. It should be applied only once at a time and drying time of minimum one hr. is to be given.

Contractor has to supply different types / sizes of approved clamps for fixing COPPER pipes suiting to the site conditions and the same shall be painted, if required, before fixing, as per the painting specifications.

Contractor has to take prior approval of EIC for quality of the clamps, solder, flux, lacquer, thinner etc. The approval shall be taken for every fresh lot of clamps from EIC before installation at site.

All riser and lateral pipe shall be clamped to the building at intervals not exceeding one meter.

Where pipe passes through a balcony floor, the floor surface shall be made slightly elevated around the service pipe or its surrounding sleeve to prevent the accumulation o f wat er at that point. Where a short piece of sleeve is used around the gas pipe, the sleeve should be embedded in the concrete with a mix of mortar and the void between the pipe and sleeve filled with a suitable sealant. The sealant should be beveled such as to prevent an accumulation of water. Supply of clamps for all sizes of the COPPER pipes is in contractor's scope. Contractor has to take prior approval for design of clamps, painting etc.

Pipe shall preferably enter a building aboveground and remain in a ventilated location. The location for entry shall be such that it can be routed to the usage points by the shortest practicable route.

The rates, mentioned in SOR are applicable from ground floor to 2nd floor. However, it may be noted that all the piping done inside the premises shall be considered as ground floor piping, the payment for such work shall be as per the SOR.

After installation of the entire piping system, final painting shall be done to the satisfaction of EIC.

All copper piping shall be clamped to the building at intervals not exceeding 500mm. These solder wire shall be of reputed company , lead free as per BS 29453: 1994 (Soft solder alloys) and supplied in coils. The details specification attached in tender. Solder for use wit Cu tube & fittings generally melt within the temperature range of 180^0C to 250^0C. The contractor has to furnish the certificate of confirmation of standards before start of work.

14.0 TESTING OF GI INSTALLATION

14.1 The installation from PE/ GI transition fitting up to regulator shall be tested at the [pressure of 6.0 bar (g)].

14.2 The testing of GI riser pipe up to regulator shall be done with the isolation valve in open condition and open end plugged.

14.3 The GI pipe shall be painted with one coat prior to installation in riser, however the ends / joints shall be painted only after carrying out testing of the installation.

14.4 The G I installation from regulator outlet to appliance valve (except meter) s hall be tested at a pressure of 2.0 bar (g) for a hold period of 4 hours and all the joints shall be checked with soap solution.

14.5 The meters hall be removed while carrying out the testing and joints of the meter shall be tested on line with soap solution after completion of the work. Proper test ends shall be made along with gauges and got approved by EIC. For the installation to be tested by manometer or diaphragm gauge the meter shall not be dismantled/removed and testing shall be carried out at 100 m bar with holding period of 15 min with no pressure drop.

14.6 The calibrated pressure gauges of suitable range shall be supplied by the contractor for testing.

14.7 The pressure gauges shall be calibrated from time-to-time as desired by Engineer In- charge but positively once in every six months.

14.8 Valves supplied by HNGPL, shall not be used for testing purpose

14.9 The details of testing shall be properly recorded in the measurement cards

15.0 INSPECTION

Any defect noticed during the various stages of inspection shall be rectified b y t he contractor to the entire satisfaction of Engineer-in-Charge before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work, contractor s hall be responsible for making good any defects found during final inspection/ guarantee period/ defect liability period as defined in general condition of contract.

16.0 PURGING & COMMISSIONING

Payment for the tapping of live mains and GI piping prior to the actual purge is included in normal laying & testing. The connection may involve the fitting of a temporary bypass, disconnection etc.
Purging shall be carried in accordance with the principles defined in the American Gas Association Publication "Purging Principles and Practice".

In addition the contractor shall submit and have approved Purging Plan before commencing any purging work. The plan shall include, but not be limited to the provision of the following materials and equipment: personal safety equipment, fire extinguisher, Purging adapter, Purge stack with flame t rap and gas sampling point, Gas sampling equipment (may be gas leak detector), squash-off tool, Polyethylene connecting pipe work etc.

The plan shall also include the purging process along with detail on the sequence of events. The process is to also specially / mention the need to lay a wet cloth over the GI pipe an d in contact with the ground, to disperse static electricity during the purging work.

A purging stack with flame trap shall be used when purging services. Care shall be taken t o ensure that the purge outlet is so located that vent gas cannot drift i nto buildings.

The purging work should be performed as follows,

- Ensure the method of purging is such that no pockets of air are left in any part of the customer's piping.

- Ensure that all appliance connections are gas tight, all appliance gas valves are turned off and there are no open ends.

- Where possible, select an appliance with an open burner at which to commence the purge i.e., a hotplate burner.

- Ensure the area is well ventilated, and free from ignition sources.

- Ensure b ranches that do not have an appliance connected are fitted with a plug or cap.

- Turn on one burner control valve until the presence of gas is detected. A change in the audible tone and smell is a good indication that gas is at the burner. L et the g as flow for a few seconds longer, then turn off and allow sufficient time for any accumulated gas to disperse.

- Turn o n o ne gas control valve again and keep a continuous flame at the burner until the gas is alight and the flame is stable.

- Continue to purge until gas is available at other appliances.

17.0 **INSTALLATION OF METERS**

The work in this section includes :

17.1 Installation of domestic and non-domestic / small commercial meters with associated inlet and outlet connections (GI/Brass fitting), on the wall with approved meter brackets and angles.

17.2 Supply of approved meter brackets and angle brackets, properly painted with one coat of Zinc primer and two coats of synthetic enamel paint of approved make. A sketch of the brackets is enclosed herewith. It is required that one sample of each type of bracket is got approved beforehand.

17.3 Firmly securing the meters on the wall with good quality supply of proper rowel plugs, s crews etc. In case the rowel plugs are not holding than wooden blocks or other fixing arrangements

like cement etc. to be used for proper grouting.

17.4 The same rates of respective SOR Item will apply irrespective of whether the meter is situated inside or outside the property. Where a bank of meters is constructed the rate shall be for each complete meter installed.

17.5 The above activities along with restoration of the area to original shall be carried out to the complete satisfaction of consumer and EIC.

17.6 The meter installation will be preferred in open/ventilated space so as to prevent Gas accumulation and easy dispensation of Gas to atmosphere in case of any smell/ leakage of Gas. The meter installation will not be provided in any fixed enclosures, cabinets (below or above the slab) or confined space in the customer premises.

17.7 The contractor shall ensure that GI installation and rubber hose shall not be exposed to direct heat of Gas burners. The installation should have minimum clearance of about 1 m from electric [point mains and switches. Minimum distance between appliance valve and Gas Burners shall be 0.3 meters. The isolation valve shall be installed after entering the customer premises /kitchen but before the meter installation.

18.0 PAINTING OF GI PIPES

The entire length of the pipeline along with fittings and clamps are to be painted after proper surface preparation and painting as follows.

- One coat of Primer application (Appropriate Zinc based primer)
- Two coats of synthetic enamel paint – canary yellow of minimum of 30 microns per coat of reputed make like Asian, Berger, Nerolac.

All painting materials including primers and thinners brought to site by contractor for application shall be procured directly from manufacturers/ dealers as per specifications and shall be accompanied by manufacturer's test certificates. Paint formulations without certificates are not acceptable.

Engineer-in-Charge at his discretion, may call for tests for paint formulations. Contractor s hall arrange to have such tests performed including batch wise test of wet paints for physical & chemical analysis. All costs there shall be borne by the contractor.

The painting work shall be subject to inspection and certification by Engineer-in- Charge at all times.

After installation of the entire piping system, final touching shall be done to the satisfaction of EIC.

19.0 BOX FOR REGULATOR

Boxes will be supplied and installed outside for regulators after due approval of the sample. The boxes will be installed as per requirement and as per instructions of HNGPL.

The box brackets are to tightly secured to the wall with good quality proper Rowel plugs, screws etc. Wooden blocks to be used in case rowel plugs, do not hold properly.

All the boxes shall be thoroughly cleaned, painted with approved colour code.

As the boxes are installed outside it is to be ensured that they are painted properly to avoid rusting / weathering.

A sketch of regulator box is enclosed herewith.

20.0 CONVERSION OF DOMESTIC APPLIANCES

The work in this section includes,

- The changing of nozzles and associated controls in accordance with manufactures instructions for both domestic and imported burners/ ovens/grills/hotplate.
- The changing of old appliance connection hoses and nozzles and re-greasing taps as necessary.
- The contractor has to supply all types of nozzles / jets required for all types of appliances including imported burners, Grills, Ovens.
- Cleaning and performing minor maintenance of appliances.
- Testing for gas escapes and the soundness and performance o f the appliance.
- Instructing the customer in the safe use of natural gas and for fixing of safety and conversion labels.
- Contractor must attend the complaints regarding appliances till the total area is handed over to HNGPL's operation and maintenance.
- All consumables (Nozzles, greases etc.) are in contractor's scope.
- Changing or repairing of any items damaged during conversion.

It may be noted that the rates will apply to all appliance found in both domestic and commercial p remises. The contractor will be required under the Rates to provide both Pin gauges and standard sized nozzles.

21.0 RESTORATION

Contractor has to restore the area where ever he has carried out drilling, clamping etc. to its original condition to the satisfaction of the consumer and to ensure no passage to the premises and seepage. If the work was carried out in Govt. Flats (PWD), contractor has to restore the area according to CPWD specifications. F or government flats the contractor has to obtain a clearance certificate form the concerned authorities maintaining the flats, after completion of the work.

Where slabs and brick work are to be reinstated, the level of the compacted sub- base is to be adjusted according to the slab / block thickness. The slabs or brick work should be laid on moist bedding material, which should be graded sand, mortar or mortar mix. The slabs or brick work should be tapped into position.

The restored slabs or brick work should match the surrounding surface levels. Joint widths should match the existing conditions, and be filled with a dry or wet mix of mortar.

Wherever any items of the consumer is damaged / broken during working, the same will be made good or replaced to the total satisfaction of the consumer.

The contractor will be responsible for the maintenance of all restoration carried out, for the duration of the contract guarantee period.

The contractor is to ensure the restoration work is properly supervised, and that the material used is suitable for the purpose and proper. Where the required standards are not achieved the contractor will be required to replace the defective reinstatement work.

Note that Payment for GI /Copper piping will only be authorized on satisfactory restoration, and where the sites has been cleared of all surplus materials etc.,

22.0 SUBMISSION OF FINAL RECORDS

Contractor shall submit the following documents in three sets each:

a) Total list of houses & commercial establishments in the area allotted to him giving details of connections provided & reasons where connection could not be given / completed.
b) The details recorded in measurement cards of every domestic house.
c) Details of houses where extra piping done along with materials used.
d) Total material consumption report.
e) Material reconciliation with respect to the materials issued.
f) Test reports & test certificates of gauges etc.
g) Any other documents / records required.

TECHNICAL SPECIFICATION

FOR HDPE

PIPES

Contents

1.0 INTENT OF SPECIFICATION

The intent of this specification is to establish minimum requirements to manufacture and supply of HDPE Pipes used for casing purpose of carrier pipe, supplying natural gas.

2.0 SCOPE OF WORK

2.1 The scope of the tendered will include manufacture/ supply, inspection/ testing/ marking/ packaging/ handling and despatch of HDPE Pipes of ratings and grades as indicated in the Material Requisition & Schedule of Rates, as per IS:4984 (Specification for HDPE Pipes for water supply).

2.2 All codes and standards for manufacture, testing, inspection etc. shall be of latest edition.

2.3 Purchaser reserves the right to delete or order additional quantities during execution of order, based on unit rates and other terms & conditions in the original order.

3.0 INSTRUCTION OF TENDERER

3.1 Length of the Pipes and their supply will be as per following :-

- DN 50 – In each coils of 100 mtrs. Length
- DN 75 – Each pipe of 12 mtrs. length minimum
- DN 90 – Each pipe of 12 mtrs. length minimum
- DN 110 – Each pipe of 12 mtrs. length minimum
- DN 250 – Each pipe of 12 mtrs. length minimum
- DN 315 – Each pipe of 12 mtrs. length minimum

3.2 Protection

i) The ends shall be protected by proper end caps to prevent from shocks and ingress of the foreign body.

ii) Coils shall be covered by black PVC/ PE Film to prevent exposure to direct sun light.

3.3 The successful bidder shall submit following for approval of Purchaser/ Consultant after placement of order

a) The Quality Assurance Plan (QAP & Sampling Plan)

b) Material test report as per clause 5 of IS:4984.

c) Performance Requirements (clause 8 of IS:4984)

d) Type Test (clause 9.1 of IS:4984).

3.4 The bidder shall submit following documents at the time of bidding,

a) BIS Certification

b) List of current orders in hand for similar items with full details such as specification, name of purchaser etc.

c) Details of the largest supply executed

d) Name and address of proposed test laboratories alongwith their credentials/ past records for carrying out all required tests.

TECHNICAL SPECIFICATION
FOR
MEDIUM DENSITY
POLYETHYLENE FITTINGS
AND
ELECTRO-FUSION

FOR

NATURAL GAS DISTRIBUTION

CONTENTS

1.0 SCOPE AND FIELD OF APPLICATION

This specification elaborates the requirements for Electrofusion fittings in the nominal size range 16 to 180 mm made from PE compound used with PE pipes for supply of natural gas and to be used at operating temperature not more than 40°C.

The material grades to be used are PE 100. The fittings shall be yellow or black in colour.

Electro Fusion Fitting Jointing

1.1 For Electro Fusion fitting jointing an electrical resistance element is incorporated in the socket of fitting which when connected to an appropriate power supply, melts and fuses the materials of the pipe and fitting together.

1.2 The effectiveness of this technique depends on attention to the preparation of the jointing surfaces , in particular the removal of the oxidized surface of the pipe over the socket depth and ensuring the jointing surface are clean. If ovality causes gap between concentrically located pipe and the fitting to exceed 1% of the pipe OD after re-rounding to ensure correct welding . If the gap still exceeds 1% of the pipe OD after re-rounding then a check should be made of the pipe OD dimensions to determine if it meets specification.

1.3 The maximum gap between eccentrically located pipe and fitting i.e. pipe touching fitting at one point must not exceed 2% of the pipe OD.

1.4 Sometimes coiled pipes may be too oval to fit into couplers, or the end of the pipe may make the alignment of the ends impossible. In such circumstances the use of a mechanical pipe straightener or rounding tool is necessary.

2. EQUIPMENT

2.1 The control box input supply is to be from a nominal 240V generator, which is normally of approximately 5kVA capacity. The Nominal output of the generator is to be 240V + 15%, -10% between no load and full load .

Control box are to include safety devices to prevent excessive voltages being present at the control box output. The safety devices shall operate in less than 0.5 s
Note that extension leads are not to be used on the control box outlet connections.
Warning : Control boxes are not intrinsically safe and must therefore not be taken to trench.

A mechanical pipe surface preparation tool is to be used before fusion is attempted. The tool is capable of removing the oxidized surface of the pipe in excess of the insertion depth. The tool is to remove a layer of surface material 0.2-0.4 mm thick form outer surface of the pipe preferably in a continuous strip of swarf over that length and round of the pipe.
Pipe clamps for restraining, aligning and re-rounding the pipes in the fusion process are to be used.

Pipe cutters with saw and saw guide

Protection against adverse weather conditions.

2.2 Electro Fusion Jointing Method / Procedure

Preparation

- Ensure there is sufficient space permit access to the jointing area . In a trench a minimum clearance of 150 mm is required.
- Check that the pipe ends to be jointed are cut square to the axis of the pipe and any burrs removed.
- Wipe pipe ends clean lint free material to remove traces of dirt or mud
- Mark the area over which the oxidized pipe surface is to be removed I.e. by placing the socket of the bagged fitting along side the pipe end. Trace a line round the circumference at the appropriate distance from the end of the pipe using a felt tip pen or similar.

Note that the fitting should not to be removed from the packaging at this stage.

- Connect the electro fusion control box input leads to the generator

- Check that the reset stop button, if fitted on the control box is in the correct mode.

- Check that reset stop button if fitted on the control box is in the correct mode
- Using the pipe end preparation tool, remove the entire surface of the pipe uniformly, preferably in continuous swarf over the area identified. i.e. in excess of insertion depth.

- A mechanical scraper could be used however there is a considerable risk that the end preparation will not be adequate with the use of such a tool.

Note that the prepared pipe surface should not be touched by hand.

- Remove the fitting from its packing and clean the scrapped area of the pipe surface and the bore of the fitting with a disposable wipe impregnated with Iso-propanol / Acetone. Ensure the prepared surfaces are completely dry before proceeding

Note that while Iso-propanol is a suitable cleaner , its use is subject to local health and safety regulation.

Check that the pipe clamps are of the correct size for the pipes to be jointed .
Insert the pipe ends into the fitting so that they are in contact with centre stop
Using the pipe clamps, secure the pipes so that they cannot move during the fusion cycle. Check that the pipes ends and the fitting are correctly aligned.
Connect the control box and check that they have been fully inserted.
If required by the control box enter the fusion jointing time into the control box timer. The jointing time is indicated on the fitting. Check the correct time as shown on the control box display.

Note 1: Automatic control box are available which obviate the need to enter the fusion time
Note 2: Gloves and goggles should be worn during the fusion process

Note 3: If the fusion cycle terminates before completion of the countdown , check for faults as indicated by the control box warning lights and check that there is adequate fuel in the generator. DO NOT attempt a second fusion cycle within one hour / cooling of joint at Ambient temperature of the first attempt.

2.3 **Records**: Records of appropriate servicing and calibration shall be kept.

2.4 **Training**: It is necessary that operators , inspection and supervisory personnel acquire the skills of Electro-fusion fitting .The necessary training should be carried out by qualified instructor with the objective of enabling participants to

- Understand the principles of electro-fusion fitting jointing
- Identify pipe and appropriate fitting markings
- Carry out pre jointing machine and equipment checks
- Make satisfactory Electro-fusion joints from pipes and fittings of different sizes
- Inspect for and identify joints of acceptable

Note that some form of assessment and certification should be associated with the training . The certificate should detail the pipe and fitting size range and the equipment used. A register of successful participants should be kept.

2.5 Electro-Fusion Saddle Jointing

For Electro Fusion fitting jointing an electrical resistance element is incorporated in the socket of fitting which when connected to an appropriate power supply, melts and fuses the materials of the pipe and fitting together.

The effectiveness of this technique depends on attention to the preparation of the jointing surfaces , in particular the removal of the oxidized surface of the pipe over the socket depth and ensuring the jointing surface are clean.

Method of holding the tapping tee saddle during the fusion cycle are used namely top loading and under clamping space around the pipe . In a trench a minimum clearance of 150 mm is required.

2.6 Electro-Fusion Saddle Jointing Method / Procedure.

Preparation

Expose the pipe onto which the aping tee is to be assembled , ensuring there is

sufficient clear space around the pipe . In a trench a minimum clearance of 150mm is required.

Clean the pipe over the general area on which the saddle is to be assembled using clean , disposable lint free material

Without removing the fitting from its packaging , place over the required position on the main . Mark the pipe surface all around and clear of the saddle base area using a felt tip pen or similar.

Remove the surface of the pipe to a depth of 0.2 to 0.4mm over the full area marked using a suitable tool , remove the swarf.

Connect the electro fusion control box input leads to the generator
Check that the reset stop button, if fitted on the control box is in the correct mode.

Check that reset stop button if fitted on the control box is in the correct mode.

Remove the fitting from its packing and clean the scrapped area of the pipe surface and the bore of the fitting with a disposable wipe impregnated with Iso-propanol / Acetone. Ensure the prepared surfaces are completely dry before proceeding

Note that while Iso-propanol is a suitable cleaner , its use is subject to local health and safety regulation.

Position the fitting base onto the prepared pipe surface , and bring the lower saddle into position then gradually and evenly tighten the nuts until the upper saddle makes firm contact with scrapped pipe.

Check that there is sufficient fuel for the generator to complete the joint .
Start the generator and check that it is functioning correctly

Switch on the control box if applicable

Connect the control box output leads to the fitting terminals and check that have they have been fully inserted.

If required by the control box enter the fusion jointing time into the control box timer. The jointing time is indicated on the fitting . Check the correct time as shown on the control box display.

Note 1 : Automatic control box are available which obviate the need to enter the fusion time
Note 2 : Gloves and goggles should be worn during the fusion process

Press the start button on the control box and check that the heating cycle is proceedings as indicated on the display.

On completion of the heating cycle , the melt indicators where incorporated should have risen . If there is no apparent move in the melt indicators a new saddle joint should be made. Cut the tee of the faulty joints from its base.

If a satisfactory joint has been made , the joint is to be left in the clamps for the cooling time specified on the fitting label or any the automatic control box

Note 3 : If the fusion cycle terminates before completion of the countdown , check for faults as indicated by the control box warning lights and check that there is adequate fuel in the

The connection of the service pipe to the fitting outlet should be carried out in accordance with the procedure of the appropriate section of this item

Do Not attempt to tap the main with the integral cutter for at least 10 minutes after the completion of cooling cycle .

Records
Records of appropriate and calibration of electro fusion machines and joint shall be kept.
Trainings

AS PER 2.4

Note that some form of assessment and certification should be associated with the training. The certificate should detail the pipe and fitting size range and the equipment used. A register of successful participants should be kept.

2.7 STOPPING THE GAS FLOW

In the operation of a distribution system there is a periodic need to stop the gas flow for either routine or emergency maintenance. The flow may be stopped through the use of installed fitting such as valves. Where installed fittings are not available or the use of such would cause significant supply disruption, then one of the following methods may be employed.

2.8 SQUEEZE - OFF

a. To control the gas flow a special tool may be used to squeeze the pipe walls together. Hydraulic jacks are used to supply the necessary force to compress the pipe walls for sizes 90 mm and above.

b. As will be seen the squeeze-off equipment comprises two bars to apply pressure to outside of the pipe. The bars are bars are brought together either manually or hydraulically, squeezing the pipe material together until a seal is formed where the upper and lower walls meet.

c. The hydraulic machines should have a spring return for the jack and locking to prevent accidental release of pressure during operation. All squeeze – off machines should be fitted with check plate or stops to avoid over compression of the pipe.

d. Where the pipe walls are compressed the polyethylene pipe will be severely deformed in the regions of maximum compression. The pipe will eventually regain its original shape after squeezing but there will be reduction in some pressure bearing properties.

e. A complete stop may not always be obtainable because of wrinkling of the inside of the pipe. If a complete stop is required than a second squeeze can be used, with an intermediate vent to remove the gas which passes the first squeeze from say the trench of three pipe diameters area. A second squeeze

– off procedure should be a minimum of three pipe diameters and right angles to the squeeze.

f. While not essential it would be good practice to fit a reinforcing stainless steel band / do not squeeze again adhesive tape around the pipe upon the completion of squeezing operation.

2.9 BENDING – BACK

Bending back of the pipe may be performed where the pipe has been served damaged and stopping they gas flow is imperative. Its application is of a temporary nature and will provide a relief until a permanent repair can be affected. The section of pipe, which has been bent back, will to be replaced because of the damage caused by the serve ness of the band back operation. The need of any bend back operation is most likely to occur as a consequence of damage caused to a PE service pipe.

While it is not the prime function of a saddle tee , controlling the flow in the service may be achieved by opening upon an installed saddle tee and winding down the internal tapping tool to shut off the flow to the service pipe.

3. SYMBOLS & DEFINITIONS

3.1 Symbols for Electro fusion Fittings

3.1.1 Symbols for Electro fusion Socket Fittings

The dimensions and main symbols used in this part of ISO 8085 are shown in figure 1, where

D1 is the mean inside diameter in the fusion zone comprising the mean inside diameter measured in a plane parallel to the plane of the mouth at a distance of L3 + 0.5 L2 from the plane at the mouth.

D2 is the minimum bore comprising the minimum diameter of the flow channel through the body of the fitting.

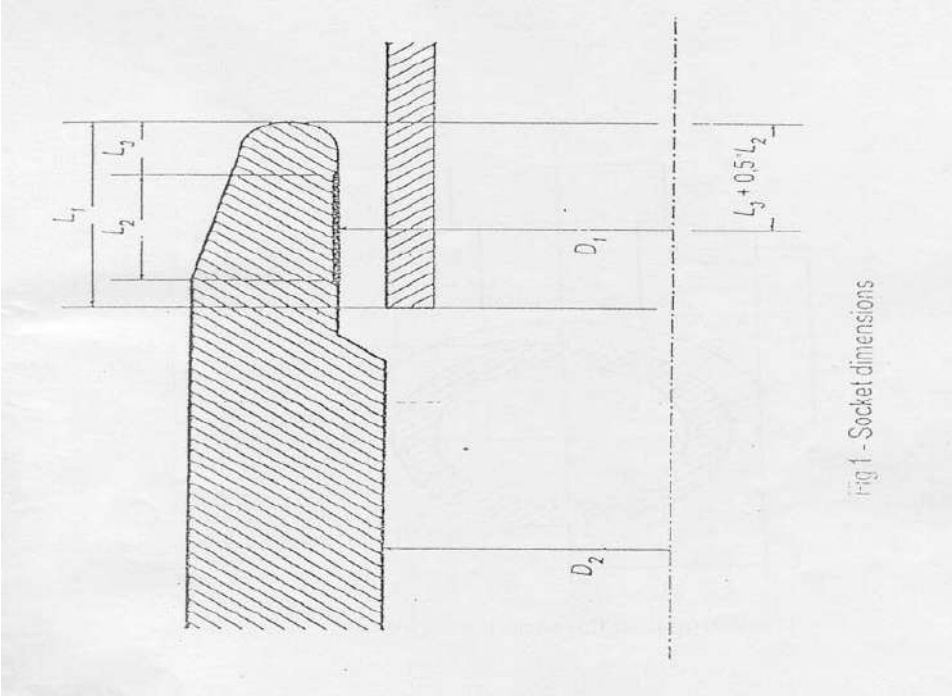
L1 is the depth of penetration of the pipe or of the male end of a spigot fittings.

L2 is the nominal length of the fusion zone corresponding to the heated length.

L3 is the nominal unheated entrance length of the fitting comprising the distance between the mouth of the fittings and the near end of the fusion zone.

3.1.2. Symbols for Electro fusion Tapping Tees

The main symbols used for tapping tees are shown in Figure 2, where. **h** is the height of the service pipe and comprising the distance between the axis of the main pipe and the axis of the service pipe.



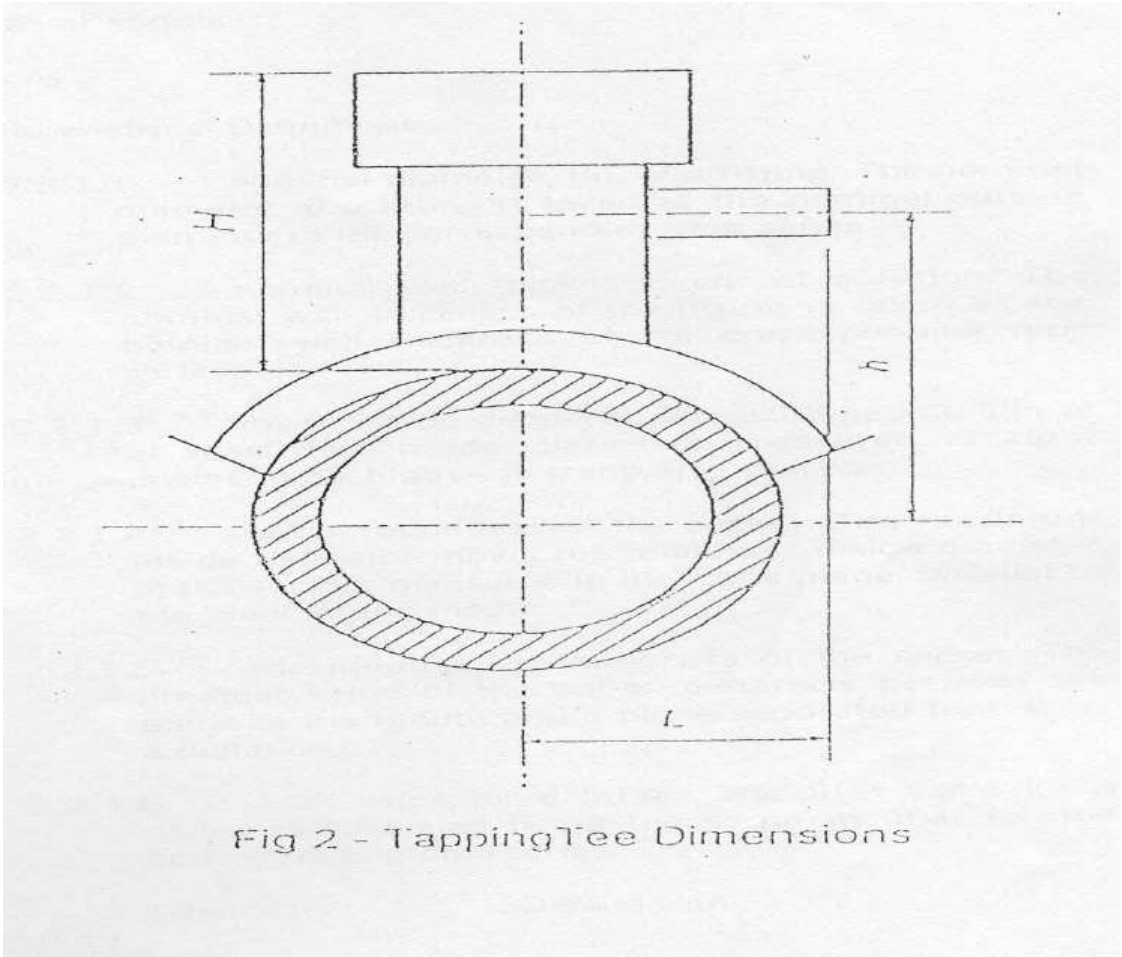


Fig 2 - TappingTee Dimensions

L is the width of the tapping tee and comprising the distance between the axis of the main pipe and the plane of the mouth of the service pipe.

H is the height of the saddle which comprises the distance from the top of the main to the top of the tapping tee or saddle.

3.2 Definitions

3.2.1. Geo metrical Definitions

3.2.1.1 Nominal diameter, dn, ofafitting:

The nominal diameter of a fitting is taken as the nominal outside diameter of the corresponding pipe series

3.2.1.2 Nominal wall thickness.en, ofafitting:

The nominal wall thickness of the fittings is taken as the nominal wall thickness of the corresponding pipe series.

3.2.1.3 Mean inside diameter:

The arithmetic mean of at least two inside diameter measured at right angles to each other in transverse planes.

3.2.1.4 Out of roundness of the Socket:

The maximum inside diameter minus the minimum inside diameter of the socket, measured in the same plane, parallel to the plane of the mouth.

3.2.1.5 Maximum out of roundness of the socket:

The greatest value of the out of roundness between the plane of the mouth and a plane separated from it by a distance L1.

3.2.1.6 SDR value for afitting:

The SDR value for a fittings is taken as being the same as that for the corresponding pipe series.

Where, SDR = dn/en

3.2.1.7 Wall thickness, Eofafitting:

The wall thickness of a fittings at any point of the body of the fitting which could be submitted to a stress inducted by the pressure of the gas in the piping system.

3.2.2 Material Definition

3.2.2.1 Virgin Material :

Materials in form such as granules or powder that has not been subjected to use or processing other than that required for its manufacturer and to which no re-processable or recyclable materials have been added.

3.2.2.2 Own Reprocessable Material :

Material prepared from rejected unused pipes, fittings or valves, including trimmings from the production of pipes, fittings or valve, that will be reprocessed in a manufacturer's plant after having been previously processed by the same manufacturer by a process such as injection moulding or extrusion.

3.2.2.3 Compound:

A homogenous mix of base polymer (PE) and additives, i.e. antioxidants, pigments, UV-stabilisers and others…, at a dosage level necessary for the processing and of components of this standards. The additives shall not have a negative influence on the performance with respect to feasibility. All additives shall be uniformly dispersed.

3.2.3 Definition related to Material Characteristics

3.2.3.1 Lower Confidence Limit (LCL):

A quantity with the unit in mega Pascals (MPs), which can be considered as a property of the material representing the 97.5% lower confidence limit of the predicted long-term hydrostatic strength at a temperature 20° C for 50 years in water.

3.2.3.2 Overall Service (Design) Coefficient(C):

An over all coefficient with a value larger than 1.0 which takes into consideration service conditions as well properties of the components of a piping system other than those represented in lcl. For gas applications, C can have any value equal to or greater than 2.0.

3.2.3.3 Minimum Required Strength (MRS):

The value of the lcl rounded down to the next lower value of the R 10 series when the lcl is less than 10 Mpa, or to the next lower value of the R 20 series when the lcl is greater than or equal to 10 Mpa.

Note: R10 and R 20 series are the Renard number series according the ISO 3 and ISO 497

3.2.3.4 Melt Mass Flow Rate (MFR):

A value relating to the viscosity of the molten material at a specified temperature and rate of shear.

3.2.4 Definitions Related to Service Conditions

3.2.4.1 Gaseous Fuel:

Any fuel which is in the gaseous state at a temperature of + 15° C and a pressure of 1 bar.

3.2.4.2 Maximum Operating Pressure (MOP)

The maximum effective pressure of the gas in the piping system, expressed in bar, which is allowed in continuos use. It takes into account the physical and the mechanic characteristics of the components of a piping system.

Note : It is given by the equation : $MOP = \frac{20 * MRS}{C*(SDR-1)}$

3.2.5 Definition on Design of Electrofusion Fittings:

3.2.5.1 Electrofusion Socket Fitting:

A polyethylene (PE) fittings which contains one or more integral heating elements, that are capable of transforming electrical energy into head to realise a fusion joint with a spigot – end or a pipe.

3.2.5.2 Electrofusion Saddle Fitting:

A polyethylene (PE) fitting (top loading or wrap around) which contains one or more integral heating elements, that are capable of transforming electrical energy into head to realise a fusion joint onto a pipe.

3.2.5.3 Tapping Tee:

An Electrofusion saddle fitting which contains an integral cutter, to cut through the pipe wall. The cutter remains in the body of the saddle after installation.

3.2.5.4 Branch Saddle:

An Electrofusion saddle fitting which requires an ancillary cutting tool for drilling a hole in the adjoining main pipe.

3.2.5.5 U Regulation :

Control of the energy supplied during the fusion process of an Electrofusion fitting, by means of the voltage parameter.

3.2.5.6 I Regulation:

Control of the energy supplied, during the fusion process of an electrofusion fitting by means of the current parameter.

4. DESIGNATION

4.1 Fittings shall be designed according to the grade of material, nominal diameter and Standard Dimension Ratio (SDR).

4.2 **Grade of Material:**

4.2.1. Fittings shall be classified according to the grade of material as given in following table:

Table–1

Material	M.R.S. Mpa	1 cl (20° C, 50 Yrs 97.5%) Mpa	Maximum Allowable Operating Pressure
PE 80	8.0	$8.00 \leq 1\ cl \leq 9.99$	5.5 Bar
PE 100	10.0	$10.00 \leq 1\ cl \leq 11.19$	7.0 Bar

4.3 **Nominal Diameter**

The Nominal Diameter for fittings covered in this standard are 16, 20, 25, 32, 40, 63, 75, 90, 110, 125, 140, 160 ,180 mm.

4.4 **Material**

4.4.1 Polyethylene Compound:

The Polyethylene compound used in the manufacture of fitting shall be a cadmium free compound. It shall be free from visible water, shall comply with the requirements as specified in Table – 2.

Table-2 : Characteristics of PE Compound

Characteristics	Units	Requirements	Test Parameters	Test Method
Conventional Density	Kg/m^3	$\geq$ 930 (base polymer)	23 °C	ISO 1183 - ISO 1872/1
Melt Mass-flow Rate	g/10 min	± 20% of value nominated by compound producer	190 °C condition 18	ISO 1133
Thermal Stability	Minutes	> 20	200 °C (2)	ISO TR 10837
Volatile Content at Extrusion	mg/kg	$\leq$ 350		ISO 4437 Annex. A
Water Content (3)	mg/kg	$\leq$ 300		ASTM D 4019
Carbon Black Content	% (m/m)	2,0 $\leq$.....$\leq$ 2,5		ISO 6964
Carbon Black Dispersion (4)	Grade	$\leq$ 3		ISO DIS 11420
Pigment Dispersion (5)	Grade	$\leq$ 3		ISO DIS 13949
Resistance to Gas Constituents	h	$\geq$ 20	80 °C 2 Mpa	ISO 4437 Annex. B
Resistance to rapid crack propagation (RCP) (6)	Mpa	The critical pressure in the FS test shall be greater than or equal to the value of the MOP of the system multiplied by 1:5	0°C	ISO DIS 13478
Full Scale (FS) test : d $\geq$ 250mm				
Or		The critical pressure in the S4 test shall be equal to or greater than the value of the MOP of the system divided by 2,4 (8)	0°C	ISO DIS 13477
S4 Test : in principle according to all diameters (7)	Mpa			
Resistance to slow crack growth en > 5mm	h	165	80 °C, 8,0 bar (f) (9) 80 °C, 9,2 bar (f) (10)	ISO DIS 13479

1) Non black compound shall conform to the weathering requirements to ISO 4437

2) Test may be carried out at 210°C providing that there is a clear correlation to the results at 200°C, in case of dispute the reference temperature shall be 200°C

3) Only applicable if the compound does not conform to the requirement for volatile content. In case of dispute the requirements for water content shall apply

4) Carbon black dispersion for black compounds only.

5) Pigment dispersion method for non-black compounds only.

6) Only applicable for fittings which incorporate extruded pipe elements.

7) Shall be performed on pipe with a wall thickness of $\geq$15 mm.

8) This factor 2.4 is still under study and may be subject to change. If the requirement is not met, then retesting by using the Full Scale (FS) test shall be performed

9) Test parameter for PE 80.

10) Test parameter for PE 100.

5.0 DESIGN

- Fittings shall be designed for system operation at the pressures given in Table – I
- Fittings shall be free from cracks, voids, blisters, distortion, dent or other defects.
- Fittings shall be capable of being fusion jointed to pipes using control boxes. The fittings shall exhibit the strengths and fusion compatibility with, pipes of respective sizes.
- Each fitting shall be bar coated and shall have a permanent fusion indicator.
- Heating coil design shall be such that it should not be damaged during assembly leading to short circuit of heating coil.

5.1 Electrofusion Socket Fittings

Electrofusion Socket Fittings shall incorporate a method of controlling pipe penetration within each socket. The inner cold zone of each socket shall not be less than (0.1 d + 5) mm for sizes upto 125 mm & 0.1 d for sizes greater than 125 mm.

5.2 Tapping Tees

Tapping tees shall be capable of installation by a force between 1 kN and 1.5 kN applied from above and on the centre line of the tapping tees stack. The tapping tees shall provide a means of cutting through the pressurised main pipe and allowing the gas flow into the outlet pipe.

5.3 Transition Pieces

To make connection between steel pipe and MDPE pipe specially fabricated transition pieces consisting of steel and MDPE pipes should conform to the requirements mentioned herein.

5.3.1 MDPE Pipe:

The MDPE pipe with one end plain should conform to the specification (IS:14885/ SDR 11)

5.3.2 Steel Pipe:

Black ERW steel pipe should conform to the specifications as laid in API STD 5L (latest revision)

5.3.2.1 Pipe End:

One end of the pipe should be bevelled for welding angle of bevel should be 30° + 5°.

5.3.3 Jointing between Steel and MDPE Pipes:

Steel and MDPE pipes should be so jointed in the factory so as to have a monolithic joint which is leak free and should be mechanically as strong or stronger than the PE Pipe.

5.4 **Transition Fittings (MDPE Pipes to threaded G.I. Fitting):**

Transition fitting for jointing of MDPE Pipes confirming to specification IS:14855/ SDR 11 to threaded G.I. tubing confirming to specification. The MDPE end of the transition fitting shall be jointed with MDPE Pipe with the electrofusion method.

6.0 ELECTRICAL CHARACTERISTICS

For each size and type of fitting, the manufacturer shall declare the nominal resistance of the heating element and specify the production tolerances.

The manufacturer shall demonstrate that satisfactory joint can be made using the extremes of these tolerances.

All fittings shall have mechanically shrouded malo electrical terminals. The fittings terminals connections shall be suitable for use with voltage less than or equal to 48 volts. Considerations should be given to the design of the shroud with respect to impact damage. When hollow terminal pins are used, the hole at the top of the pin shall be less than 1 mm diameter. The terminal pin material shall be corrosion resistant and the surface finish shall be N7.

Fittings incorporation two electrofusion sockets shall have both sockets fused in a single operation.

The heating elements shall be suitable designed to prevent short circuiting or local overheating/ under heating during the fusion operation. Protective coating applied to the heating element shall not have a detrimental effect on the joint.

The heating element wire shall not be disturbed during assembly.

7.0 DIMENSIONS

7.1 Measuring Temperature

Fittings shall not be measured within 24 hrs. of manufacturer to allow for normalization. The fittings shall be measured at an ambient temperature of 23 ± 2°C, after a conditioning period of 5 Hrs.

Methods of measurements shall provided the appropriate degree of accuracy, and the reference conditions specified in this clause 6 apply in case of disputes in dimensional measurement.

7.2 Dimensional Stability

7.2.1 Couplers (Including all forms of socket fittings)

All coupler dimensions shall conform to their specified value when the fitting has been stored for a period of 12 months at a temperature of 30 ± 2°C.

7.2.2 Tapping Tees and Branch Saddles:

All tapping tee and branch saddle dimensions shall conform to their specified agreed values when the fitting has been stored for a period of 12 month at a temperature of 30 ± 2°C.

TABLE 3 : SOCKET DIMENSIONS

Pipe Size d mm	Limits for average diameter d on each fitting measured over apparent fusion length L mm		Apparent fusion length L mm	Penetration depth L mm
	Maximum	Minimum	Minimum	Maximum
16	16.6	16.4	15	41
20	20.6	20.4	16	41
25	25.6	25.4	18	41
32	32.9	32.5	18	41
40	41.0	40.6	18	49
50	51.1	50.7	20	55
55	56.1	55.7	21	63
63	64.1	63.7	23	63
75	76.3	75.9	25	70
90	91.5	91.1	28	79
110	111.3	111.1	32	82
125	126.7	126.2	35	87
140	141.7	141.2	38	92
160	162.1	161.4	42	98
180	182.1	181.5	46	105

Notes:

1. The apparent fusion length, L, is the length of the integral heating elements, from the first regular section of the element to the end of the regular section, on one side of the fitting. This dimension to be measured from outside edge to outside edge of wire.

2. Any protrusions into the bore of the fitting (e.g. centralization ribs) shall not prevent easy assembly in the field.

3. The overall length of a straight coupler is equal to twice the quoted maximum penetration depth L.

TABLE 4: OVERALL LENGTH OF REDUCERS

Major Diameter mm	Maximum Length mm
25	90
32	90
63	120
90	180
125	215
180	280
200	245
225	260
250	280
280	300
315	320

TABLE 5: BRANCH SADDLE ASSEMBLY OUTLET LENGTH

Off-take Size mm	Shut-off method	Dimension from flange face to crown of main		Dimension from pipe end to crown of main	
		Class B fitting mm	Class B fitting mm	Class B fitting mm	Class B fitting mm
63	Valve	-	-	-	-
63	Squeeze	-	260*	-	-
90	Valve	-	-	400	-
90	Squeeze	400	180**	-	-
125	Valve	-	-	550	-
125	Squeeze	360	180***	-	-
180	Valve	-	-	750	-
180	Squeeze	360	180+	-	-
250	Valve	-	-	-	-
250	Squeeze	360	180++	-	-

* Flange size DN 50
** Flange size DN 100
*** Flange size DN 150
\+ Flange size DN 250
++ Flange size DN 250

8 PERFORMANCE REQUIREMENTS

8.1 Mechanical Characteristics

Fittings shall be tested using pipes, which conform to ISO 4437, Test samples shall be assembled in accordance with ISO DIS 11413, following the technical instruction of the manufacturer and using fusion equipment conforming ISO DIS 12176.2.

When tested in accordance with the test methods as specified in table – 6 using the indicated parameters, the fittings have mechanical characteristics confirming to the requirements given in Table 6.

TABLE 6: MECHANICAL PROPERTIES

Characteristics	Units	Requirements I	Test	Parameters	Test Method
Hydrostatic strength at 20°C	H	Failure time ≥ 100	End caps orientation conditioning time. Type of test circumferential (hoop) stress pipe PE 80, PE 100, Test temperature.	Type a) free 1 h 9 Mpa, 12.4 Mpa, 20°C	ISO DIS 9356
Hydrostatic strength at 80°C	H	Failure time ≥ 165	End caps orientation conditioning time. Type of test circumferential (hoop) stress pipe PE 80, PE 100, Test temperature.	Type a) free 12 h water-in-water 4.6 Mpa 5.5 Mpa 80°C	ISO DIS 9356
Hydrostatic strength at 80°C	H	Failure time ≥ 1000	End caps orientation conditioning time. Type of test circumferential (hoop) stress pipe PE 80, PE 100, Test temperature.	Type a) free 12 h water-in-water 4 Mpa, 5 Mpa, 80°C	ISO DIS 9356
Cohesive resistance	mm	Length of initiation of brittle fracture L/3	Test temperature choice of method	23°C	ISO 13954 (A) ISO 13955 (A) ISO 13956 (B)
Impact strength (B)		No failure No leakage	Test temperature Falling height Mass of the striker	20°C 23°C 5m 5kg	ISO DIS 13957

Characteristics	Units	Requirements I	Test	Parameters	Test Method
Pressure drop (B)	M^3/h	0.5 mbar : dn ≤ 63 0.1 mbar : dn^2 > 63	Air flow rate Test medium Test pressure	Indicated by the manufacturer Air source 25 mbar	PrEN 12117

(A) Electrofusion Socket Fittings
(B) Tapping Tees

For hydrostatic strength test at 80°C only brittle failure shall be taken into account. If ductile failure occurs before the required time, a lower stress shall be selected and the minimum test time will be obtained from the line through the stress/ time points given in Table – 7.

TABLE 7
Hydrostatic strength (80°C) – Stress/ Minimum Failure Time Correlation

PE-80		PE-100	
Stress Mpa	Minimum Failure Time h	Stress Mpa	Minimum Failures Time h
4.6	165	5.5	165
4.5	219	5.4	233
4.4	293	5.3	332
4.3	394	5.2	476
4.2	533	5.1	688
4.1	727	5.0	1000
4.0	100	-	-

8.2 Physical Characteristics

When tested in accordance with the test methods as specified in Table 8 using the indicated parameters, the fittings shall have physical characteristics conforming to the requirements given in Table 8.

TABLE 8 : Physical Characteristics of Fittings

Property	Units	Requirements	Test Parameters	Test Method
Thermal Stability	Minutes	> 20	200 °C (1)	ISO TR 10837

Property	Units	Requirements	Test Parameters	Test Method
Melt Mass-flow Rate (MFR)	g/10 min	$0.2 \leq$ MFR ≤ 1.4 and after processing maximum deviation of $\pm$ 20% of the value measured on the batch compound	Condition 18	ISO 4440.1

(1) Test may be carried out at 210 °C providing that there is a clear correlation to the results at 200 °C, in case of dispute the reference temperature shall be 200 °C.

8.3 **Technical File**

The manufacturer of the fittings shall make availability of a technical file (generally confidential) with all relevant data to prove the conformity of the fittings to this specification. It shall include all results of the type testing and shall conform to the specification relevant technical brochure (e.g. ISO 12093 for electro fusion fittings).

The technical description of the manufacturer shall include the following information:

1. Field of appliance (pipe and fitting temperature limits SDR's and out of roundness):
2. Assembly instructions:
3. Fusion instruction (fusion parameters with limits)
4. For saddles and tapping tee:

   - The means of attachment (tools and/ or under clamp).
   - The need to maintain the under clamp in position in order to ensure the performances of the assembly.

For electrofusion fitting, the format of the technical brochure shall conform to ISO DIS 12093.

In the event of modification of the fusion parameters, the manufacturer shall ensure that the joint conforms to this standard.

9. MARKING

Following information shall be embossed upto height of 0.15 mm onto the fitting and also in the form of bar code:

a) The manufacturer's identity
b) The size of the fitting in mm
c) Material and Designation
d) The date of manufacturer (code may be used)
e) Fusion time in seconds
f) Cooling time in minutes
g) Fusion parameters in BAR code
h) Lot Number.

The information may be printed on a label associated with the fitting.

10 . PACKING

The fittings shall be packaged in bulk or individually protected where necessary in order to prevent deterioration. Whenever possible, they shall be placed in airtight plastic bags in card board boxes or cartons.

The cartons and/or individual bags shall bear at least one label with the manufacturer's name, date of manufacturer, type and dimensions of the part, number of units in the box, and any special storage conditions and storage time limits.

Note:

All the fittings required shall be bar coded electrofusion fitting type. In case bidder is quoting for spigot fittings, the necessary electrofusion coupler for all non electrofusion ends shall be included in the complete package

The transition fittings shall also be bar coded electrofusion type for PE connection, NPT Female threading confirming to ANSI B 20.1 for G.I connection & butt welded for carbon steel end.

The carbon steel material of transition fittings shall be confirming to APL 5L x 42 and thickness shall be of 4.8 mm.

All the fittings shall be used for the network operating at 4.0 Bar(g) Pressure.

TECHNICAL SPECIFICATION

FOR POLYETHYLENE

PIPES

C O N T E N T S

1.0 **INTENT OF SPECIFICATION**

The intent of this specification is to establish minimum requirements to manufacture and supply of Polyethylene Pipes used for supply of natural gas.

2.0 **INSTRUCTION TO THE TENDERER**

2.1 The PE pipes are to be supplied as per IS:14885.

2.2 The length of the Pipes and their supply will be as per following :-

- 20mm OD – In each Coils of 100 mtrs. length
- 32mm OD – In each Coils of 100 mtrs. length
- 63mm OD – In each Coils of 100 mtrs. Length
- 90mm OD – In each Coils of 50 mtrs, Length
- 125mm OD – In each Coils of 50 mtrs. length
- 180mm OD – Each pipe of 12 mtrs. length minimum & above

2.3 **PROTECTION**

i) The ends shall be protected by proper end caps to prevent from shocks and ingress of the foreign body.

ii) Coils shall be covered by black PVC/ PE Film to prevent exposure to direct sun light.

2.4 The successful bidder shall submit following for approval of Purchaser/ Consultant after placement of order

a) The Quality Assurance Plan (QAP & Sampling Plan)

b) Certified test result of PE Compound (clause 5 of IS:14885)

c) Performance Requirements (clause 8 of IS:14885)

d) Type Test (clause 9.1.2 of IS:14885).

2.5 The bidder shall submit following documents at the time of bidding,

a) BIS/ ISO Certification if obtained already, or documentary evidence of applying for the same

b) List of current orders in hand for similar items with full details such as specification, name of purchaser etc.

c) Details of the largest supply executed

d) Name and address of proposed test laboratories alongwith their credentials/ past records for carrying out all required tests.

e) The names of standards/ codes being followed in manufacture and supply

f) Any accreditation certificates obtained or applied for.

2.6 **MARKING**

The pipe shall be marked in continues length in addition to the requirement of the applicable code.

TECHNICAL SPECIFICATION

FOR

GI PIPES

TECHNICAL SPECIFICATION FOR GI PIPES

Service	:	Natural Gas
Working Pressure	:	4 bar (g)
Hydrostatic Test Pressure	:	6 bar (g)
Working Temperature	:	0°C to 50°C
Material Description	:	IS:1239 (Part-I) Heavy Duty, Continuous Welded
Min. Tensile Strength	:	30 kgf/sq.mm
Min. Elongation	:	6%
Tolerance	:	+ Not limited, - 10%
Protective Coating	:	Galvanised uniformly to protect from corrosion as per IS:4736/ ASTM A53 or by Electro Galvanising
Ends of Pipes	:	Plain End
Inspection	:	Inspection shall be carried out as per applicable code & approved QAP and 100% Pressure Testing shall be carried out at factory.

1.0 **GENERAL NOTES**

1.1 All pipes and their dimensions, tolerance, chemical composition, physical properties, heat treatment, hydrotest and other testing and marking shall conform to the codes and standards.

1.2 Material test certificates (physical property chemical composition & heat treatment report) shall also be furnished for the pipes supplied.

1.3 All pipes shall be supplied with length between 5 to 7 mtr but average length of pipes supplied shall not be less than 6 meter. Overall length tolerance shall be (–) zero and (+) one length to complete the ordered quantity.

1.3 Pipes shall be galvanised uniformly to protect from corrosion as per IS:4736 / ASTM A53 or by electro galvanising.

2.0 **MARKING AND DESPATCH**

2.1 All pipes shall be marked in accordance with the IS 1239 codes, standards and specifications.

2.2 Paint or ink for marking shall not contain any harmful metal or metallic salts, such as zinc lead or copper which causes corrosive attack in heat.

2.3 Pipes shall be dry, clean and free from moisture, dirt and loose foreign materials of any kind.

2.4 Pipes shall be protected from rust, corrosion and mechanical damage during transportation, shipment and storage.

2.5 Both ends of the pipe shall be protected with the following material.

Plain End	:	Plastic Cap
Bevel End	:	Wood, Metal or Plastic Cover
Threaded End	:	Metal or Plastic Threaded Cap

Encl.-II

SPECIFICATION FOR PURE POLYSTER POWDER COATING OF GI PIPES

This Specification specifies the requirements for powder coating (Pure Polyester) of GI Pipes suitable to use for carrying Natural Gas directly exposed to sunlight.

Specification For Powder coating:

Powder Material	:	Pure Polyester.
Application	:	Electrostatic Spraying. (40 & 90 kV, Manual / Automatic)
Baking Schedule	:	180^0C to 200^0C for 10 minutes (Metal Temperature)
Coating Thickness	:	50 – 60 Microns (For GI Pipes)
		70 – 80 Microns (For ERW Pipes (Heavy Class))*

* ERW pipes are generally obtained from the manufacturers with a protective layer like a varnish applied on the pipe, to prevent corrosion. In order to obtain a proper application of pure polyester powder coating on the ERW pipes, the varnish has to be removed by use of a suitable method approved by /HNGPL.

TESTING:

Film Type	:	Glossy / Satin
Gloss 60^0 (ASTM D-523- 60)	:	86 & 95%
Cross Hatch Adhesion (ASTM D-5870)	:	GT = 0/100.
Cylindrical bending Test (ASTM D-522) 5 mm rod dia.	:	Passes.
Enrichsen cupping (minimum):		8 Passes.
Pencil Hardness (minimum)	:	2H.
Scratch Resistance (Kg. Min)	:	3
Impact Resistance	:	Direct – 150
Kg. Min (ASTM D-2794)	:	Indirect – 150
Salt Spray Resistance (ASTM B-117)	:	1000 hours (minimum).
Porosity (DIN -53161)	:	Passes.
Humidity Resistance (ASTM D-2247)	:	1000 hours (minimum).
Weathering Gloss retention after 1000 hours (Sun test with water immersion, Xenon 150 K.lux)	:	60 – 70%
Color	:	YELLOW.

Bidder should use powder of reputed manufacturers only (like Berger, Southfield, etc.) and the same should be approved by HNGPL prior to commencement of the powder coating activity

TECHNICAL SPECIFICATION

FOR

GI FITTINGS

STANDARD TECHNICAL SPECIFICATION FOR GI FITTINGS

TABLE OF CONTENTS

1.0 SCOPE

This specification covers the requirements for Malleable Cast Iron Fittings. Unless modified by this specification, requirements of IS 1879 – latest edition shall be valid.

2.0 MATERIAL

The material used for the manufacturing of GI fittings shall conform to IS 14329 – 1995 with latest amendments Grade BM 300. Relevant test certificates conforming to all the test agreements of IS 14329 shall be provided with fittings.

3.0 DIMENSIONS AND DIMENSIONAL TOLERANCES

1. Dimensions of various types of fittings shall be as specified in sections 2 to 10 of IS 1879 – 1987 with latest amendments, as applicable.

2. Wall thickness of fittings and tolerances on them shall be as given in Table 1.2 of IS 1879 – 1987 with latest amendments,

3. In case of reducing fittings, the dimensions at each outlet shall be those appropriate to the nominal size of the outlet.

4. All GI fittings shall be of reinforced type. Reinforcement shall be provided as per Table 1.2 of IS: 1879.

4.0 WEIGHT

Weights of various types of fittings shall be as specified in sections 2 to 10 of IS 1879 – 1987 with latest amendments, as applicable.

5.0 THREADS

1. Threads shall be NPT type and conforming to ASME B1.20.1.

2. Outlets of fittings shall be threaded to dimensions & the tolerances as specified in ASME B1.20.1.

3. All internal & external threads shall be tapered.

4. For checking conformity of threads gauging practice in accordance with ASME B1.20.1 shall be followed.

5. Chamfering: The outlet of fittings shall have chamfer.

6.0 FREEDOM FROM DEFECTS

On visual examination, the outside & inside surfaces of fittings shall be smooth & free from any defects such as cracks, injurious flaws, fine sand depth etc.

7.0 GALVANIZING

i. Fittings shall be galvanized to meet the requirement of IS: 4759 – 1996 with latest amendments.

ii. Zinc conforming to any grade specified in IS: 13229-1991 with latest amendments shall be used for the purpose of galvanizing.

iii. Galvanizing bath: The molten metal in the galvanizing bath shall contain not less than 98.5% by mass of zinc.

iv. Coating requirements: Mass of coating shall be 610 - 700 g/m2.

v. Freedom from defect: The zinc coating shall be uniform adhered, reasonably smooth & free from such imperfections as flux, ash bare patches, black spots, pimples, lumpiness runs, rust stains, bulky white deposits & blisters.

vi. **Sampling plan and testing for Galvanization**:

a. All materials of the same type in coating bath having uniform coating characteristics shall be grouped together to continue a lot. Each lot shall be tested separately for the various requirements of the specification. The number of units to be selected from each lot for this purpose shall be given in Table 2 of IS 4759 – latest edition.

b. The sample selected according to Column 1 & 2 of Table 2, IS: 4759 – latest edition shall be tested for visual requirements as per Clause 6.2 of IS:4759 – latest edition

c. The sample found conforming to above requirements shall then be tested for mass of zinc coating in accordance with Clause 9.2 of IS: 4759 – latest edition.

vii. Criteria for conformity: As per Clause 8.3 of IS: 4759-latest edition.

viii. Test procedure shall be as per Clause 9 of IS: 4759-latest edition.

8.0 PRESSURE TEST

Vendor shall carry out pneumatic pressure test as per Clause 12.1b of IS:1879 – 1987 with latest amendments on each & every fittings. Vendor has to submit the Internal Quality control certificate for the same.

9.0 COMPRESSION TEST

This test shall be conducted to judge the malleability of the pipe fittings & shall be carried out as per Clause 13 of IS:1879 – 1987 with latest amendments.

10.0 SAMPLING

Owner Representative of Third Party Inspection Agency appointed by Owner shall witness the tests as per Appendix-B of IS 1879 – 1987 with latest amendments. However, vendor to perform 100% inspection of visual, dimensional & pressure test. Vendor shall furnish Internal test certificates at the time of final inspection to the Owner.

11.0 MARKING

1. Each fitting shall be embossed with Client's logo, manufacturer's name or trademark and the size designation to the extent possible depending upon available space. Detailed marking arrangement shall be submitted by vendor for approval.

2. Each packing containing fittings shall carry the following embossed, stamped or written by indelible ink.

3. Manufacturer's name or trade mark.

4. Designation of fittings.

5. Lot number.

6. Each fitting conforming to this standard shall also be marked with BIS standard mark.

12.0 PACKAGING

Packing size is to be mentioned to ensure uniformity in delivery conditions of the material being procured. Packing size shall be approved by owner / owner's representative before packing the material. The vendor shall submit the packaging details during QAP and also complied with at the time of delivery.

13.0 INSPECTION / DOCUMENTS

1. Inspection shall be carried out as per Owner Technical Specification/ referred codes.

2. Owner Representative/ Consultant or Third Party Inspection Agency appointed by Owner shall carry out inspection during manufacturing / final inspection.
3. Vendor shall furnish all the material test certificates, proof of approval / licence from specified authority as per specified standard, if relevant, internal test / Inspection reports as per Technical Specification & specified code for 100% material, at the time of final inspection of each supply lot of material.

4. Even after third party inspection, Owner reserves the rights to select a sample of fittings randomly from each manufacturing batch & have these independently tested. Should the results of these tests fall outside the limits specified in Owner technical specification, then Owner reserves the rights to reject all production supplied from the batch.

STANDARD SPECIFICATION

FOR

BRASS FITTINGS

STANDARD TECHNICAL SPECIFICATION FOR BRASS FITTINGS

TABLE OF CONTENTS

1.0 SCOPE

This specification covers the requirements for Brass Capillary fittings (End feed fittings). Unless modified by this specification, requirement of EN 1254 Part 1 shall be valid.

2.0 MATERIAL

i) The material used for the manufacturer of Brass Capillary Fittings shall conform to IS 319 Grade-2 or CW 602N as per EN12164.

ii) Material used for the solder should conform to BSEN 29453 and should be lead free. Solder material shall be generally melting within the temperature range 180 ° C to 250 ° C.

iii) Threading on the Brass fittings shall be done as per NPT (ASME 1.20.1).

3.0 DIMENSIONS

I. Dimensions tolerances of various types of brass capillary fittings (End feed fittings). shall be as per EN 1254 Part 1 .The tolerances at the end shall be as per EN 1254 Part I in nominal diameter which are as follows (Ref. table 2)

Diameter	Tolerance on the mean diameter with respect to the nominal diameter		Resulting Diametrical difference	
D	Outside Dia of male end (mm)	Inside Dia of socket (mm)	Max (mm)	Min (mm)
12 mm	+.0.04 -.0.05	+ 0.15 +0.06	0.20 0.0	

The minimum wall thickness of a fitting shall be in accordance as given below (Ref table 5 of EN 1254 Part 1)

Nominal Dia mm, D	Minimum wall thickness (mm) Brass
12	1.1

II. Minimum length of engagement shall be as per table-3 of BS EN 1254-1.

III. Minimum bore area of fittings shall be corresponding to minimum bore as per table-4 of BS EN 1254-1.

IV. Tube abutment shall be shown in the drawing submitted for approval a s per guidelines of BS EN 1254- 1.

4.0 END CONNECTION

End connection of the fitting must be capable of end feeding to the NPT x 12 mm. Integral solder ring type fitting is not acceptable.

5.0 CHEMICAL PROPERTIES

Chemical composition & mechanical properties of Brass shall be as mentioned in IS:319 Grade-2/ CuZn36Pb2As or CW602N as per EN12164. The material shall be Dezincification-resistant.

6.0 CARBON IN BORE

The internal surface of brass capillary fittings for soldering or brazing shall not contain any detrimental film nor present a carbon level high enough to allow the formation of such a film during installation. The maximum total carbon level on internal surfaces shall not exceed 1.0 mg/dm2. The test shall be carried out as per clause no. 5.4 and Annexure- A of EN 1254 -1.

7.0 RESISTANCE TO DEZINCIFICATION

The fitting s shall be manufactured from alloys containing more than 10% Zinc. Accordingly resistance to dezincification test shall be carried out as per Cl. 5.5 of EN 1254 -1. The acceptance criteria shall be as per Clause 4.5.3.

8.0 STRESS CORROSION RESISTANCE TEST

A stress corrosion resistance is to be carried out on fittings as per method defined in ISO 6957 using test solution of pH 9.5 but without pickling.

9.0 FREEDOM FROM DEFECT

The fittings shall be free from internal fins, blow holes, skin defects etc. or other irregularities which might restrict the free flow of fluid, and shall be designed that resistance to the flow of fluid through the fittings is minimized.

10.0 HYDROSTATIC PRESSURE TEST

All fittings shall be leak tightness tested at 1.5x25 bars for a period of 15 minutes and no leakage is permitted. This test shall be performed on each size of the fittings.

11.0 PNEUMATIC PRESSURE TEST

All fittings shall be leak tested at 6 bars for a period of 10 seconds and no leakage is permitted.

12.0 MARKING

Each fittings shall be embossed with client's lo go, manufacturers name and trade mark EN 1 254 Part – I and designation of fittings. Each packing containing fittings shall carry the following stamped or written in indelible ink.

a) Manufacturer's name or trade mark. b)

Designation of fittings.

c) Month and year of manufacturing

13.0 PACKAGING

Packing size to be mentioned to the ensure uniformity in de livery conditions of the material being procured. Bidder shall submit the packaging details during QAP and also complied with at the time of delivery.

14.0 INSPECTION / DOCUMENTS

(i) Inspection shall be carried out as per design codes/standards, Technical Specification and Inspection Plan/ Vendor's detailed QAP duly approved by owner/owner's representative.

(ii) Client's representative or third party inspection agency appointed by client/ vendor shall carry out random inspection during manufacturing/ final inspection.

(iii) Vendor shall furnish all the material test certificates, proof of approval/ license from specified authority as per specified standard, if relevant, in ternal test/ inspection reports as per Technical Specification, at the time of final inspection of each supply lot of material.

(iv) Even after third party inspection, Client reserves the right to select a sample of tube randomly from each manufacturing batch and have these independently tested. If the results of these tests fall outside the limits specified in Technical specification, then client reserves the rights to reject all production supplied from the batch.

(v) Vendor s hall prepare and submit the detail drawings of required brass fitting and QAP for approval by Client/ consultant before starting production.

(vi) For any control test or examination required under the supervision of TPIA/owner/owner's representative, latter s hall be in formed in writing one (1) week in advance by vender about inspection date & place along with production schedule.

TECHNICAL SPECIFICATION

FOR

ISOLATION & APPLIANCE BALL VALVES

Contents

1.0 **INTENT OF SPECIFICATION**

The intent of this specification is to establish minimum requirements to manufacture and supply of Isolation & Appliance Ball Valves used for supply of natural gas.

2.0 **SCOPE OF WORK**

2.1 The scope of the tenderer will include manufacture/ supply, inspection/ testing/ marking/ packaging/ handling and despatch of Isolation & Appliance Ball Valves, as indicated in the Material Requisition & Schedule of Rates, meeting all the requirements as laid down in ASME B16.33 and should be approved by any certified agency for Gas application.

2.2 All codes and standards for manufacture, testing, inspection etc. shall be of latest edition.

3.0 **MATERIAL SPECIFICATION**

3.1 Metallic parts of Valves shall be manufactured as per material specified in respective datasheets.

3.2 Lubricants and Sealants. Lubricants and/or sealants shall be resistant to the action of fuel gases such as natural, manufactured, and LP gases. The valve manufacturer is responsible for the selection of lubricants and sealants, and for the determination of their suitability for the service conditions specified in the scope of this Standard.

3.3 Seating and Stem Seal Materials. The valve manufacturer is responsible for selection of seating and stem seal materials and for determination of their suitability for the service conditions specified in the scope of this Standard.

3.4 Air Aging Tests. Elastomer parts that are exposed to fuel gas shall be made from materials that, following 70-hr air aging in accordance with ASTM D573 at 212°F (100°C), meet elongation, tensile, and hardness property requirements as per ASME B16.33.

3.5 Elastomeric components' material shall qualify swell test and compression set tests as per requirement of ASME B16.33.

4.0 **DESIGN AND CONSTRUCTION**

4.1 DESIGN QUALIFIACTION: Manufacturer shall qualify the design of the valves as per clauses mentioned below. Relevant documents for establishment of design qualification shall be submitted along with bid.

4.1.1 Each basic valve design shall be qualified and demonstrated as suitable for the service by testing randomly selected production valves of each size, type, and pressure shell material.

4.1.2 Following tests shall be carried out for design qualification as per ASME B 16.33 a) Gas tightness

b) Temperature resistance

c) Structural tests viz. Strength test, Twist test, Bend Test, Tensile Test, Turning Torque test
d) Flow Capacity

4.2 Production Testing
Each Valve shall be tested to a test pressure of 1.5 times the pressure rating of the valve according to test method of gas tightness. No leakage is permitted during production testing.

4.3 Valve ends shall be as specified in respective datasheets.

5.0 Inspection and Testing

5.1 Each valve shall be tested for leakage as specified in cl. 4.2 above. Test certificate shall be provided for production testing.

5.2 Test certificates for physical and chemical properties of all the components of valves shall be provided as per agreed QA/QC requirements.

5.3 Test certificates of all the tests conducted for design qualification as per ASME B16.33 shall be submitted for review.

5.4 Type of inspection documents as per EN 10204 shall be as defined in respective QAP/ Datasheet.

6.0 Packing and Marking

6.1 Valves shall be marked as mentioned below.

6.1.1 The manufacturer's name or trademark and, where space permits, the designation"B16.33." The B16.33 mark is the manufacturer's acknowledgement that the valve was manufactured in conformance with ASME B16.33.

6.1.2 Pressure Rating.

6.1.3. Open and close indication. when a 1/4 turn valve is in the open or closed position (if flat head, longitudinal axis of the head shall be perpendicular to the longitudinal axis of the valve when valve is in the closed position)

6.2 Each Valve shall be packed in individual card board boxes so as to avoid wear and tear during transport.

6.3 For threaded end valves, end caps shall be provided.

Data Sheet - Isolation Ball Valve		
S.NO	**Description**	**Details**
1	**Process Data**	
1.01	Fluid	Natural Gas
2	**Operating Condition**	
2.01	Pressure	4 Bar (g)
2.02	Temprature (°C)	0-48
3	**Design Condition**	
3.01	Pressure	-
3.02	Temprature (°C)	-29 to 65
4	**Valve Data**	
4.01	Size	1/2" and 3/4"
4.02	Type	Isolation Ball Valve of Full Bore with NPT Female (Confirming to ANSI B1.20.1) as an inlet with operating Knob and locking arrangement with provision for sealing wire and lead seal (without Key).metallic operating Knob for full open/close at 90 ^{o} position.
4.03	Rating	125#
4.04	End Connections	NPT Female (Confirming to ANSI B1.20.1)
4.05	Body Material	Total Body Including the Nozzle shall be of forged Brass (ASTM B 283, Alloy UNSC37700) with Nickel/ Chrome plated.
4.06	Ball Material	Hard Chrome/ Nickel Plated, ASTM B 283
4.07	Stem	ASTM B283
4.08	Seat	Teflon
4.12	Extension Stem	Not required
4.13	Operator	Butterfly Arrangement
5	**Painiting**	
5.01	Surface Preparation	Not Required
5.02	primer	Not Required
5.03	finish	Not Required
5.04	insulation	Not Required
6	**Test**	
	Production Test	-
6.01	Production Test Pressure	1.5 times of design class pressure
6.02	Test Medium	As per ASME B16.33
6.05	Tes duration	15 seconds
Note	1. Lever type handle not acceptable.	
	2. Minimum Nickel/ Chrome Plated on the ball & body of Isolation ball valve shall be 25 micron	
	3. The above specified tests in TS/ Data sheet are minimum however, the other remaining/ specified test shall be done as per ASME B.16.33	

Data Sheet - Appliance Ball Valve		
S.NO	**Description**	**Details**
1	**Process Data**	
1.01	Fluid	Natural Gas
2	**Operating Condition**	
2.01	Pressure	4 Bar (g)
2.02	Temprature (°C)	0-48
3	**Design Condition**	
3.01	Pressure	-
3.02	Temprature (°C)	-29 to 65
4	**Valve Data**	
4.01	Size	1/2"
4.02	Type	Appliance Ball Valve of Full Bore with ½" NPT (Confirming to ANSI B1.20.1) Female as an inlet and the outlet shall be having Ni/ Cr plated brass or steel a nozzle (Serrated to suit ¼" rubber tubing/ hose connection) and the material is required for Domestic Natural Gas Service with a metallic operating Knob for full open/close at 90^{o} position.
4.03	Rating	125#
4.04	End Connections	Female as an inlet and the outlet shall be having Ni/ Cr plated brass or steel as nozzle
4.05	Body Material	Total Body Including the Nozzle shall be of forged Brass (ASTM B 283, Alloy UNSC37700) with Nickel/ Chrome plated.
4.06	Ball Material	Hard Chrome/ Nickel Plated, ASTM B 283
4.07	Stem	ASTM B283
4.08	Seat	Teflon
4.12	Extension Stem	Not required
4.13	Operator	Knob Arrangement.
5	**Painiting**	
5.01	Surface Preparation	Not Required
5.02	primer	Not Required
5.03	finish	Not Required
5.04	insulation	Not Required
6	**Test**	
	Production Test	-
6.01	Production Test Pressure	1.5 times of design class pressure
6.02	Test Medium	As per ASME B16.33
6.05	Test duration	15 seconds
Note	1. Minimum Nickel/ Chrome Plated on the ball & body of Isolation ball valve shall be 25 micron	
	2. The above specified tests in TS/ Data sheet are minimum however, the other remaining/ specified test shall be done as per ASME B.16.33	

TECHNICAL SPECIFICATION

FOR WARNING

MATS

SPECIFICATION FOR THE WARNING MATS

Purpose	:	For using as a warning sign for Under Ground Natural Gas Pipeline and HDPE Duct/ OFC
Width	:	150mm for HDPE Duct/ OFC 300mm for Underground Gas Pipeline
Thickness	:	0.25mm thk. for HDPE Duct/ OFC 1.00mm thk. for Underground Gas Pipeline
Material of the mat	:	The material shall be of high density Polyethylene
Colour of the mat	:	Red for HDPE Duct/ OFC Golden Yellow for Underground Gas Pipeline
Art Work	:	A sample piece of 30mm wide an d 200mm long of every batch shall be checked by immersing in 20% solution of Ammonium Sulphide for period of 2 weeks at a temperature of 15°C for colour intactness of the strip. Art work would be finalized after placement of order.
Mechanical Properties of HDPE		
Tensile Strength	:	Minimum 1.8 kg/cm^2
Elongation at Break	:	Minimum 125%
Bundle Length	:	1.0mm thick warning mat shall be supplied as 50 mtrs. bundle. 0.25mm thick warning mat shall be supplied as 100 mtrs. each bundle.
Test Certificates	:	Vendor has to submit the all test certificates to Purchaser
Inspection	:	The manufacturer has to submit the QAP and get the sample approved before commencement of production

HIGHLY INFLAMMABLE GAS PIPELINE BELOW HARIDWAR NATURAL GAS PRIVATE LIMITED

IN EMERGENCY PLEASE CONTACT PHONE NOS. ……..

TECHNICAL SPECIFICATION

FOR

FLEXIBLE HOSE PIPE
(Anaconda)

STANDARD TECHNICAL SPECIFICATION

FOR

CORRUGATED FLEXIBLE METAL HOSE

(ANACONDA)

CONTENTS

1.0 INTENT OF SPECIFICATION

The intent of this specification is to establish minimum requirements to manufacture and supply of corrugated flexible metal hose used for supply of domestic natural gas.

2.0 SCOPE OF WORKS

The scope of the tender will include manufacture/ supply, inspection, testing, marking, packaging handling and dispatch of corrugated flexible metal hose assembly, as indicated in the Material Requisition & Schedule of Rates, meeting all the requirements as laid down in manufacturing standard BS: 6501 Part 1(latest)/ ISO 10380.

All codes and standard for manufacture, testing, inspection etc. shall be of latest edition.

Owner/ Owner's Representative reserves the right to delete or order additional quantities during execution of order, based on unit rates and other terms & conditions in the original order.

3.0 TECHNICAL SPECIFICATIONS

Item	:	Corrugated Flexible metal Hose Assembly (Type-A flexibility) for Natural Gas Service
Applicable Code	:	BS: 6501 Part-I: (latest)/ ISO 10380 Specification for Corrugated Hose Assemblies
Nominal Size	:	DN 12
Total Length of Hose Assembly	:	350mm end to end
Movement Required	:	Static
Medium Flowing through Hose assembly	:	Natural gas (PNG)
Nominal Pressure/Design Pressure	:	0.25 bar (g) at 20°C
Temperature Range	:	0–65°C

Cyclic Life	:	30 Bends minimum when tested in accordance with Cl.14.2 Of BS: 6501 Part-I (latest)/ ISO 10380.
Static Bend Radius	:	25mm
Type & Material of End Fitting	:	¾" NPT SS316L Female Swivel Nut with Flat Seat Nipple with Rubber Gasket / `O' Ring (and second end shall be SS Male ¾" NPT and threads shall be conforming to ANSI B1.20.1 . Fittings shall be conforming to SS316L.

Note: TIG welding shall be carried out for welding SS fittings to corrugated hose.

Material of rubber gasket	:	Polymer NBR / nitrile with thickness 3-4 mm
Material of Hose	:	SS316L, 0.3 mm thickness
Braiding	:	Not required
Product to be conveyed	:	Natural Gas
Heat Treatment Requirement	:	Parent sheet or the finished hose must undergo annealing.The purpose of this is to relieve stress due to cold working.
Surface Coating	:	No zinc plating is required on SS hose, SS fittings & welded portion. At the welded portion suitable anti rusting provision shall be made. .

4.0 TESTING, CLEANING & PACKAGING

Tests	:	Pneumatic Test at a pressure of 1.5 kg/cm^2(g) & Type testing as per Cl.Nos. 14.1, 14.2, 14.5 & 14.6 of BS: 6501 Part-I (latest)/ ISO 10380
Cleaning & Packaging	:	As per Cl.No. 17.0 of BS:6501 Part-I (latest)/ ISO 10380
Test Certificate :		As per Cl.No. 18.0 of BS:6501 Part-I (latest)/ ISO 10380

5.0 MARKING

Each corrugated flexible metal hose and SS316 fittings shall be embossed with owner's logo, manufacturers name or trade mark BS: 6501 part I (latest)/ ISO 10380 and designation of fittings.

Each packing containing corrugated flexible metal hose shall carry the following stamped or written in indelible ink.

- Indication of the source of manufacture/Trade mark/Type
- Designation of fittings
- Maximum working pressure
- Nominal bore
- Month and year of manufacture

6.0 PACKAGING

Packing size to be mentioned to ensure uniformity in delivery conditions of the material being procured.

Bidder shall submit the packaging details like numbering of pieces per package, along with QAP and also complied with at the time of delivery. One package will consist of one corrugated flexible metal hose assembly (metal hose + end fitting on both sides) & two gaskets for each end.

7.0 INSPECTION / DOCUMENTS

a) Inspection shall be carried out as per design code/standard, Technical Specification and Inspection Plan/ Vendor's detailed QAP duly approved by Owner/Owner's representative.

b) Owner representative or third party inspection agency appointed by owner shall carry out random inspection during manufacturing/ final inspection.

c) Vendor shall furnish all the material test certificates, proof of approval/ license from specified authority as per specified standard, if relevant, internal test/ inspection reports as per Technical Specification and specified code for 100% material, at the time of final inspection of each supply lot of material.

d) Even after third party inspection, owner reserves the right to select a sample of flexible metal hose randomly from each manufacturing batch and have these independently tested. If the results of these tests fall outside the limits specified in Technical specification, then owner reserves the rights to reject all production supplied from the batch.

e) For any control test or examination required under the supervision of TPIA/owner/owner's representative, latter shall be informed in writing one (1) week in advance by vender about inspection date & place along with production schedule.

f) Vendor shall submit the dimensional drawing for Hose, end fittings and Rubber Gasket along with the technical bid.

SPECIFICATION FOR

QUALITY ASSURANCE SYSTEMS REQUIREMENTS

CONTENTS

1.0 INTRODUCTION

This specification establishes the Quality Assurance Requirements to be met by the sub-contractors (including turnkey Contractors) and their sub-vendors.

In case of any conflict between this specification and other provisions of the contract/ purchase order, the same shall be brought to the notice of HNGPL, at the stage of bidding and shall be resolved with HNGPL, prior to the placement of order.

2.0 DEFINITION

Bidder

For the purpose of this specification, the word "Bidder" means the person(s), firm, company or organisation who is under the process of being contracted by HNGPL/ Owner for delivery of some products (including service). The word is considered synonymous to supplier, contractor or vendor.

Correction

Action taken to eliminate the detected non-conformity.

Refers to repair, rework or adjustment and relates to the dis position of an existing non-conformity.

Corrective Action

Action taken to eliminate the ca uses of an existing non-conformity, defect or other undesirable situation in order to prevent recurrence.

Preventive Action

Action taken to eliminate the causes of a potential non-conformity, defect or other undesirable situation in order to prevent its recurrence.

Process

Set of inter-related resources and activities which transforminputs into outputs.

Special Process

Processes requiring pre-qualification of their process capability.

3.0 CONTRACTORS SCOPE OF WORK

3.1 Prior to award of contract

The bidder shall understand scope of work, drawings, specifications and standards etc., attached to the tender/ enquiry document, before he makes an offer.

The bidder shall submit milestone char t s hawing the time required for each milestone activity and linkages between different milestone activities alongwith overall time period required to complete the entire scope of work.

The bidder shall develop and submit manpower and resource deployment chart.

The bidder shall submit, alongwith the bid, a manual or equivalent document describing/ indicating/ addressing various control/ check points for the purpose of quality assurance and the responsibilities of various functions responsible for quality assurance.

3.2 After the award of contract

The bidder shall submit the schedule for submission of following documents in the kick-

off meeting or within two weeks of the placement of order, whichever is earlier.

- Detailed Bar Chart
- Quality pia n for all activities, required to be do ne by the bidder, to accomplish offered scope of work.
- Inspection and test plans, covering various control aspects.
- Job procedures as required by HNGPL/ Owner.
- Procurement schedule for items to be supplied by contractor covering inspection of the same.

Various documents submitted by the bi dder shall be finalised in cons ultation with HNGPL. Here it shall be presumed that ones a bidder has made an offer, he has understood the requirements given in this specification and agrees to comply with them in totality unless otherwise categorically so indicated during pre-award stage through agreed deviation/ exception request. All Quality Assurance Plan (QAP) documents shall be reviewed by concerned functional groups of HNGPL and the bidder shall be required to incorporate all comments within the framework of this specification at this stage of the contract. It is also obligatory on the part of the bidder that obtains approval on every Quality Assurance Plan (QAP) documents, before he starts using a particular document for deli very of contracted scope of work. Participation of HNGPL/ Owner in review/ approval of quality pian/ QAP documents does not absolve the contractor of his contractual obligations towards specified and intended use of the product (or service) provided/ to be provided by him under the contract.

3.3 **During job execution**

During job execution, the bidder shall fully comply with all quality document submitted and finalised/ agreed against the requirements of this specification. Approval of MECO N on all these documents shall be sought before start of work.

Bidder sha ll produce sufficient quality records on controlled/ agreed form such that requirements given in this specification are objectively/ demonstrable.

Bidder shall facilitate HNGPL/ Owner du ring quality/ technical audits at his works/ sites.

Bidder shall discharge all responsibilities towards enforcement of this specification on all his sub-contractors for any part of the scope which is sub- contracted.

4.0 **QUALITY ASSURANCE SYSTEM REQUIREMENTS**

4.1 The bidder shall nom inate an overall inch arge of the contract titled as "Project Manager" for the scope of work of agreed contract. The name of this person shall be duly intimat ed to HNGPL including all subsequent changes, if any. HNGPL shall correspond only with the project manage r of the bidder on all matters of the project. The project manager of the bidder shall be responsible for co-ordination and management of activities with bidder's organisation and all sub-vendors appointed by the bidder.

After award of work, the bidder may review augmentation of manpower and resources deployment chart (submitted earlier), detail it out , if so consent ed by HNGPL/ Owner and resubmit the same as "issued for effective implementation of the project".

4.2 The bidder shall plan the contract scope of work on quality pian format sue h that no major variation is expected during delivery of contract scope of work. These quality plan shall be made on enclosed format complete in all respect. The quality plan sha ll be assumed to be detailing bidder's understanding and planning for the contract/ offered scop e of work. The bidder shall pian the type of resources including various work methodology which he agrees to utilize for delivery of contract scope of work.

4.3 The bidder is required to review the contract at all appropriate stages to evaluate his capabilities with respect to timely and quality completion of all activities pertaining to contracted scope of work and shall report for constraints, if any to HNGPL/ Owner.

4.4 The design activities, if any, performed during delivery of contract scope of work shall be so controlled that the outputs is reliable enough. It is expected that during development of design, the bidder shall take recourse to detailed checking, inter departmental reviews and documented verification methods.

4.5 For all documents which the bidder is likely to utilise for delivery of contract scope of work, a system must exist which assures that latest/ required version(s) of the document(s) is available at all location/ point of use.

4.6 In case the bidder dec ides to sub-contract any part/ full of the contract scope of work (without prejudice to main Contractual condition), the bidder shall :

- Evaluate the technical and financial capabilities and past performance of the sub-contractor(s) and their products and/ or services before awarding them with the sub-contracted scope of work. Selection of a sub-contractor should meet HNGPL approval in documented form.

Requirement of this specification shall be enforced on sub-contracted agency also. The bidder shall choose sub-contractor based on their capability to meet requirements of this specification also.

Note: It may so happen that, in a given situation, a sub-contractor may not have a system meeting the requirements of this specification. In all such eventualities, bidder may lend his system to sub-contractor for the contract such that sub-contractor effectively meets the requirements of this specification. In all such cases HNGPL shall be duly informed.

4.7 Bidder sha II establish adequate methodology such that the materials supplied by the

Owner/ HNGPL shall be adequately preserved, handled and made use of for the purpose for which they are provided.

4.8 All output delivered against contract scope of work shall be suitably identified in such a manner that either through identification or some other means, sufficient traceability is maintained which permits effective resolution of any problem reported in the outputs.

4.9 Critical activities shall be identified and the bidder is required to have documented methodologies which he is going to utilize for carrying out such activities under the contract scope of work. Wherever it is difficult to fully inspect or verify the out put (special process), bidder shall pre -qualify, the performers and methodologies.

4.10 All inspections carried out by the bidder's surveillance/ inspection staff shall be conformity to quality plans and/ or inspection and test plans. All inspection results shall be duly documented on controlled/ agreed forms such that results can be co-related to specific product, that was inspected/ tested.

4.11 All inspection, measuring & test equipments (IMTEs) shall be duly calibrated as per National/ International standards/ codes and only calibrated and certified IMTEs shall be utilized for delivery of contract scope of work.

4.12 All out puts/ products delivered against contract scope of work shall be duly marked such that their inspection status is clearly evident during all stage s/ period of the contract.

All non-conformities (NCs) found by the contractor's inspection/ surveillance staff shall be duly recorded, including their disposal action. The deficiencies observed during stage of the product, shall be recorded and resolved suitably. Effective corrective and preventive action shall be implemented by the bidder for all repetitive NCs, including deficiencies.

4.14 All deficiencies noticed by HNGPL/ Owner representative(s) shall be recorded on a controlled form (Format No. 00002). Such deficiencies shall be analysed by the bidder and effective and appropriate correction, corrective and preventive actions shall be implemented. Bidder shall intimate HNGPL/ Owner of all such corrective and preventive action implemented by him.

4.15 Bidder s hall establish appropriate methodologies for safe and effective handling, storage, preservation of various materials/ inputs encountered during delivery of contract scope of work.

4.16 Bidder shall prepare sufficient records for various processes carried out by him for deli very of contract scope of work such that requirements of this specification are objectively demonstrable. In case HNGPL/ Owner finds that enough objective evidence/ recording is not available f or any particular process, bidder shall be oblige d to make additional records so as to provide sufficient objective evidence.

The decision of HNGPL/ Owner shall be final and binding on such issues.

4.17 The bidder shall arrange internal quality audits at quarterly intervals, to independently assess the conformance by various performers to the requirements of this specification. The findings of such assessment shall be duly recorded and a copy shall be sent to HNGPL/ Owner for review.

For all special processes, bidder shall deploy only qualified performers. Wherever HNGPL/ 0wner observes any deficiency, the bidder shall arrange the adequate training to the performer(s) before any further delivery of work

OBSERVATION OF QUALITY ASPECTS

FORMAT - 00002

<table>
<tr><td colspan="4">Job No. and Description No.
Issued to : M/s Date:</td></tr>
<tr><td colspan="4">Location of Work :
Item of Work :</td></tr>
<tr><td colspan="2" rowspan="2">Details of Observation(Deficiency)</td><td colspan="2">Recommended Course of Action</td></tr>
<tr><td colspan="2">Time Allowed for Correction :</td></tr>
<tr><td colspan="4">Issued by : _____
Name of Signature of , HNGPL Site</td></tr>
<tr><td colspan="4">Corrective Action taken report by Contractor/ Vendor :

Date: Name and Signature</td></tr>
<tr><td colspan="4">Distribution (before resolution) :</td></tr>
<tr><td>Project Manager
Owner</td><td>Chief Business Executive
HNGPL</td><td>HNGPL Inspection</td><td>Resident Construction
Manager, HNGPL Site</td></tr>
<tr><td colspan="4">Verification of Resolution by HNGPL :

Date: Name of Signature</td></tr>
<tr><td colspan="4">Distribution (before resolution) :</td></tr>
<tr><td>Project Manager
Owner</td><td>Chief Business Executive
HNGPL</td><td>HNGPL Inspection</td><td>Resident Construction
Manager, HNGPL Site</td></tr>
</table>

FORMAT – 00001

Bidder's Quality Plan		Project Name :				PO/ Contract Ref:				
General			Performing Functions			Inspection Functions			Audit Function	
Activity Description	Procedure Number	Code of Conformance	Performer	Checker	Reviewer/ Approver	Sampling Plan	Testing and Inspection Code	Type of (Approval) Surveillance	Audit Scope	Owner's/ HNGPL Review/ Audit Requirement

Note: 1) The bidder ensures that the filled up format conforms to minimum requirements on Quality Plan/ Quality Assurance, specified by HNGPL on drawings/ standards/ specifications/ write-up.
2) The bidder confirms that document is issued for information/ approval of Owner/ HNGPL for the project implementation

SPECIFICATION
FOR
HEALTH, SAFETY
AND
ENVIRONMENT (HSE)
MANAGEMENT

CONTENTS

1.0 **SCOPE**

This specification establishes the Healthy, Safety and Environment (HSE) management requirement to be compiled with by the Contractors during construction.

This specification is not intended to replace the necessary professional judgement needed to design & implement an effective HSE system for construction activities and the contractor is expected to exceed requirements given in this specification.

Requirement stipulated in this specification shall supplement the requirement of HSE management given in relevant Act (S)/ legislations. General Condition of Contract (GCC) Special Condition of Contract (SCC) and Job Specifications. Where different documents stipulate different requirements, the most stringent shall be adopted.

2.0 **REFERENCES**

This document should be read in conjunction with following:

- General Conditions of Contract (GCC)
- Special Conditions of Contract (SCC)
- Building and other construction workers (regulation of employment and condition of service) Act, 1996
- Job Specifications
- Relevant IS Codes (refer Annexure-A)
- Reporting Formats (refer Annexure-B)
- Statutory requirements

3.0 **REQUIREMENT OF HEALTH, SAFETY & ENVIRONMENT (HSE) MANAGEMENT SYSTEM TO BE COMPLETED BY BIDDERS.**

3.1 **Management Responsibility**

3.1.1 The Contract should have a document HSE policy to cover commitment of the organization to ensure health, safety and environment aspects in their line of operations

3.1.2 The HSE management system of the Contractor shall cover HSE requirement including but not limited to what specified under clause 1.0 & 2.0 mentioned above

3.1.3 Contractor shall be fully responsible for planning and implementing HSE requirement to the satisfaction of the company. Contractor as a minimum requirement shall designate/deploy the following to co-ordinate the above:

No. Of workers deployed		
Up to 250	-	Designate one safety supervisor who will guide the workers from time to time, as well as impart training basic guidelines at least weekly once.

Above 250 & upto 500	-	Deploy one qualified and experienced safety Engineer/ Officer who will guide the workers from time to time as well as impart basic guideline & training at least weekly once. He / She shall possess a recognized Degree in any branch of engineering or technology or architecture and had a post qualification construction experience of minimum two years or possess a recognized Diploma in any branch of engineering or technology or Graduate in Science stream and had a post qualification construction experience of minimum five years.
Above 500 (for every 500 or less)	-	One additional safety engineer/Officer whose function will be as mentioned above

Contractor shall indemnify and hold harmless OWNER/ HNGPL & their representative's from any and all liabilities arising out of non fulfillment of HSE requirements.

Above is the minimum requirement and the Contractor shall ensure physical presence of a safety personnel at each place where Hot work permit is required. No work shall be started at site until above safety personnel are physically present at site. The contractor shall submit a safety organogram clearly indicating the lines of responsibility and reporting system. He shall furnish Bio-Data/Resume/Curriculum Vitae of the safety personnel he intends to mobilize, at least 1 month before the intended mobilization, for HNGPL/Owner's approval.

3.1.4 The Contractor shall ensure that the Health, Safety and Environment (HSE) requirements are clearly understood & faithfully implemented at all levels, at each and every site/ work place.

3.1.5 The Contractor shall promote and develop consciousness for Health, Safety and Environment among all personnel working for the Contractor. Regular awareness programs and fabrication shop/work site meeting shall be arranged on HSE activities to cover hazards involved in various operations during construction.

3.1.6 Arrange suitable first aid measures such as First Aid Box, trained personnel to give First Aid, Stand by Ambulance or Vehicle and install fire protection measures such as: adequate number of steel buckets with sand and water and adequate fire extinguishers to the satisfaction of OWNER/ HNGPL. In case the number of workers exceeds 500, the Contractor shall position an ambulance /vehicle on full time basis very close to the worksite.

3.1.7 The Contractor shall evolve a comprehensive planned and documented system for implementation and monitoring of the HSE requirements. This shall submitted to OWNER & HNGPL for approval well in advance, prior to start of work. The monitoring for implementation shall be done by regular inspection and compliance to the observations thereof. The Contractor shall get similar HSE requirements implemented at his sub-contractor (s) work site/ Office. However, compliance of HSE requirement shall be the sole responsibility of the Contractor. Any review/ approval by OWNER/ HNGPL shall not absolve the Contractor of his responsibility/ liability in relation to all HSE requirements.

3.1.8 Non-Conformance on HSE by the Contractor (including his Sub-contractors) as brought out during review/ audit by HNGPL/ OWNER representative shall be resolved forthwith by Contractor. Compliance report shall be possibility submitted to HNGPL/ OWNER at the earliest.

3.1.9 The Contractor shall ensure participation of his Resident Engineer/Site-in-Charge in the Safety Committee/HSE Committee meetings arranged by OWNER/ HNGPL. The compliance of any observation shall be arranged urgently. Contractor shall assist OWNER/HNGPL to achieve the targets set by them on HSE during the project implementation.

The contractor shall ensure that his staff members & workers (permanent as well casual) shall not be in a state of intoxication during working hours and shall abide by any law relating to consumption & possession of intoxicating drinks or drugs in force. Awareness about local laws on this issue shall form part of the Induction Training.

The contractor shall ensure that all personnel working for him comply with No-smoking requirements of the owner as notified from time to time. Cigarettes, lighters, auto ignition tools or appliances shall not be allowed inside the plant complex. Smoking shall be permitted only inside smoking booths expressly designated & authorized by the Owner/HNGPL.

3.1.10 The Contractor shall adhere consistently to all provisions of HSE requirements. In case of non-compliance or continuous failure in implementation of any of HSE provisions; OWNER/ HNGPL may impose stoppage of work without any Cost & Time implication to Owner and/or impose a suitable penalty for non-compliance with a notice of suitable period, upto a cumulative limit of 1.0% (one percent) of Contract value with a ceiling of Rs. 10 lakhs.

0.2% (Zero decimal two percent) of the contract value for LSTK, EPC, EPCC or Package contracts with an overall ceiling of Rs. 1,00,00,000/- (Rupees one crore).

S. No.	Violation or HSE norms	Penalty Amount
1.	For not using personal protective equipment (Helmet, Shoes, Goggles, Gloves, Full body harness, Face shield, Boiler suit, etc.)	Rs. 250/- per day / item / person
2.	Working without Work Permit / Clearance	Rs.5,000/- per occasion

S. No.	Violation or HSE norms	Penalty Amount
3.	Unsafe electrical practices (not installing ELCB, using poor joints of cables, using naked wire without top plug into socket, laying wire / cables on the roads, electrical jobs by incompetent person, etc.)	Rs.3,000/- per item per day.
4.	Working at height without full body harness, using non-standard / rejected scaffolding and not arranging fall protection arrangement as required like Safety Nets.	Rs.1,000/ per case per day.
5.	Unsafe handling of compressed gas cylinders (No trolley, jubilee clips double gauge regulator, improper storage / handling).	Rs. 100/- per item per day
6.	Use of domestic LPG for cutting purpose.	Rs.1,000/- per occasion
7.	No fencing / barricading of excavated areas.	Rs.1,000/- per occasion
8.	Not providing shoring / strutting / proper slope and not keeping the excavated earth at least 1.5 M away from excavated area.	Rs.5,000/- per occasion
9.	Non display of caution boards, list of hospitals, emergency services available at work locations.	Rs.500/- per occasion
10.	Traffic rules violations like over speeding of vehicles, rash driving, wrong parking, not using seat belts, vehicles not fitted with reverse warning alarms.	Rs.1,000/- per occasion
11.	Absence of Contractor's top most executive at site in the safety meetings whenever called by HNGPL / Owner	Rs.1,000/- per occasion
12.	Failure to maintain safety records by Contractor Safety personnel.	Rs.1,000/- per month.
13.	Failure to conduct daily safety site inspection, HSE meeting and HSE audit at predefined frequencies.	Rs.1,000/- per occasion
14.	Failure to submit the monthly HSE report by 5th of subsequent month to Engineer-in-Charge.	Rs. 1,000/- per occasion and Rs. 100/- per day for further delay.
15.	Poor House Keeping	Rs.1,000/- per occasion
16.	Failure to report & follow up accident (including Near Miss) reporting system.	Rs. 10,000/- per occasion

S. No.	Violation or HSE norms	Penalty Amount
17.	Degradation of environment (not confining toxic spills oil / lubricants onto ground)	Rs.1,000/- per occasion
18.	Not medically examining the workers before allowing them to work at height, not providing ear muffs while allowing them to work in noise polluted areas, made them to work in air polluted areas without respiratory protective devices, etc.	Rs.1,000/- per occasion
19.	Violation of any other safety condition as per job HSE plan, work permit and HSE conditions of contract (using crowbar on cable trenches, improper welding booth, not keeping fire extinguisher ready at hot work site, unsafe rigging practices, non-availability of First-Aid box, etc.)	Rs.1,000/- per occasion
20.	Any violation not covered above.	To be decided by HNGPL / Owner

This penalty shall be in addition to all other penalties specified else where in the contract. The decision of imposing stoppage of work, its extent & monitory penalty shall rest with HNGPL/OWNER & binding on the Contractor.

3.1.11 All fatal accidents and other personnel accidents shall be investigated by a team of Contractor's senior personnel for root cause and recommend corrective and preventive actions. Findings shall documented and suitable actions taken to avoid recurrences shall be communicated to OWNER / HNGPL. OWNER / HNGPL shall have the liberty to independently investigate such occurrences and Contractor shall extend all necessary help and co-operation in this regard. HNGPL / Owner shall have to right to share the content of this report with the outside world.

3.2 **House Keeping**

3.2.1 Contractor shall ensure that a high degree of house keeping is maintained and shall ensure the followings:

a. All surplus earth and debris are removed/disposed off from the working site to identified location (s).

b. Unused/Surplus Cables Steel items and steel scrap lying scattered at different places within the working areas are removed to identified location (s).

c. All wooden scrap, empty wooden cable drums and other combustible packing materials shall be removed from work place to identified location(s).

d. Roads shall be kept clear and materials like pipes, steel, sand, boulders, concrete chips and bricks, etc. shall not be allowed in the roads to obstructs free movement of men & machineries.

e. Fabricated steel structurals, pipes & piping materials shall be stacked properly for erection.

f. Water logging on rods shall not be allowed.

g. No parking of trucks/ trolleys, cranes and trailors etc. shall be allowed on of roads, which may obstruct the traffic movements.

h. Utmost care shall be taken to ensure over all cleanliness and proper up keep of the working areas.

i. Trucks carrying sand, earth and pulverized materials etc. shall be covered while moving within the plant areas.

j. The contractor shall ensure that the atmosphere in plant area and on roads is free from particulate matter like dust, sand, etc. by keeping the top surface wet for ease in breathing.

k. At least two exits for any unit area shall be assured at all times.

3.3 **Healthy, Safety and Environment**

a) The Contractor shall provide safe means of access to any working place including provision of suitable and sufficient scaffolding at various stages during all operations of the work for the safety of his workmen, and OWNER/ HNGPL. Contractor shall ensure deployment of appropriate equipment and appliances for adequate safety and healthy of the workmen and protection of surrounding areas.

Contractor shall ensure identification of all Occupational Health, Safety & Environmental hazards in the type of work he is going to undertake and enlist mitigation measures. Contractor shall carry out Job Safety Analysis (JSA) specifically for high risk jobs like working at height & in confined space, deep excavations, radiography jobs, electrical installations, blasting operations, demolishing / dismantling activities, welding / gas cutting jobs and submit the findings to HNGPL / Owner. The necessary HSE measures devised shall be in place prior to start of an activity by the contractor.

b) The Contractor shall ensure that all their staff workers including their sub-Contractor (s) shall wear Safety Helmet and Safety shoes. Contractor shall also ensure use of safety belt, protective goggles, gloves etc. by the personnel as per jobs requirements. All these gadgets shall conform to relevant IS specification equivalent.

The Contractor shall ensure that all their staff, workers and visitors including their sub-contractor(s) have been issued (records to be kept) & wear appropriate PPEs like nape strap type safety helmets preferably with head & sweat band with ¾" cotton chin strap (made of industrial HDPE), safety shoes with steel toe cap and antiskid sole, full body harness (C∈ marked and conforming to EN361), protective goggles, gloves, ear muffs, respiratory protective devices, etc. All these gadgets shall conform to applicable IS Specifications / C∈ or other applicable international standards.

Owner may issue a comprehensive color scheme for helmets to be used by various agencies. The Contractor shall follow the scheme issued by the owner. All Safety / Fire personnel shall preferably wear red colour helmet so that workmen can approach them for guidance during emergencies.

For shot blasting, the usage of protective face shield and helmets, gauntlet and protective clothing is mandatory.

For offshore jobs/contracts, contractor shall provide PPEs (new) to HNGPL & Owner's personnel, at his (contractor's) cost. All personnel shall wear life jacket at all time.

An indicative list of HSE standards/codes is given under Appendix-A.

The contractor shall issue height permit for working at height after verifying and certifying the checkpoints as specified in the attached permit (Format No. HSE-6). He shall also undertake to ensure compliance to the conditions of the permit during the currency of the permit including adherence to personal protective equipments.

The permit shall be issued initially for one week or expected duration of an activity and extended further for the balance duration. This permit shall be applicable in areas where specific clearance from Owner's operation Deptt. / Safety Deptt. is not required. HNGPL field Engineers / Safety Officers / Area Coordinators may verify and counter sign this permit (as an evidence of verification) during the execution of the job.

In case work is undertaken without taking sufficient precautions as given in the permit, HNGPL Engineers may cancel the permit and stop the work till satisfactory compliance is arranged. Contractors are expected to maintain a register for issuance of permit and extensions thereof including preserving the used permits for verification during audits etc.

Contractor shall arrange (at his cost) and ensure use of Fall Arrester Systems by his workers. Fall arresters are to be used while climbing / descending tall structures. These arresters should lock automatically against the anchorage line, restricting free fall of the user. The device is to be provided with a double security opening system to ensure safe attachment or release of the user at

any point of rope. In order to avoid shock, the system should be capable of keeping the person in vertical position in case of a fall.

Contractor shall ensure that Full body harnesses conforming EN361 and having authorized CC marking is used by all personnel while working at height. The lanyards and life lines should have enough tensile strength to take the load of the worker in case of a fall. One end of the lanyard shall be firmly tied with the harnesses and the other end with life line. The harness should be capable of keeping the workman vertical in case of a fall, enabling him to rescue himself.

Contractor shall provide Roof Top Walk Ladders for carrying out activities on sloping roofs in order to reduce the chances of slippages and falls.

c) Contractor shall ensure that a proper Safety Net System shall be used at appropriate locations. The safety net shall be located not more than 30 feet (9.0 metres) below the working surface at site to arrest or to reduce the consequences of possible fall of persons working at different heights.

d) Contractor shall ensure that flash back arrestors conforming to BS:6158 or equivalent are installed on all gas cylinders as well as at the torch end of the gas hose, while in use. All cylinders shall be mounted on trolleys and provided with a closing key. The burner and the hose placed downstream of pressure reducer shall be equipped with Flash Back Arrester / Non Return Valve device. The hoses for acetylene and oxygen cylinders must be of different colours. Their connections to cylinders and burners shall be made with a safety collar. At end of work, the cylinders in use shall be closed and hoses depressurized. All welding machines shall have effective earthing. In order to help maintain good housekeeping, and to reduce fire hazard, live electrode bits shall be contained safely and shall not be thrown directly on the ground.

e) The Contractor shall assign to his workmen, tasks commensurate with their qualification, experience and state of health for driving of vehicles, handling and erections of materials and equipment's. All lifting equipments shall be tested certified for its capacity before use. Adequate and suitable lighting at every work place and approach there to shall be provided by the contractor before starting the actual work/ operation at night.

Contractor shall ensure installation of Safe Load Indicator (SLI) on all cranes (while in use) to minimize overloading risk. SLI shall have capability to continuously monitor and display the load on the hook, and automatically compare it with the rated crane capacity at the operating condition of the crane. The system shall also provide visual and audible warnings at set capacity levels to alert the operator in case of violations.

The contractor shall be responsible for safe operations of different equipments mobilized and used by him at the workplace like transport

vehicles, engines, cranes, mobile ladders, scaffoldings, work tools, etc.

f) Hazardous and/or toxic material such as solvent coating or thinners shall be stored in appropriate containers.

g) All hazardous materials shall be labeled with the name of the materials, the hazards associated with its use and necessary precautions to be taken.

The work place shall be checked prior to start of activities to identify the location, type and condition of any asbestos materials which could be disturbed during the work. In case asbestos material is detected, usage of appropriate PPEs by all personnel shall be ensured and the matter shall be reported immediately to HNGPL / Owner.

h) Contractor shall ensure that during the performance of the work all hazards to the health of personnel have been identified assessed and eliminated.

i) Chemical spills shall be contained & cleaned up immediately to prevent further contamination.

j) All personnel exposed to physical agents such as ionizing or non-ionizing radiation ultraviolet rays or similar other physical agents shall be provided with adequate shielding or protection commensurate with type of exposure involved. For ionizing radiation, requirements of Bhabha Atomic Research Centre (BARC)/ Atomic Energy Regulatory Board (AERB) shall be followed.

k) Where contract or exposure of hazardous materials could exceed limits or could otherwise have harmful affects, appropriate personal protective equipment's such as gloves, goggles, aprons, chemical resistant clothing and respirator shall be used.

l) Contractor shall ensure the following facilities at work sites:

I) A Crèche where 10 or more female workers are having children below the age of 6 years.

II) Reasonable Canteen facilities are made available at appropriate location depending upon site conditions.

m) Suitable facilities for toilet, drinking water, proper lighting shall be provided at site and labor camps, commensurate with applicable Laws/Legislation.

n) Contractor shall ensure storage and utilization methodology of material that are not detrimental to the environment. Wherever required Contractor shall ensure that only the environment friendly material are selected.

Emphasize on recycling of waste materials such as metals, plastics, glass, paper, oil & solvents. The waste that can not be minimized, reused or

recovered shall be stored and disposed of safely. In no way, toxic spills shall be allowed to percolate into the ground. The contractor shall not use the empty areas for dumping the wastes.

o) All person deployed at site shall be knowledgeable of and comply with the environmental laws, rules & regulation relating to the hazardous materials substance and wastes. Contractor shall not dump, release or otherwise discharge or dispose off any such materials without the authorization of OWNER/ HNGPL.

Suitable scaffoldings shall be provided to workmen for all works that cannot be safely done from the ground or from solid construction except such short period work that can be safely done using ladders. When a ladder is used, an extra workman shall be engaged for holding the ladder.

The contractor shall ensure that the scaffolds used during construction activities shall be strong enough to take the designed load. Owner / HNGPL reserves the right to ask the contractor to submit certification and or design calculations from his Engineering regarding load carrying capacity of the scaffoldings.

All scaffolds shall be inspected by a Scaffolding Inspector of the contractor. He shall paste a GREEN tag on each scaffold found safe and a RED tag on each scaffold found unsafe. Scaffolds with GREEN tag only shall be permitted to be used and RED ones shall immediately be removed from the site.

All electrical installations / connections shall be carried out as per the provisions of latest revision of following codes/standards, in addition to the requirements of Statutory Authorities and IE / applicable international rules & regulations:

- OISO SID 173 : Fire prevention & protection system for electrical installations
- SP 30 (BIS) : National Electric Code

All electrical installations shall be approved by the concerned statutory authorities.

- The contractor shall meet the following requirements:

i) Ensure that electrical systems and equipment including tools & tackles used during construction phase are properly selected, installed, used and maintained as per provisions of the latest revision of the Indian Electrical / applicable international regulations.

ii) Shall deploy qualified & licensed electricians for proper & safe installation and for regular inspection of construction power

distribution system / points including their earthing. A copy of the license shall be submitted to HNGPL / Owner for records. Availability of at least one competent licensed electrician shall be ensured at site round the clock to attend to the normal / emergency jobs.

iii) All switchboards / welding machines shall be kept in well-ventilated & covered shed. The shed shall be elevated to avoid water logging. No flammable materials shall be used for constructing the shed. Also flammable materials shall not be stored in and around electrical equipment / switchboard. Adequate clearances and operational space shall be provided around the equipment.

iv) Fire extinguishers and insulating mats shall be provided in all power distribution centers.

v) Temporary electrical equipment shall not be employed in hazardous area without obtaining safety permit.

vi) Proper house keeping shall be done around the electrical installations.

vii) All temporary installations shall be tested before energising, to ensure proper earthing, bonding, suitability of protection system, adequacy of feeders/cables etc.

viii) All welders shall use hand gloves irrespective of holder voltage.

ix) Multilingual (Hindi, English and local language) caution boards, shock treatment charts and instruction plate containing location of isolation point for incoming supply, name & telephone No. of contact person in emergency shall be provided in substations and near all distribution boards / local panels.

x) Operation of earth leakage device shall be checked regularly by temporarily connecting series test lamp (2 bulbs of equal rating connected in series) between phase and earth.

xi) Regular inspection of all installations (at least once in a month)

- The following features shall also be ensured for all electrical installations during construction phase by the contractor:

i) Each installation shall have a main switch with a protective device, installed in an enclosure adjacent to the metering point. The operating height of the main switch shall not exceed 1.5 M. The main switch shall be connected to the point of supply by means of armoured cable.

ii) The outgoing feeders shall be double or triple pole switches with fuses / MCBs. Loads in a three phase circuit shall be balanced as far as

possible and load on neutral should not exceed 20% of load in the phase.

iii) The installation shall be adequately protected against overload, short circuit and earth leakage by the use of suitable protective devices. Fuses wherever used shall be HRC type. Use of rewirable fuses shall be strictly prohibited. The earth leakage device shall have an operating current not exceeding 30 mA.

iv) All connections to the hand tools / welding receptacles shall be taken through proper switches, sockets and plugs.

v) All single phase sockets shall be minimum 3 pin type only. All unused sockets shall be provided with socket caps.

vi) Only 3 core (P+N+E) overall sheathed flexible cables with minimum conductor size of 1.5 mm^2 copper shall be used for all single phase hand tools.

vii) Only metallic distribution boxes with double earthing shall be used at site. No wooden boxes shall be used.

viii) All power cables shall be terminated with compression type cable glands. Tinned copper lugs shall be used for multistrand wires / cables.

ix) Cables shall be free from any insulation damage.

x) Minimum depth of cable trench shall be 750 mm for MV & control cables and 900 mm for HV cables. These cables shall be laid over a sand layer and covered with sand, brick & soil for ensuring mechanical protection. Cables shall not be laid in waterlogged area as far as practicable. Cable route markers shall be provided at every 25 M of buried trench route. When laid above ground, cables shall be properly cleated or supported on rigid poles of atleast 2 M high. Minimum head clearance of 6 meters shall be provided at road crossings.

xi) Under ground road crossings for cables shall be avoided to the extent feasible. In any case no under ground power cable shall be allowed to cross the roads without pipe sleeve.

xii) All cable joints shall be done with proper jointing kit. No taped / temporary joints shall be used.

xiii) An independent earthing facility should preferably be established within the temporary installation premises. All appliances and

equipment shall be adequately earthed. In case of armoured cables, the armour shall be bonded to the earthing system.

xiv) All cables and wire rope used for earth connections shall be terminated through tinned copper lugs.

xv) In case of local earthing, earth electrodes shall be buried near the supply point and earth continuity wire shall be connected to local earth plate for further distribution to various appliances. All insulated wires for earth connection shall have insulation of green colour.

xvi) Separate core shall be provided for neutral. Earth / Structures shall not be used as a neutral in any case.

xvii) ON/OFF position of all switches shall be clearly designated / painted for easy isolation in emergency.

The contractor shall identify all operations that can adversely affect the health of its workers and issue & implement mitigation measures.

For surface cleaning operations, sand blasting shall not be permitted even if not explicitly stated elsewhere in the contract.

To eliminate radiation hazard, Tungsten electrodes used for Gas Tungsten Arc Welding shall not contain Thorium.

Appropriate respiratory protective devices shall be used to protect workmen from inhalation of air borne contaminants like silica, asbestos, gases, fumes, etc.

Workmen shall be made aware of correct methods for lifting, carrying, pushing & pulling of heavy loads. Wherever possible, manual handling shall be replaced by mechanical lifting equipments.

For jobs like drilling / demolishing / dismantling where noise pollution exceeds the specified limit of 85 decibels, ear muffs shall be provided to the workers.

To avoid upper limb disorders and backaches, Display Screen Equipments' workplace stations shall be carefully designed & used with proper sitting postures. Power driven hand-held tools shall be maintained in good working condition to minimize their vibrating effects and personnel using these tools shall be taught how to operate them safely & how to maintain good circulation in hands.

The contractor shall arrange health check up for all the workers at the time of induction. Health check may have to be repeated if the nature of duty assigned to him is changed necessitating health check or doubt arises about his wellness. HNGPL / Owner reserve the right to ask the contractor to submit test reports.

Weather Protection

Contractor shall take appropriate measures to protect workers from severe storms, solar radiations, poisonous gases, dust, etc. by ensuring proper usage of PPEs like Sun glasses, Sun screen lotions, respirators, dust masks, etc. and rearranging / planning the construction activities to suit the weather conditions.

Communication

All persons deployed at the work site shall have access to effective means of communication so that any untoward incident can be reported immediately and assistance sought by them.

All health & safety information shall be communicated in a simple & clear language easily understood by the local workforce.

Unsuitable Land Conditions

Contractor shall take appropriate measures and necessary work permits / clearances if work is to be done in or around marshy areas, river crossings, mountains, monuments, etc.

Under Water Inspection

Contractor shall ensure that boats and other means used for transportation, surveying & investigation works shall be certified seaworthy by a recognized classification society. It shall be equipped with all life saving devices like life jackets, adequate fire protection arrangements and shall posses communication facilities like cellular phones, wireless, walkie-talkie. All divers used for seabed surveys, underwater inspections shall have required authorized license, suitable life saving kit. Number of hours of work by divers shall be limited as per regulations. HNGPL / Owner shall have the right to inspect the boat and scrutinize documents in this regard.

TOOL BOX MEETING (TBM)

Contractor shall conduct daily TBM with workers prior to start of work and shall maintain proper record of the meeting. A suggested format is given below. The TBM is to be conducted by the immediate supervisor of the workers.

TOOLBOX MEETING RECORDING SHEET

Date & Time		
Subject		
Presenter		
Hazards involved		
Precautions to be taken		
Worker's Name	Signature	Section
Remarks, if any		

The topics during TBM shall include

- Hazards related to work assigned on that day and precautions to be taken.
- Any forthcoming HSE hazards / events / instruction / orders, etc.

The above record can be kept in local language, which workers can read. These records shall be made available to HNGPL / Owner whenever demanded.

TRAINING

Contractor shall ensure that all his personnel possess appropriate training to carry out the assigned job safely. The training should be imparted in a language understood by them and should specifically be trained about

- Potential hazards to which they may be exposed at their workplace
- Measures available for prevention and elimination of these hazards

The topics during training shall cover, at the minimum;

- Education about hazards and precautions required
- Emergency and evacuation plan
- HSE requirements
- Fire fighting and First-Aid
- Use of PPEs
- Local laws on intoxicating drinks, drugs, smoking in force

Records of the training shall be kept and submitted to HNGPL / Owner whenever demanded.

For offshore and jetty jobs, contractor shall ensure that all personnel deployed have undergone a structured sea survival training including use of lifeboats, basket landing, use of radio communication etc. from an agency acceptable to Owner / HNGPL.

INSPECTION

The contractor shall carryout daily HSE inspection and record observations at a central location. These inspection records shall be freely accessible to Owner / HNGPL representatives. The contractor shall also assist Owner / HNGPL representatives during the HSE inspections conducted by them.

ADDITIONAL SAFETY REQUIREMENTS FOR WORKING INSIDE A RUNNING PLANT

As a minimum, the contractor shall ensure adherence to following safety requirements while working in or in the close vicinity of an operating plant :

a) Contractor shall obtain permits for Hot work, Cold work, Excavation and Confined Space from Owner in the prescribed format.

b) The contractor shall monitor, record and compile list of his workers entering the operational plant/unit each day and ensure & record their return after completing the job.

c) Contractor's workers and staff members shall use designated entrances and proceed by designated routes to work areas only assigned to them. The workers shall not be allowed to enter units' area, tanks area, pump rooms, etc. without work authorization permit.

d) Work activities shall be planned in such a way so as to minimize the disruption of other activities being carried out in an operational plant / unit and activities of other contractors.

e) The contractor shall submit a list of all chemicals / toxic substances that are intended to be used at site and shall take prior approval of the Owner.

f) Specific training on working in a hydrocarbon plant shall be imparted to the work force and mock drills shall be carried out for Rescue operations / First-Aid measures.

g) Proper barricading / cordoning of the operational units / plants shall be done before starting the construction activities. No unauthorized person shall be allowed to trespass. The height and overall design of the barricading structure shall be finalized in consultation with the Owner and shall be got approved from the Owner.

h) Care shall be taken to prevent hitting underground facilities such as electrical cables, hydrocarbon piping during execution of work.

i) Barricading with water curtain shall be arranged in specific/critical areas where hydrocarbon vapors are likely to be present such as near horton spheres or tanks. Positioning of fire tenders (from owner) shall also be ensured during execution of critical activities.

j) Emergency evacuation plan shall be worked out and all workmen shall be apprised about evacuation routes. Mock drill operations may also be conducted.

k) Flammable gas test shall be conducted prior to any hot work using appropriate measuring instruments. Sewers, drains, vents or any other gas escaping points shall be covered with flame retardant tarpaulin.

l) Respiratory devices shall be kept handy while working in confined zones where there is a danger of inhalation of poisonous gases. Constant monitoring of presence of Gas / Hydrocarbon shall be done.

m) Clearance shall be obtained from all parties before starting hot tapping, patchwork on live lines and work on corroded tank roof.

n) Positive isolation of line/equipment by blinding for welding/cutting/grinding shall be done. Closing of valve will not be considered sufficient for isolation.

o) Welding spatters shall be contained properly and in no case shall be allowed to fall on the ground containing oil. Similar care shall be taken during cutting operations.

p) The vehicles, cranes, engines, etc. shall be fitted with spark arresters on the exhaust pipe and got it approved from Safety Department of the Owner.

q) Plant air should not be used to clean any part of the body or clothing or use to blow off dirt on the floor.

r) Gas detectors should be installed in gas leakage prone areas as per requirement of Owner's plant operation personnel.

s) An experienced full time safety personnel shall be exclusively deployed to monitor safety aspects in running plants.

HSE PROMOTION

The contractor shall encourage his workforce to promote HSE efforts at workplace by way of organizing workshops / seminars / training programmes, celebrating HSE awareness weeks & National Safety Day, conducting quizzes & essay competitions, distributing pamphlets, posters & material on HSE, providing incentives for maintaining good HSE practices and granting bonus for completing the job without any lost time accident.

4.0 DETAILS OF HSE MANAGEMENT SYSTEM BY CONTRACTOR

4.1 On Award of Contract

The Contractor shall prior to start of work submit his Health. Safety and Environment Manual of procedure and HSE Plans for approval by OWNER/HNGPL. The Contractor shall participate in the pre-start meeting with OWNER/HNGPL to finalize HSE plans including the following.

- Job procedure to be followed by Contractor for activities covering Handling of equipment's, Scaffolding, Electric Installation, describing the risks involved, actions to be taken and methodology for monitoring each.

- Organizations structure alongwith responsibility and authority records/ reports etc. on HSE activities.

4.2 During job execution

4.2.1 Implement approved Health, Safety and Environment management procedure including but not limited to as brought our under para 3.0. Contractor shall also ensure to:

- Arrange workmen compensation insurance, registration under ESI Act, third party liability insurance etc. as applicable.

- Arrange all HSE permits before start of activities (as applicable) like her work, confined space, work at heights, storage of Chemicals/explosives materials and its use and implement all precautions mentioned therein

- Submit timely the completed check list on HSE activities, Monthly HSE report, accident report, investigation report, etc. as per OWNER/HNGPL requirements. Compliance of instructions on HSE shall be done by Contractor and informed urgently to OWNER/HNGPL.

- Ensure that resident Engineers/Site-In-Charge of the Contractor shall amend all the Safety Committee/HSE meeting arranged by OWNER/ HNGPL only in case of his absence from site, a seconds senior most person shall be nominated by him in advance and communicated to OWNER/HNGPL.

- Display at site office and work locations caution boards, list of hospitals for emergency services available.

- Provided posters, banners, for safe working to promote safety consciousness

- Carryout audits/inspection at sub Contractor work as per approved HSE documents & submit the reports for OWNER/HNGPL review.

- Assist in HSE audits by OWNER/ HNGPL and submit compliance report.

- Generate & submit HSE records/ reports as per HSE Plan.

- Appraise OWNER/HNGPL on HSE activities at site.

5.0 RECORDS

At the minimum, the contractor shall maintain/ submit HSE records in the following reporting formats:

1.	Monthly HSE Checklist cum compliance report	HSE-1
2.	Accident / Incident Report	HSE-2
3.	Supplementary Accident / Incident Investigation report	HSE-3
4.	Near Miss Incident Report	HSE-4
5.	Monthly HSE Report	HSE-5
6.	Permit for working at height	HSE-6
7.	Permit for working in confined space	HSE-7
8.	Permit for radiation work	HSE-8
9.	Permit for demolishing / dismantling	HSE-9

ANNEXURE-A

A. I.S. CODES ON HSE

SP:53	Safety code for the use, Care and protection of hand operated tools.
IS: 818	Code of practice for safety and health requirements in electric and gas welding and cutting operations
IS: 1179	Eye and Face precautions during welding, equipment etc.
IS: 1860	Safety requirements for use, care and protection of abrasive grinding wheels.
IS: 1989(Part-I & II)	Leather safety boots and shoes
IS: 2925	Industrial Safety Helmets
IS: 3016	Code of practice for fire safety precautions in welding and cutting operations.
IS: 3043	Code of practice for earthing.
IS: 3764	Code of safety for excavation work
IS: 3786	Methods for computation of frequency and severity rates for industrial injuries and classification of industrial accidents.
IS: 3996	Safety Code of scaffolds and ladders.
IS: 4082	Recommendation on stacking and storage of construction materials and components at site.
IS: 4770	Rubber gloves for electrical purposes
IS: 5121	Safety code for piling and other deep foundations
IS: 5216 (Part-I)	Recommendations on Safety procedures and practices in electrical works
IS: 5557	Industrial and Safety rubber lined boots.
IS: 5983	Eye protectors
IS:6519	Selection, care and repair of Safety footwear
IS: 6994 (Part-I)	Industrial Safety Gloves (Leather & Cotton Gloves)
IS: 7293	Safety Code for working with construction Machinery

IS: 8519	Guide for selection of industrial safety equipment for body protection
IS: 9167	Ear protectors
IS: 11006	Flash back arrestor (Flame arrestor)
IS:11016	General and safety requirements for machine tools and their operation
IS: 11057	Specification for Industrial safety nets
IS: 11226	Leather safety footwear having direct moulded rubber sole
IS: 11972	Code of practice for safety precaution to be taken when entering a sewerage system
IS: 13367	Code of practice-safe use of cranes
IS: 13416	Recommendations for preventive measures against hazards at working place

B. INTERNATIONAL STANDARDS ON HSE

Safety Glasses	:	ANSI Z 87.1, ANSI ZZ 87.1, AS 1337, BS 2092, BS 1542, BS 679, DIN 4646 / 58211
Safety Shoes	:	ANSI Z 41.1, AS 2210, EN 345
Hand Gloves	:	BS 1651
Ear Muffs	:	BS 6344, ANSI S 31.9
Hard Hat	:	ANSI Z 89.1 / 89.2, AS 1808, BS 5240, DIN 4840
Goggles	:	ANSI Z 87.1
Face Shield	:	ANSI Z 89.1
Breathing Apparatus	:	BS 4667, NIOSH
Welding & Cutting	:	ANSI Z 49.1
Safe handling of compressed Gases in cylinders	:	P-1 (Compressed Gas Association 1235 Jefferson Davis Highway, Arlington VA 22202 – USA)

ANNEXURE-B

DETAILS OF FIRST AID BOX

SL. NO	DESCRIPTION	*QUANTITY*
1.	Small size Roller Bandages, 1 inch wide (Finger Dressing small)	6 Pcs.
2.	Medium size Roller Bandages, 2 inch wide (Hand and Foot Dressing)	6 Pcs.
3.	Large size Roller Bandages, 4 inch wide (Body Dressing Large)	6 Pcs.
4.	Large size Burn Dressing (Burn Dressing Large)	4 Pkts.
5.	Cotton wool (20 gms packing)	4 Pkts.
6.	Antiseptic Solution Dettol (100 ml.) or Savlon	1 Bottle
7.	Mercurochrome Solution (100 ml.) 2% in water	1 Bottle
8.	Ammonia Solution (20 ml.)	1 Bottle
9.	A Pair of Scrissors	1 Piece
10.	Adhesive Plaster (1.25 cm x 5 m)	1Spool
11.	Eye pads in Separate Sealed Packet	4 Pcs.
12.	Tourniqut	1 No.
13.	Safety Pins	1 Dozen
14.	Tinc. Iodine / Betadin (100 ml.)	1 Bottles
15.	Ointment for burns (Burnol 20 gms.)	1 Bottole
16.	Polythene Wash cup for washing eyes	1 No.
17.	Potassium Permanganate (20 gms.)	1 Pkt.
18.	Tinc. Benzoine (100 ml.)	1 Bottole
19.	Triangular Bandages	2 Nos.
20.	Band Aid Dressing	5 Pcs.
21.	Iodex / Moov (25 gms.)	1 Bottole
22.	Tongue Depressor	1 No.
23.	Boric Acid Powder (20 gms.)	2 Pkt.
24.	Sodium Bicarbonate (20 gms.)	1 Pkt.
25.	Dressing Powder (Nebasulf) (10 gms.)	1 Bottole
26.	Medicinal Glass	1 No.
27.	Duster	1 No.
28.	Booklet (English & Local Language)	1 No. each
29.	Soap	1 No.
30.	Toothache Solution	1 No.
31.	Eye Ointment	1 Bottle
32.	Vicks (22 gms.)	1 Bottle
33.	Forceps	1 No.
34.	Cotton Buds (5 nos.)	1 Pkt.
35.	Note Book	1 No.
36.	Splints	4 Nos.
37.	Lock	1 Piece
38.	Life Saving/Emergency/Over-the Counter Drugs	As decided at site
	Box size : 14” x 12” x 4”	

Note : The medicines prescribed above are only indicative. Equivalent medicines can also be used. A prescription, in this regard, shall be required from a qualified Physician.

ANNEXURE – C

TYPE OF FIRES VIS-À-VIS FIRE EXTINGUISHERS

Fire	Fire Extinguishers				
	Water	**Foam**	**CO_2**	**Dry Powder**	**Multi Purpose (ABC)**
Originated from paper, clothes, wood	√	√	Can control minor surface fires	Can control minor surface fires	√
Inflammable liquids like alcohol, diesel, petrol, edible oils, bitumen	x	√	√	√	√
Originated from gases like LPG, CNG, H_2	x	x	√	√	√
Electrical Fires	x	x	√	√	√

Legend : √ Can be used
x Not to be used

Note : Fire extinguishing equipment must be checked atleast once a year and after every use by an authorized person. The equipment must have an inspection label on which the next inspection date is giver:. Type of extinguisher shall clearly be marked on it.

ANNEXURE – D

Indicative List of Statutory Acts & Rules Relating to HSE

- The Indian Explosives Act and Rules
- The Motor Vehicle Act and Central Motor Vehicle Rules
- The Factories Act and concerned Factory Rules
- The Petroleum Act and Petroleum Rules
- The Workmen Compensation Act
- The Gas Cylinder Rules and the Static & Mobile Pressure Vessels Rules.
- The Indian Electricity Act and Rules
- The Indian Boiler Act and Regulations
- The Water (Prevention & Control & Pollution) Act
- The Water (Prevention & Control of Pollution) Cess Act
- The Mines & Minerals (Regulation & Development) Act
- The Air (Prevention & Control of Pollution) Act
- The Atomic Energy Act
- The Radiation Protection Rules
- The Indian Fisheries Act
- The Indian Forest Act
- The Wild Life (Protection) Act
- The Environment (Protection) Act and Rules
- The Hazardous Wastes (Management & Handling) Rules
- The Manufacturing, Storage & import of Hazardous Chemicals Rules
- The Public Liability Act
- The Building and Other Construction Workers (Regulation of Employment and Condition of service) Act
- Other statutory acts Like EPF, ESIS, Minimum Wage Act.

ANNEXURE – E

CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
(A) EXCAVATION Pit Excavation up to 3.0m	➢ Falling into pit	➢ Personal injury	➢ Provide guard rails/barricade with warning signal. ➢ Provide at least two entries/exits. ➢ Provide escape ladders.
	➢ Earth Collapse	➢ Suffocation / Breathlessness ➢ Buried	➢ Provide suitable size of shoring and strutting, if required. ➢ Keep soil heaps away from the edge equivalent to 1.5m or depth of pit whichever is more. ➢ Don't allow vehicles to operate too close to excavated areas. Maintain at least 2m distance from edge of cut. ➢ Maintain sufficient angle of repose. Provide slope not less than 1:1 and suitable bench of 0.5m width at every 1.5m depth of excavation in all soils except hard rock. ➢ Battering/benching the sides.
	➢ Contact with buried electric cables ➢ Gas/ Oil Pipelines	➢ Electrocution ➢ Explosion	➢ Obtain permission from competent authorities, prior to excavation, if required. ➢ Locate the position of buried utilities by referring to plant drawings. ➢ Start digging manually to locate the exact position of buried utilities and thereafter use

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
			mechanical means.
Pit Excavation beyond 3.0m	➢ Same as above plus ➢ Flooding due to excessive rain/ underground water	➢ Can cause drowning situation	➢ Prevent ingress of water ➢ Provide ring buoys ➢ Identify and provide suitable size dewatering pump or well point system
	➢ Digging in the vicinity of existing Building/ Structure	➢ Building/ Structure may collapse ➢ Loss of health & wealth	➢ Obtain prior approval of excavation method from local authorities ➢ Use under-pining method ➢ Construct retaining wall side by side
	➢ Movement of vehicles / equipments close to the edge of cut.	➢ May cause cave-in or slides ➢ Persons may get buried	➢ Barricade the excavated area with proper lighting arrangements ➢ Maintain at least 2m distance from edge of cut and use stop block to prevent over-run. ➢ Strengthen shoring and strutting
Narrow deep excavations for pipelines, etc.	➢ Same as above plus ➢ Frequent cave-in or slides	➢ May cause severe injuries or prove fatal	➢ Battering/benching of sides ➢ Provide escape ladders
	➢ Flooding due to Hydrostatic testing	➢ May arise drowning situation	➢ Same as above plus ➢ Bail out accumulated water ➢ Maintain adequate ventilation
Rock excavation by blasting	➢ Improper handling of explosives	➢ May prove fatal	➢ Ensure proper storage, handling & carrying of explosives by trained personnel. ➢ Comply with the applicable explosive acts & rules.
	➢ Uncontrolled explosion	➢ May cause severe injuries or prove fatal	➢ Allow only authorized persons to perform blasting operations. ➢ Smoking and open

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
			flames are to be strictly prohibited.
	➢ Scattering of stone pieces in atmosphere	➢ Can hurt people	➢ Use PPE like goggles, face mask, helmets etc.
Rock excavating by blasting (Contd)	➢ Entrapping of persons/ animals.	➢ May cause severe injuries or prove fatal	➢ Barricade the area with red flags and blow siren before blasting.
	➢ Misfire	➢ May explode suddenly	➢ Do not return to site for at least 20 minutes or unless announced safe by designated person.
Piling Work	➢ Failure of pile-driving equipment	➢ Can hurt people	➢ Inspect Piling rigs and pulley blocks before the beginning of each shift.
	➢ Noise pollution	➢ Can cause deafness ➢ and psychological imbalance	➢ Use personal protective equipments like ear plugs, muffs, etc.
	➢ Extruding rods / casing	➢ Can hurt people	➢ Barricade the area an install sign boards ➢ Provide first-aid
	➢ Working in the vicinity of 'Live-Electricity'	➢ Can cause electrocution / asphyxiation	➢ Keep sufficient distance from Live-Electricity as per IS code. ➢ Shut off the supply, if possible ➢ Provide artificial/rescue breathing to he injured.
(B) CONCRETING	➢ Air pollution by cement	➢ May affect Respiratory System	➢ Wear respirators or cover mouth and nose with wet cloth.
	➢ Handling of ingredients	➢ Hand s may get injured	➢ Use gloves and other PPE.
	➢ Protruding reinforcement rods.	➢ Feet may get injured	➢ Use Safety shoes. ➢ Provide platform above reinforcement for movement of workers.
	➢ Earthing of electrical mixers,	➢ Can cause electrocution / asphyxiation	➢ Ensure earthing of equipments and proper functioning of

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
	vibrators, etc. not done		electrical circuit before commencement of work.
	➢ Falling of materials from height	➢ Persons may get injured	➢ Use hard hats ➢ Remove surplus material immediately from work place ➢ Ensure lighting arrangements during night hours.
	➢ Continuous pouring by same gang	➢ Cause tiredness of workers and may lead to accident.	➢ Insist on shift pattern ➢ Provide adequate rest to workers between subsequent pours.
	➢ Revolving or concrete mixer/ vibrators	➢ Parts of body or clothes may get entrapped.	➢ Allow only mixers with hopper ➢ Provide safety cages around moving motors ➢ Ensure proper mechanical locking of vibrator
Super-structure	➢ Same as above plus ➢ Deflection in props or shuttering material	➢ Shuttering / props may collapse and prove fatal	➢ Avoid excessive stacking on shuttering material ➢ Check the design and strength of shuttering material before commencement of work ➢ Rectify immediately the deflection noted during concreting
	➢ Passage to work place	➢ Improperly tied and designed props / planks may collapse	➢ Ensure the stability and strength of passage before commencement of work ➢ Do not overload and under the passage.
(C) REINFORCEMENT	➢ Curtailment and binding of rods	➢ Persons may get injured	➢ Use PPE like gloves, shoes, helmets, etc. ➢ Avoid usage of shift tools
	➢ Carrying of rods for short distance/ at	➢ Workers may injure their hands and shoulders	➢ Provide suitable pads on shoulders and use safety

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
	heights		gloves. ➢ Tie up rods in easily liftable bundles ➢ Ensure proper staging.
	➢ Checking of clear distance/ cover with hands	➢ Rods may cut or injure the finger	➢ Use measuring devices tape, measuring rods, etc.
	➢ Hitting projected rods and standing on cantilever rods	➢ Persons may get injured and fall down	➢ Use safety shoes and avoid standing unnecessarily on cantilever rods ➢ Avoid wearing loose clothes
	➢ Falling of material from height	➢ May prove fatal	➢ Use helmets ➢ Provide safety nets
	➢ Transportation of rods by trucks / trailers	➢ Protruded rods may hit the persons	➢ Use red flags/lights at the ends ➢ Do not protrude the rods in front of or by the side of driver's cabin. ➢ Do not extend the rods 1/3rd of deck length or 1.5 m which is less
(D) WELDING AND GAS CUTTING	➢ Welding radiates invisible ultraviolet and infrared says	➢ Radiation can damage eyes and skin.	➢ Use specified shielding devices and other PPE of correct specifications ➢ Avoid throated tungsten electrodes for GTAW.
	➢ Improper placement of oxygen and acetylene cylinders	➢ Explosion may occur	➢ Move out any leaking cylinder ➢ Keep cylinder in vertical position ➢ Use trolley for transportation of cylinders and chain them ➢ Use flash back arrestors
	➢ Leakage / cuts in hoses	➢ May cause fire	➢ Purge regulators immediately and then turn off ➢ Never use grease or

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			oil on oxygen line connections and copper fittings on acetylene lines ➢ Inspect regularly gas carrying hoses ➢ Always use red hose for acetylene & other fuel gases and black for oxygen.
	➢ Opening-up of cylinder	➢ Cylinder may burst	➢ Always stand back from the regulator while opening the cylinder ➢ Turn valve slowly to avoid bursting ➢ Cover the lug terminals to prevent short circuiting.
	➢ Welding of tanks, container or pipes storing flammable liquids	➢ Explosion may occur	➢ Empty & purge them before welding ➢ Never attach the ground cable to tanks, container or pipe storing flammable liquids ➢ Never use LPG for gas cutting
(E) RADIOGRAPHY	➢ Ionizing Radiation	➢ Radiations may react with the skin and can cause cancer, skin irritation, dermatitis, etc.	➢ Ensure safety regulations as per BARC/AERB before commencement of job. ➢ Cordon off the area and install Radiation warning symbols ➢ Restrict the entry of unauthorized persons ➢ Wear appropriate PPE and film badges issued by BARC/AERB
	➢ Transportation and Storage of Radiography source	➢ Same as above	➢ Never touch or handle radiography source with hands ➢ Store radiography source inside a pit in an exclusive isolated

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
			storage room with lock and key arrangement. The pit should be approved by BARC/AERB ➢ Radiography source should never be carried either in passenger bus or in a passenger compartment of trains. ➢ BARC/AERB have to be informed before source movement. ➢ Permission from Director General of Civil Aviation is required for booking radio isotopes with airlines.
	➢ Loss of Radio isotope	➢ Same as above	➢ Try to locate with the help of Survey Meter. ➢ Inform BARC/AERB(*) (*) Atomic Energy Regulatory Board (AERB), Bhabha Atomic Research Centre (BARC) Anushaktinagar, Mumbai – 400 094
(F) ELECTRICAL INSTALLATION AND USAGE	➢ Short circuiting	➢ Can cause Electrocution or Fire	➢ Use rubberized hand gloves and other PPE ➢ Don't lay wires under carpets, mats or door ways. ➢ Allow only licensed electricians to perform on electrical facilities ➢ Use one socket for one appliance ➢ Ensure usage of only fully insulated wires or cables ➢ Don't place bare wire ends in a socket

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
			➢ Ensure earthing of machineries and equipments ➢ Do not use damaged cords and avoid temporary connections ➢ Use spark-proof/flame proof type field distribution boxes. ➢ Do not allow open/bare connections ➢ Provide all connections through ELCB ➢ Protect electrical cables / equipment's from water and naked flames ➢ Check all connections before energizing.
	➢ Overloading of Electrical System	➢ Bursting of system can occur which leads to fire	➢ Display voltage and current ratings prominently with 'Danger' signs. ➢ Ensure approved cable size, voltage grade and type. ➢ Switch off the electrical utilities when not in use. ➢ Do not allow unauthorized connections. ➢ Ensure proper grid wise distribution of Power.
	➢ Improper laying of overhead and underground transmission lines / cables	➢ Can cause electrocution and prove fatal	➢ Do not lay unarmored cable directly on ground, wall, roof of trees ➢ Maintain at least 3m distance from HT cables ➢ All temporary cables should be laid at least 750 mm below ground on 100 mm

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
			fine sand overlying by brick soling ➢ Provide proper sleeves at crossings/ intersections ➢ Provide cable route markers indicating the type and depth of cables at intervals not exceeding 30m and at the diversions / termination.
(G) FIRE PREVENTION AND PROTECTION	➢ Small fires can become big ones and may spread to the surrounding areas	➢ Cause burn injuries and may prove fatal.	➢ In case a fire breaks out, press fire alarm system and shout “Fire, Fire” ➢ Keep buckets full of sand & water/fire extinguishing equipment near hazardous locations ➢ Confine smoking to ‘Smoking Zones’ only ➢ Train people for using specific type of fire equipments under different classes of fire ➢ Keep fire doors/ shutters, passages and exit doors unobstructed ➢ Maintain good house keeping and first-aid boxes (for detail refer Annex-2) ➢ Don’t obstruct assess to Fire extinguishers ➢ Do not use elevators for evacuation during fire ➢ Maintain lightening arrestors for elevated structures ➢ Stop all electrical motors with internal combustion. ➢ Move the vehicles from dangerous

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			locations. ➢ Remove the load hanging from the crane booms. ➢ Remain out of the danger areas.
	➢ Improper selection of Fire Extinguisher	➢ It may not extinguish the fire	➢ Ensure usage of correct fire extinguisher meant for the specified fire (for details refer Appendix-C) ➢ Do not attempt to extinguish Oil and electric fires with water. Use foam cylinders/CO_2/sand or earth.
	➢ Improper storage of highly inflammable substances	➢ Same as above	➢ Maintain safe distance of flammable substances from source of ignition ➢ Restrict the distribution of flammable materials to only min. necessary amount ➢ Construct specifically designed fuel storage facilities ➢ Keep chemicals in cool and dry place away from hat. Ensure adequate ventilation ➢ Before welding operation, remove or shield the flammable material properly ➢ Store flammable materials in stable racks, correctly labeled preferably with catchments trays. ➢ Wipe off the spills immediately

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
	➢ Short circuiting of electrical system	➢ Same as above ➢ Can cause Electrocution	➢ Don't lay wires under carpets, mats or door ways ➢ Use one socket for one appliance ➢ Use only fully insulated wires or cables ➢ Do not allow open/bare connections ➢ Provide all connections through ELCB ➢ Ensure earthing of machineries and equipments
(H) VEHICULAR MOVEMENT	➢ Crossing the Speed Limits (Rash driving)	➢ Personal injury	➢ Obey speed limits and traffic rules strictly ➢ Always expect the unexpected and be a defensive drive ➢ Use sat belts/helmets ➢ Blow horn at intersections and during overtaking operations. ➢ Maintain the vehicle in good condition ➢ Do not overtake on curves, bridges and slopes
	➢ Adverse weather condition	➢ Same as above	➢ Read the road ahead and ride to the left ➢ Keep the wind screen and lights clean ➢ Do not turn at speed ➢ Recognize the hazard, understand the defense and act correctly in time.
	➢ Consuming alcohol before and during he	➢ Same as above	➢ Alcohol and driving do not mix well. Either choose

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
	driving operation		alcohol or driving. ➢ If you have a choice between hitting a fixed object or an oncoming vehicle, hit the fixed object ➢ Quit the steering at once and become a passenger. Otherwise take sufficient rest and then drive. ➢ Do not force the driver to drive fast and round the clock ➢ Do not day dram while driving
	➢ Falling objects / Mechanical failure	➢ May prove fatal	➢ Ensure effective braking system, adequate visibility for the drives, reverse warning alarm. ➢ Proper maintenance of the vehicle as per manufacturer instructions
(I) PROOF TESTING (HYDROSTATIC/ PNEUMATIC TESTING	➢ Bursting of piping ➢ Collapse of tanks ➢ Tanks flying off	➢ May cause injury and prove fatal	➢ Prepare test procedure & obtain CONSULTANT/ Owner's approval ➢ Provide separate gauge for pressurizing pump and piping/equipment ➢ Check the calibration status of all pressure gauges, dead weight testers and temperature recorders ➢ Take dial readings at suitable defined intervals and ensure most of them fall between 40-60% of the gauge scale range ➢ Provide safety relief valve (set at

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
			pressure slightly higher than test pressure) while testing with air/nitrogen ➢ Ensure necessary precautions, stepwise increase in pressure, tightening of bolts/ nuts, grouting, etc. before and during testing ➢ Keep the vents open before opening any valve while draining out of water used for hydro testing of tanks ➢ Pneumatic testing involves the hazard of released energy shored in compressed gas. Specific care must therefore be taken to minimize the chance of brittle failure during a pneumatic leak test. Test temperature is important in this regard and must be considered when the designer chooses the material of construction ➢ A pressure relief device shall be provided, having a set pressure not higher than the test pressure plus the lesser of 345 KPa (50 psi) or 10% of he test pressure. The gas used as test fluid, if not air, shall be nonflammable and nontoxic.
(J) WORKING AT HEIGHTS	➢ Person can fall down	➢ May sustain severe injuries or	➢ Provide guard rails/barricade at the

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
		prove fatal	work place ➢ Use PPE like safety belts, full body harness, life line, helmets, safety shoes, etc. ➢ Obtain a permit before starting the work at height above 3 meters ➢ Fall arrest systems like safety nets, etc. must be installed ➢ Provide adequate working space (min. 0.6 m) ➢ Tie/weld working platform with fixed support ➢ Use roof top walk ladder while working on a slopping roofs ➢ Avoid movement on beams
		➢ May hit the scrap / material stacked at the ground or in between	➢ Keep the work place neat and clean ➢ Remove the scrap immediately
	➢ Material can fall down	➢ May hit the workers working at lower levels and prove fatal.	➢ Same as above plus ➢ Do not throw or drop material or equipment from height ➢ All tools to be carried in a toolkit bags or on working uniform ➢ Remove scrap from the planks ➢ Ensure wearing of helmet by the workers at low level
(K) CONFINED SPACES	➢ Suffocation / drowning	➢ Unconsciousness, death	➢ Use respiratory devices, if required ➢ Avoid over crowding inside a confined space ➢ Provide Exhaust Fans for ventilation ➢ Do not wear loose clothes, neck ties,

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			etc. ➢ Fulfill conditions of the permit. ➢ Check for presence of hydrocarbons, O_2 level ➢ Obtain work permit before entering a confined space ➢ Ensure that the connected piping of the equipment which is to be opened is pressure free, fluid has been drained, vents are open and piping is positively isolated by a blind flange
	➢ Presence of foul smell and toxic substances	➢ Inhalation can pose threat to life.	➢ Same as above plus ➢ Check for hydrocarbon and Aromatic compounds before entering a confined space ➢ Depute one person outside the confined space for continuous monitoring and for extending help in case of an emergency
	➢ Ignition / flame can cause fire	➢ Person may sustain burn injuries or explosion may occur	➢ Keep fire extinguishers at a hand distance ➢ Remove surplus material and scrap immediately ➢ Do not smoke inside a confined space ➢ Do not allow gas cylinders inside a confined space ➢ Use low voltage (24V) lamps for lighting ➢ Use tools with air motors or electric tools with max.

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
			voltage of 24V ➢ Remove all equipments at the end of the day
(L) HANDLING AND LIFTING EQUPMENTS	➢ Failure of load lifting and moving equipments	➢ Can cause accident and prove fatal	➢ Avoid standing under the lifted load and within the operating radius of cranes ➢ Check periodically oil, brakes, gears, horns and tyre pressure of all moving machinery ➢ Check quality, size and condition of all chain pulley blocks, slings, U-clamps, D-shackles, wire ropes, etc. ➢ Allow crane to move only on hard, firm and leveled ground ➢ Allow lifting slings as short as possible and check gunny packings at the friction points ➢ Do not allow crane to tilt its boom while moving ➢ Install Safe Load Indicator ➢ Ensure certification by applicable authority.
	➢ Overloading of lifting equipments	➢ Can cause electrocution and fire	➢ Safe lifting capacity of derricks and winches written on them shall be got verified. ➢ The max safe working load shall be marked on all lifting equipments ➢ Check the weight of columns and other heavy items painted on them and accordingly decide about the crane

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
			capacity, boom and angle of erection ➢ Allow only trained operators and riggers during crane operation
	➢ Overhead electrical wires	➢ Can cause electrocution and fire	➢ Do not allow boom or other parts of crane to come within 3 m reach of overhead HT cables ➢ Hook and load being lifted shall preferably remain in full visibility of crane operator.
(M) SCAFFOLDING, FORMWORK AND LADDERS	➢ Person can fall down	➢ Person may sustain severe injuries and prove fatal	➢ Provide guard rails for working at height ➢ Face ladder while climbing and use both hands ➢ Ladders shall extend about 1m above landing for easy access and tying up purpose ➢ Do not place ladders against movable objects and maintain base at ¼ unit of the working length of the ladder ➢ Suspended scaffolds shall not be less than 500 mm wide and tied properly with ropes ➢ No loose planks shall be allowed ➢ Use PPE, like helmets, safety shoes, etc.
	➢ Failure of scaffolding material	➢ Same as above	➢ Inspect visually all scaffolding materials for stability and anchoring with permanent structures. ➢ Design scaffolding

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
			for max. load carrying capacity ➢ Scaffolding planks shall not be less than 50x250 mm full thickness lumber or equivalent. These shall be cleared or secured and must extend over the end supports by at least 150mm and not more that 300 mm ➢ Don't overload the scaffolds ➢ Do not splice short ladders to make a longer one. Vertical ladders shall not exceed 6m.
	➢ Material can fall down	➢ Persons working at lower level gets injured.	➢ Remove excess material and scrap immediately ➢ Carry the tools in a tool-kit bag only ➢ Provide safety nets
(N) STRUCTURAL WORKS	➢ Personal negligence and danger of fall	➢ Can cause injury or casualty	➢ Do not take rest inside rooms built for welding machines or electrical distribution system ➢ Avoid walking on beams at height ➢ Wear helmet with chin strap and safety belts when working at height ➢ Use hand gloves and goggles during grinding operations ➢ Cover or mark the sharp and projected edges ➢ Do not stand within the operating radius of cranes
	➢ Lifting / slipping of	➢ Same as above	➢ Do not stand under the lifted load

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
	material		➢ Stack properly all the materials. Avoid slippage during handling ➢ Control longer pieces lifted up by cranes from both ends ➢ Remove loose materials from height ➢ Ensure tightening of all nuts and bolts
(O) PIPELINE WORKS	➢ Erection / lowering failure	➢ Can cause injury	➢ Do not stand under the lifted Load ➢ Do not allow any person to come within the radii of the side boom handling pipes ➢ Check the load carrying capacity of the lifting tools and tackles ➢ Use safe Load Indicators ➢ Use appropriate PPEs
	➢ Other	➢ Same as above	➢ Wear gum boots in marshy areas ➢ Allow only one person to perform signaling operations while lowering of pipes ➢ Provide night caps on pipes ➢ Provide end covers on pipes for stoppage of pigs while testing/cleaning operations.

FORMAT NO. : HSE-1, REV. 0

HSE CHECKLIST CUM COMPLIANCE REPORT (1/6)

Project: _____ Contractor :_____
Date: _____ Owner :_____
Inspection By:_____ Report No. :_____
Frequency : Fortnightly Job No :_____

Note: write 'NA' wherever the item is not applicable

SL. NO.	ITEM	YES	NO	REMARKS	ACTION
1	**HOUSEKEEPING**				
a)	Waste containers provided and used				
b)	Sanitary facilities adequate and clean				
c)	Passageways and Walkways clear				
d)	General neatness of working areas				
e)	Others				
2	**PERSONNEL PROTECTIVE EQUIPMENT**				
a)	Goggles; Shields				
b)	Face protection				
c)	Hearing protection				
d)	Safety shoes				
e)	Hand protection				
f)	Respiratory Masks etc.				
g)	Safety Belts				
h)	Safety Helmet/Hard Hat				
I)	Others				
3	**EXCAVATIONS/OPENINGS**				
a)	Openings properly covered or barricaded				
b)	Excavations shored				
c)	Excavations barricaded				
d)	Overnight lighting provided				
e)	Others				
4	**WELDING & GAS CUTTING**				
a)	Gas cylinders chained upright				
b)	Cables and hoses not obstructing				
c)	Screens or shields used				
d)	Flammable materials protected				
e)	Fire extinguisher(s) accessible				
f)	Others				
5	**SCAFFOLDING**				
a)	Fully decked platforms				
b)	Guard and intermediate rails in place				

SL. NO.	ITEM	YES	NO	REMARKS	ACTION
c)	Toe boards in place				
d)	Adequate shoring				
e)	Adequate access				
f)	Others				
6	**LADDERS**				
a)	Extension side rails 1m above				
b)	Top of landing				
c)	Properly secured				
d)	Angle + 70 from horizontal				
e)	Others				
7	**HOISTS, CRANES AND DERRICKS**				
a)	Condition of cables and sheaves OK				
b)	Condition of slings, chains, hooks and eyes OK				
c)	Inspection and maintenance logs maintained				
d)	Outriggers used				
e)	Signs/barricades provided				
f)	Signals observed and understood				
g)	Qualified operators				
h)	Others				
8	**MACHINERY, TOOLS AND EQUIPMENT**				
a)	Proper instruction				
b)	Safety devices				
c)	Proper cords				
d)	Inspection and maintenance				
e)	Others				
9	**VEHICLE AND TRAFFIC**				
a)	Rules and regulations observed				
b)	Inspection and maintenance				
c)	Licensed drivers				
d)	Others				
10	**TEMPORARY FACILITIES**				
a)	Emergency instructions posted				
b)	Fire extinguishers provided				
c)	Fire-aid equipment available				
d)	Secured against storm damage				
e)	General neatness				
f)	In accordance with electrical requirements				
g)	Others				
11	**FIRE PREVENTION**				
a)	Personnel instructed				
b)	Fire extinguishers checked				
c)	No smoking in Prohibited Areas				
d)	Hydrants Clear				

SL. NO.	ITEM	YES	NO	REMARKS	ACTION
e)	Others				
12	**ELECTRICAL**				
a)	Use of 3-core armoured cables				
b)	Usage of 'All insulated' or 'double insulated' electrical tools				
c)	All electrical connection are routed through ELCB				
d)	Natural Earthing at the source of power (main DB)				
e)	Continuity and tightness of earth conductor				
f)	Covering of junction boxes, panels and other energized wiring places				
g)	Ground fault circuit interrupters provided				
h)	Prevention of tripping hazards				
i)	Others				
13	**HANDLING AND STORAGE OF MATERIALS**				
a)	Properly stored or stacked				
b)	Passageways clear				
c)	Others				
14	**FLAMMABLE GASES AND LIQUIDS**				
a)	Containers clearly identified				
b)	Proper storage				
c)	Fire extinguishers nearby				
d)	Others				
15	**WORKING AT HEIGHT**				
a)	Erection plan and work permit obtained				
b)	Safety nets				
c)	Full body harness and lanyards; chute lines				
d)	Health Check record available for workers going up?				
e)	Others				
16	**CONFINED SPACE**				
a)	Work permit obtained				
b)	Test for toxic gas and sufficient availability of oxygen conducted				
c)	At least one person outside the confined space for monitoring deputed				
d)	Availability of sufficient means of entry, exit and ventilation				
e)	Fire extinguishers and first-aid facility ensured				
f)	Lighting provision made by using 24V lamps				
g)	Proper usage of PPEs ensured				
17	**RADIOGRAPHY**				
a)	Proper storage and handling of source as per BARC / AREB guidelines				
b)	Working permit obtained				
c)	Cordoning of the area done				

SL. NO.	ITEM	YES	NO	REMARKS	ACTION
d)	Use of appropriate PPE's ensured				
e)	Proper training to workers/supervisors imparted				
f)	Minimum occupancy of workplace ensured				
18	**HEALTH CHECKS**				
a)	Workers medically examined and found to fit for working : i) At heights ii) In confined space.				
b)	Availability of First-aid facilities				
c)	Proper sanitation at site, office and labour camps				
d)	Arrangement of medical facilities				
e)	Measures for dealing with illness				
f)	Availability of Portable drinking water for workmen & staff				
g)	Provision of crèches for children				
h)	Stand by vehicle available for evacuation of injured.				
19	**ENVIRONMENT**				
a)	Chemical and other effluents properly disposed				
b)	Cleaning liquid of pipes disposed off properly				
c)	Seawater used for hydro-testing disposed off as per agreed procedure				
d)	Lubricant Waste/Engine oils properly disposed				
e)	Waste from Canteen, offices, sanitation etc. disposed properly				
f)	Disposal of surplus earth, stripping materials, oily rags and combustible materials done properly				
g)	Green belt protection				

_____

Signature of Resident Engineer with Seal

FORMAT NO. : HSE-2, REV. 0

ACCIDENT / INCIDENT REPORT

(To be submitted by Contractor after every Accident / Incident within 24 hours)

Report No:_____
Date: _____

Name of Site:-_____
CONTRACTOR_____

Type of Accident / Incident : ☐ Fatal ☐ Other Lost Time ☐ Non Loss Time ☐ First-Aid case

NAME OF THE INJURED……
AGE ……
FATHER'S NAME……..
SUB-CONTRACTOR M/S……..
DATE & TIME OF ACCIDENT…….
LOCATION ……

BRIEF DESCRIPTION OF ACCIDENT

CAUSE OF ACCIDENT

NATURE OF INJURY/DAMAGE

MEDICAL AID PROVIDED/ACTIONS TAKEN

INTIMATION TO LOCAL AUTHORITIES (IF APPLICABLE)

DATE: SIGNATURE OF CONTRACTOR WITH SEAL

To : OWNER…….. 1 COPY
: SITE-IN-CHARGE, HNGPL 3 COPIES

FORMAT NO. : HSE-3, REV. 0

SUPPLEMENTARY ACCIDENT / INCIDENT INVESTIGATION REPORT

Supplementary to Report No: _____(Copy enclosed)

Project:_____ Site:_____
Name of Work :_____ Date:_____
Contractor:_____ Work Order / LOI No. :_____

NAME OF THE INJURED …….
AGE : ……...
SUB-CONTRACTOR M/S……...
DATE & TIME OF ACCIDENT / INCIDENT ……
LOCATION……

BRIEF DESCRIPTION & CAUSE OF A ACCIDENT/ INCIDENT

NATURAL OF INJURY/DAMAGE

COMMENTS FROM MEDICAL PRACTITIONER WHO ATTENDED THE VICTIM/INJURED

SUGGESTED IMPROVEMENT IN THE WORKING CONDITION IF ANY

LOSS OF MANHOURS AND IMPACT ON SITE WORKS

ANY OTHER COMMENT BY SAFETY OFFICER.

DATE: SIGNATURE OF CONTRACTOR
WITH SEAL

To	:	OWNER……..	1 COPY
	:	SITE-IN-CHARGE, HNGPL	3 COPIES

FORMAT NO. : HSE-4, REV. 0

NEAR MISS INCIDENT – SUGGESTED PROFORMA

Report No: _____

Name of Site :_____ Date :_____

Name of Work :_____ Contractor :_____

INCIDENT REPORTED BY :

DATE & TIME OF INCIDENT :

LOCATION :

BRIEF DESCRIPTION OF INCIDENT

PROBABLE CAUSE OF INCIDENT

SUGGESTED CORRECTIVE ACTION

STEPS TAKEN TO AVOID RECURRENCE YES ☐ NO ☐

DATE: SIGNATURE OF CONTRACTOR WITH SEAL

To : OWNER…….. 1 COPY

: SITE-IN-CHARGE, HNGPL 3 COPIES

FORMAT NO. : HSE-5, REV. 0

MONTHLY HEALTH, SAFETY & ENVIRONMENT (HSE) REPORT
(To be submitted by each Contractor)

Actual work start Date:_____ For the Month of:_____
Project:_____ Report No:_____
Name of the Contractor:_____ Status as on:_____
Name of Work:_____ Name of Safety officer:_____

ITEM			UPTO PREVIOUS MONTH	THIS MONTH	CUMU-LATIVE
a)	Average number of Staff & Workmen (average daily headcount, not man days)				
b)	Manhours Worked				
c)	Number of HSE meeting organized at site				
d)	Number of HSE awareness programmes conducted at site				
e)	Number of Lost Time Accidents (LTA)	Fatal			
		Other LTA			
f)	Number of Loss time Injuries (LTI)	Fatalities			
		Other LTI			
g)	Number of Loss Time Accidents				
h)	Number of First Aid Cases				
i)	Number of Near Miss Incidents				
j)	Man-days lost due to accidents				
k)	LTA Free Manhours i.e. Number of LTA free manhours from the Lst LTA				
l)	Compensation cases raised with Insurance				
m)	Compensation case resolved and paid to workmen				
n)	Whether workmen compensation policy taken		Y/N		
o)	Whether workmen compensation policy valid		Y/N		
p)	Whether workmen registered under ESI Act		Y/N		
Remark					

DATE:

Safety Officer /Resident Engineer
(Signature and Name)

To : OWNER
: /, HNGPL (2 COPIES)

FORMAT NO. : HSE-6, REV. 0

PERMIT FOR WORKING AT HEIGHT (ABOVE 2 METER)

Project Site : …… Sr. No.: ……
Name of the work: …… Date: ……
Name of Contractor : …….. Nature of Work : ……
Total No.of Workers: ..... Exact location of work : ……
Duration of work: from ..…….. to ……

The following items have been checked and compliance shall be ensured during the currency of the permit:

Sl.	ITEM	DONE	NOT REQD.
1.	Equipment/Work Area inspected	☐	☐
2.	Considered hazard from other routine/non-routine operations and concerned person alerted	☐	☐
3.	ELCB provided	☐	☐
4.	Proper lighting provided	☐	☐
5.	Area cordoned off.	☐	☐
6.	Precautions against public traffic taken	☐	☐
7.	Sound Scaffolding provided	☐	☐
8.	Adequate protected Platform provided	☐	☐
9.	Acces and Exit to the area (Ladder properly fixed)	☐	☐
10.	Floor Openings covered	☐	☐
11.	Safety Net provided	☐	☐
12.	Heath check of personnel	☐	☐

A. Following personal protective equipment are provided (mark) and used as relevant Safety helmet/Gloves/Goggles/Shoes/Face Shield/Life Line/Safety Belt/Safety Harness.

B. This permit shall be available at the work site at all times.

C. Permit shall be issued for maximum one week only (Monday to Sunday).

D. This permit shall be applicable in non-operational areas.

E. After completion of the work, used permits shall be preserved for record purposes.

F. Additional precautions, if any …….

Permission is granted to work (See overleaf) = Yes/No

Name of Contractor's Supervisor (Initiator)

Name of Contractor's Safety Officer (Issuing Authority)

GRANT OF PERMIT AND EXTENSIONS

Sl. No.	Validity Period From …… To ……	Work time From …..Hrs. To.....Hrs.	Initiator (Supervisor of Contractor)	Issuing Authority (Safety Officer) of Contractor	Verification by CONSULTANT with date

Additional safety instructions, if any.

FORMAT NO. : HSE-7, REV. 0

CONFINED SPACE ENTRY PERMIT

Project Site : …… Sr. No.: ……
Name of the work: …… Date: ……
Name of Contractor : …….. Nature of Work : ……
Exact location of work : ……..

Safety Requirements : POSITIVE ISOLATION OF THE VESSEL IS MANDATORY

(A) Has the equipment been ?								
Y	**NR**		**Y**	**NR**		**Y**	**NR**	
ϒ	ϒ	isolated from power / steam / air	ϒ	ϒ	water flushed &/or steamed	ϒ	ϒ	radiation sources removed
ϒ	ϒ	isolated from liquid or gases	ϒ	ϒ	Manways open & ventilated	ϒ	ϒ	Proper lighting provided
ϒ	ϒ	depressurized &/or drained	ϒ	ϒ	cont. inset gas flow arranged	ϒ	ϒ	
ϒ	ϒ	blanked / blinded / disconnected	ϒ	ϒ	adequately cooled	ϒ	ϒ	

(B) Expected Residual Hazards								
Y	**NR**		**Y**	**NR**		**Y**	**NR**	
ϒ	ϒ	lack of O_2	ϒ	ϒ	combustible gas / liquid	ϒ	ϒ	H_2S / toxic gases
ϒ	ϒ	corrosive chemicals	ϒ	ϒ	pyrophoric iron / scales	ϒ	ϒ	electricity / static
ϒ	ϒ	Heat / stream / frost	ϒ	ϒ	high humidity	ϒ	ϒ	ionizing radiation
ϒ	ϒ		ϒ	ϒ		ϒ	ϒ	

(C) Protective Measures								
Y	**NR**		**Y**	**NR**		**Y**	**NR**	
ϒ	ϒ	gloves	ϒ	ϒ	ear plug / muff	ϒ	ϒ	goggles / face shield
ϒ	ϒ	protective clothing	ϒ	ϒ	dust / gas / air line mask	ϒ	ϒ	personal gas alarm
ϒ	ϒ	Grounded air educater / blower / AC	ϒ	ϒ	attendant with SCBA / air mask	ϒ	ϒ	rescue equipment / team
ϒ	ϒ	Fire fighting arrangements	ϒ	ϒ	safety harness & lifeline	ϒ	ϒ	communication equipment
ϒ	ϒ		ϒ	ϒ		ϒ	ϒ	

Authorization / Renewal (It is safe to enter the confirmed space)

Date	No. of Persons Allowed	Name of Persons allowed	Signature		Time		Signature
			Contractor's Supervisor	Contractor's Safety Officer	From	To	Workman

Permit Closure :

(A) Entry ϒ was closed ϒ stopped ϒ will continue on

(B) ϒ Site left in a safe condition
ϒ Housekeeping done

(C) Multi lock ϒ removed ϒ key transferred
ϒ Ensured all men have come out ϒ Manways barricaded

Remarks, if any :

FORMAT NO. : HSE-8, REV. 0

RADIATION WORK PERMIT

Project : Sr. No.:

Name of the work : Date:

Name of Contractor : Job No. :

Location of work :

Source Strength :

Cordoned distance (m) :

Name of Radiographing agency : Approved by Owner / HNGPL ☐

The following items have been checked & compliance shall be ensured during currency of the permit :

S. No.	Item Description	Done
1.	Safety regulations as per BARC/AERB ensured while source in use/ in transit & during storage.	☐
2.	Area cordoned off.	
3.	Lighting arrangements for working during nights ensured.	
4.	Warning signs / flash lights installed.	
5.	Cold work permit taken (if applicable)	
6.	PPEs like film badges, dosimeters used.	

Additional precautions, if any _____

(Radiography Agency's BARC / AREB authorized Supervisor) (Contractor's Safety Officer)

Permission is granted.

Permit is valid from _____ AM/PM _____ Date to _____ AM/PM _____ Date

(Signature of permit issuing authority)

Name : Designation : Date :

Permit renewal :

Permit extended upto		Additional precautions required, if any.	Sign of issuing authority with date
Date	**Time**		

Work completed / stopped / area cleared at _____ Hrs. of Date _____

(Sign of permit issuing authority)
Name :

FORMAT NO. : HSE-9, REV. 0

RADIATION WORK PERMIT

Project : Sr. No.:

Name of the work : Date:

Name of Contractor : Job No. :

Name of Contractor :

Line No. / Equipment No. /Structure to be dismantled :

Location details of dismantling / demolition with sketch : (Clearly indicate the area)

The following items have been checked & compliance shall be ensured during currency of the permit :

S. No.	Item Description	Done	Not Applicable
1.	Services like power, gas supply, water, etc. disconnected.	☐	☐
2.	Dismantling / Demolishing method reviewed & approved.	☐	☐
3.	Usage of appropriate PPEs ensured.	☐	☐
4.	Precautions taken for neighboring structures	☐	☐
5.	First-Aid arrangements made	☐	☐
6.	Fire fighting arrangements ensured	☐	☐
7.	Precautions taken for blasting	☐	☐

(Contractor's Supervisor) (Contractor's Safety Officer)

Permission is granted.

(Permit issuing authority)
Name :
Date :

Completion Report :

Dismantling / Demolishing is completed on _____ Date at _____ Hrs.

Materials / debris transported to identified location ☐

Tagging completed (as applicable) ☐

Services like power, gas supply, water, etc. restored ☐

(Permit issuing authority)

DATA SHEETS

CONTENTS

DRAWING
(Attached Separately)

TECHNICAL SPECIFICATION OF STEEL REINFORCED RUBBER HOSE

STANDARD TECHNICAL SPECIFICATION FOR STEEL REINFORCED RUBBER HOSE

CONTENTS

1.0 SCOPE

This present document covers the technical specification for the procurement of steel reinforced rubber hose, Type 4 used in distribution systems. It describes the general requirements, controls, tests, QA/QC examination and final acceptance criteria which need to be fulfilled.

This specification covers the requirements for steel reinforced rubber hose unless modified by this specification, requirements of IS: 9573 shall be valid.

2.0 MATERIAL

i. Lining: - It shall be nitrile – butadiene rubber (NBR) or chloroprene rubber (CR) compound. It shall be smooth in bore, uniform in thickness and free from air blisters, porosity and splits.

ii Reinforcement material :- It shall have wire reinforcement in braided form in between the lining & cover.

iii Cover :- It shall be manufactured out of synthetic rubber compound resistant to abrasion,weather and natural gas. The cover color shall be orange.

iv. The whole shall be consolidated by wrapping or any other suitable method anduniformly vulcanized to give good adhesion between reinforcement plies and the rubber lining of the cover.

3.0 DIMENSIONS & TOLERANCES

i. Bore size

Nominal size (mm)	Minimum base diameter (mm)	Minimum bend radius (mm)
8 mm	7.9	95

The Nominal bore size of the hose shall be accordance to table # 1 of IS 9573 : 1998 shall be as given above table. It shall be tested/ checked as method defined in IS 4143

ii. The Minimum thickness of lining & cover shall be 2 mm & 1 mm respectively.
iii. Length of hose shall be as defined in M.R. & the tolerances on length shall be permitted ± 1%.

4.0 FEATURES

4.1 Mechanical properties

Tensile strength (Lining & cover) at break - 10 MPa (minimum)

Elongation (Lining & cover) in at break (%) - 200 & 250 respectively (minimum)

4.2 Resistance of Lining to n-pentane

The n-pentane absorbed and the n-pentane extractable matter as determined Clause no. 5.4.3.2 of IS 9573: 1998 shall not exceed 10% & 5% respectively to the initial mass of lining.

4.3 Adhesion

The minimum adhesion between rubber lining & reinforcement, between layers of reinforcement and between reinforcement & cover shall be 2KN/m.

4.4 Low temperature flexibility

Flexible hose is conditioned at -40 ° C for at least 5 hrs. and then bent at 180° around a mandrel with a diameter 12 times the nominal bore diameter of the hose, no cracks or breaks shall be shown.

4.5 Flexibility of Hose

The hose shall be capable of being bent empty to the radius 95 mm without flattening and suffering structural damages.

4.6 Ozone resistance

It shall be carried out as per clause no. 5.5.of IS 9573: 1978

4.7 Hydrostatic test

All hoses shall be leak tightness tested at 2 Mpa for a period of 1 minutes and no leakage is permitted. This test shall be performed on each size of the hoses as per clause no. 5.5.5.1 of IS 9573: 1978.

4.8 Bursting pressure

It shall be carried out as per Clause 5.5.2 of IS 9573. The minimum burst pressure shall be 5 Mpa.

4.9 Grip strength test

The hose shall comply to the requirement of Clause no. 5.5.7 of IS 9573.

4.10 Burning behaviour

The burning test shall be carried out on hose as per clause no. 5.5.8 of IS 9573. The hose at least shall not burn till 45 second.

5.0 MARKING

Each hose shall be indelibly marked as follows:

a) Manufacturer's name or trade mark., if any
b) Nominal bore
c) Batch no. / Lot no.
d) Month and year of manufacturer
e) Type of hose i.e Type 4
f) BIS marking

6.0 PACKAGING

Packing size to be mentioned to ensure uniformity in delivery conditions of the material being procured. Bidder shall submit the packaging details during offer and also complied with at the time of delivery.

7.0 INSPECTION / DOCUMENTS

i. Inspection shall be carried out as per design codes/standards, Technical Specification and Inspection Plan/ Vendor's detailed QAP duly approved by owner/owner's representative.

ii. For all tests purposes, the minimum time between vulcanization & testing shall be 16 h.

iii. Owner representative or third party inspection agency appointed by Owner shall carry out random inspection during manufacturing/ final inspection.

iv. Vendor shall furnish all the material test certificates, proof of approval/ license from specified authority as per specified standard, if relevant, internal test/ inspection reports as per Technical Specification, at the time of final inspection of each supply lot of material.

v. Even after third party inspection, Owner reserves the right to select a sample of hose randomly from each manufacturing batch and have these independently tested. If the results of these tests fall outside the limits specified in Technical specification, then Owner reserves the rights to reject all production supplied from the batch.

vi. Vendor shall prepare and submit the detail drawings of required steel reinforced rubber hose for approval by Owner before starting production.

vii. For any control test or examination required under the supervision of TPIA/owner/owner's representative, latter shall be informed in writing one (1) week in advance by vender about inspection date & place along with production schedule.