

C O N T E N T S
**LIST OF SPECIFICATION/
STANDARDS VOLUME-II of II**

TECHNICAL SPECIFICATION

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TECHNICAL SPECIFICATION
FOR
LAYING OF MDPE MAIN PIPELINES
AND SERVICE PIPELINES

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TECHNICAL SPECIFICATION

1.0 GENERAL INFORMATION

This specification covers the minimum requirement for various activities to be carried out by contractor for or about the construction/laying of PE pipelines. This specification shall be read in conjunction with the conditions of all specifications and documents included in contract between Contractor and BPCL.

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 BPCL. 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 BPCL for approval.
- 2.4 Receipt of free issue items from BPCL'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 Supplying, Uncoiling/ stringing the PE pipes of required sizes (i.e. 20, 32, 63, 90, 125 & 180 mm) 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, alongwith 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, tiles, flooring masonry etc. to original condition and to match with adjoining conditions- functionally and aesthetically upto the entire satisfaction of BPCL, any other third party agency designated by BPCL 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 BPCL stores, reconciliation of free issue material/ consumables if supplied by BPCL and obtaining 'no objection certificates' from BPCL. Handing over the completed works to BPCL for their operation / use purposes.

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

3.0 MATERIAL, LABOUR, PLANT AND EQUIPMENT

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

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 of MDPE Pipe (if required as per scope of work and SOR) ,HDPE casing pipe, PE fittings and 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 BPCL informed. The inspection of bought out items would be carried out by BPCL or as per instruction by EIC.

In general PE pipe (if required) shall be of the following lengths indicated.

20mm/32mm	100 Mtrs. coils
63 mm	100 Mtrs. Coils
90 mm	50 Mtrs Coils
125 mm	50 Mtrs. Coils
180 mm	12 Mtrs

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 feetor 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 asphaltting/ road works.

3.2.2 Imported Backfill and Material

The Contractor shall be responsible to arrange the supply of any imported backfill including approved Sweet earth/ Coarse Sand and aggregate etc. Payment for the supply of sand only is included in Schedule of Rates. The other soils shall be supplied without any cost implication to Owner.

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.
- 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.
- Permanent markers as shown in the drawings enclosed in the tender.

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 BPCL 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 be noted and forwarded to stores for replacement immediately with P.O reference and only with 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, BPCL 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, BPCL'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 BPCL'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, boots, 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 BPCL 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 a 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. BPCL 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 BPCL on site. All work will be issued and sanctioned through the EIC and site control exercised by Site Engineer BPCL. 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 BPCL is maintained.
- 9.2 Contractor shall designate RCM who will be the single point coordinator to interact with EIC of BPCL 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 BPCL as is required. The normal day to day issue of work instructions, communication between BPCL 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 facility
- 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.

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

TRENCHING

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 land slides, the pipeline trench shall be maintained open only for the time strictly necessary. BPCL 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 :

a) For Distribution Main and Service Lines

i)	Minor Water Crossing/ Canal	1.5 meter
ii)	Uncased/ Cased Road Crossing	1.2 meter
iii)	Rail/ Road Cased Crossing	1.7 meter
iv)	Normal Areas	1.0 meter

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 BPCL.

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.

- 150mm 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 BPCL 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 BPCL. 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 BPCL.

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 BPCL.

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 BPCL.

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

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 BPCL 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 BPCL 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

LAYING

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 EIC 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.

13.0 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 plastic 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

14.0 BACK FILLING

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 BPCL, 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 BPCL 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 BPCL.

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 BPCL. 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 BPCL 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-up to.

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 is completed.

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

15.0

MOLING:

The Moling shall be carried out as per the requirement specified by BPCL, 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 BPCL. Aprior 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 .

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 BPCL.

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.

16.0

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 BPCL. Execution of the work shall be based on the BPCL 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 BPCL. 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 BPCL.

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

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.

17.0 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.

18.0 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.

19.0

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 be 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.

20.0

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.

21.0 VALVE PIT

The valve pit shall be constructed in accordance with enclosed tender drawings.

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.

22.0 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.

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 BPCL'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 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.

23.0 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 BPCL.

24.0 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 execute / supervise the work. However, the assessment on the qualification of the personnel shall be at the discretion of EIC.
- 25.3 Fusion operators and other skilled personnel shall be approved by BPCL 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.

25.0 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 change in alignment/orientation and offset distance etc. of the pipeline in between the above said 20 meters, the same shall be clearly 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.

26.0

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 BPCL. 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**

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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 scope 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 BPCL.
- 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 Contractor shall procure every material, from the outlet of PE/GI transition fitting upto the Domestic/Commercial customers "Appliance/Stove/Oven valve for satisfactory completion to the owner/Owner's representative.
- 2.5 Installation of GI pipes of 1/2", 3/4", 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.

- 2.6 Installation of GI 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 .
- 2.7 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.
- 2.8 Conversion of all types of LPG kitchen appliances to NG based appliances inclusive of supply of nozzles. Signing of Joint Meter Records (JMRs).
- 2.9 To demonstrate to the customer regarding use, safety and maintenance related aspects of NG based appliances and installations.
- 2.10 Testing & Commissioning of installations including purging as per specification and handing over the installation of BPCL/ customer to the entire satisfaction of BPCL.
- 2.11 Dismantling of scaffolding / temporary structures and cleaning of site.
- 2.12 Restoration of walls, flooring and other damages while executing the above ground installation.
- 2.13 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.
- 2.14 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 BPCL..

3.0 MATERIAL, PLANT AND EQUIPMENT

The contractor has to supply all GI Fittings, flexible hose, suraksha hose, Valves, Fittings, Clamps, 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 BPCL informed. The inspection of bought out items

would be carried out by BPCL / Third Party Inspection or as instruction by EIC.

3.1.1 Plant and Equipment

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.

3.1.2 Sealant, grout

The contractor shall be responsible to arrange the supply of any consumable sealant or ready mix grout 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.

3.1.3 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.

3.1.4 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.

3.1.5. 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 and all paints or painting of 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 BPCL 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).

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 / new areas and as directed by EIC. 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 in the tender document. It may vary in case of individual and multistoried flats. A general scheme of distribution to commercial 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 identity cards duly signed by EIC shall only be authorized to take up respective jobs. The contractor has to arrange the identity cards.
- 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 7.0, 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 REFERENCE SPECIFICATION, CODES AND STANDARDS

The contractor shall carry out the work in accordance with this specification, 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) , the American Gas Association Document -Purging Principles and Practice and latest PNGRB guidelines..

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 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.

8.0 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 BPCL.

A survey will be conducted jointly by BPCL 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 a 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.

BPCL 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 BPCL necessary to protect the public.

9.0 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.

10.0 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.

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 GI 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.

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 shall 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 covers pipe work laid from the ground floor level to ceiling level on the 2nd 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 2nd 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 band. 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.

11.0 TESTING OF GI INSTALLATION

- 11.1 The installation from PE/ GI transition fitting up to regulator shall be tested at the [pressure of 6.0 bar(g)].
- 11.2 The testing of GI riser pipe up to regulator shall be done with the isolation valve in open condition and open end plugged.
- 11.3 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.
- 11.4 The GI installation from regulator outlet to appliance valve (except meter) shall 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.
- 11.5 The meter shall 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.
- 11.6 The calibrated pressure gauges of suitable range shall be supplied by the contractor for testing.
- 11.7 The pressure gauges shall be calibrated from time-to-time as desired by Engineer In-charge but positively once in every six months.
- 11.8 The details of testing shall be properly recorded in the measurement cards

12.0 **INSPECTION**

Any defect noticed during the various stages of inspection shall be rectified by the 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 shall be responsible for making good any defects found during final inspection/ guarantee period/ defect liability period as defined in general condition of contract.

13.0 **PURGING & COMMISSIONING**

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 trap 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 and 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 to ensure that the purge outlet is so located that vent gas cannot drift into 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 branches 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. Let the gas flow for a few seconds longer, then turn off and allow sufficient time for any accumulated gas to disperse.

- Turn on one 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.

14.0 INSTALLATION OF METERS

The work in this section includes :

- 14.1 Installation of domestic and commercial meters with associated inlet and outlet connections, on the wall with approved meter brackets and angles. This work is payable under Item No. 2.3.2 of the SOR
- 14.2 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.
- 14.3 Firmly securing the meters on the wall with good quality supply of proper rowel plugs, screws 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.
- 14.4 The same rates of SOR Item 2.3.1 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.
- 14.5 The above activities along with restoration of the area to original shall be carried out to the complete satisfaction of consumer and EIC.

15.0 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 shall 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.

16.0 INSTALLATION OF REGULATORS

1) Regulators (6 bar / 4 bar to 21 mbar)

Boxes for the regulators (6 bar / 4 bar to 21 mbar) shall be supplied and installed outside after due approval of the sample. The boxes shall be installed as per requirement and as per instructions of BPCL / Consultant.

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.

2) Service Regulators (6 bar / 4 bar to 100 mbar)

Service Regulators (6 bar / 4 bar to 100 mbar) shall be installed within a enclosure placed above the ground or in a pit as per the instruction of the EIC.

Enclosures for Service Regulators shall be supplied by the contractor.

All the enclosures shall be thoroughly cleaned, painted with approved colour code. It is to be ensured that the enclosures are painted properly to avoid rusting / weathering. A sketch of Enclosure is enclosed herewith.

In case of pit, the Service Regulator shall be installed along with two valves (one before and one after the regulator) in the pipe line. The pit for Service Regulator shall be constructed as per the sketch / drawing enclosed.

17.0 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 of 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 BPCL'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 premises. The contractor will be required under the Rates to provide both Pin gauges and standard sized nozzles.

18.0 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 seepage to the premises. If the work was carried out in Govt. Flats (PWD), contractor has to restore the area according to CPWD specifications. For governmentflats 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 brickwork should be laid on moist bedding material, which should be graded sand, mortaror 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 piping will only be authorized on satisfactory restoration, and where the sites has been cleared of all surplus materials etc.,

TECHNICAL SPECIFICATION
FOR
GI PIPES

TECHNICAL SPECIFICATION FOR GI PIPES

Service	: Natural Gas
Working Pressure	: 4 bar (g)
Test Pressure	: 6 bar (g)
Working Temperature	: 0°C to 50°C
Material Description	: IS:1239 (Part-I) Heavy Duty (C - Class), 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	: 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, hydro test 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 Pipe shall be supplied in single or double random length of 4 to 7 and 7 to 14 meters respectively.
- 1.4 Galvanised pipes shall be coated with zinc by hot DLF process conforming to IS:4736/ ASTM A53 or by electro galvanising.
- 1.5 Zinc conforming to any grade specified in IS 13229-1991 with latest amendment shall be used for the purpose of galvanizing
- 1.6 **Galvanizing bath** : The molten metal in the galvanizing bath shall contain not less than 98.5 % by mass of zinc.
- 1.7 **Mass of zinc coating** : Minimum mass of zinc coating determined as per IS :6745 shall be 360 gms/m²
- 1.8 **Uniformity of galvanized coating** : The galvanized coating when determined on a 100mm long test piece in accordance with IS 2633 : 1986 with latest amendments shall withstand 5 one minute dips
- 1.9 **Freedom from defect** : The zinc coating on internal and external surfaces shall be uniform adhered reasonably smooth and free from such imperfection as flux, ash and drop inclusion , bare patches, black spots, lumpiness runs , rust stains, bulky white deposits and blisters. Rejection and acceptance of these defects shall be in accordance with Appendix A of IS 2629: 1985 with latest amendments.

2.0 **MARKING AND DESPATCH**

- 2.1 All pipes shall be marked in accordance with the applicable 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.

TECHNICAL SPECIFICATION
FOR
GI FITTINGS

TECHNICAL SPECIFICATION FOR GI FITTINGS

Service	: Natural Gas
Working Pressure	: 4 bar (g)
Pressure Test	: As per Clause 11.1b of IS:1879-1987 with latest amendment on each and every fittings.
Working Temperature	: 0°C to 50°C
Material Description	: IS:14329-1995, latest amendments Grade BM 300
Tolerance	: As per IS 1879 -1987 with latest amendments
Protective Coating	: Fitting should be galvanized as per IS:4759 - 1996 with latest amendments.
Weight	: As per section 2-10 of IS:1879- 1987 with latest amendments.
Inspection	: 100% Pressure Testing shall be carried out at factory
Thread Type	: NPT type conforming to ASME B1.20.1 (External & internal threads shall be tapered. The outlet fittings shall be chamfered.)

1.0 **GENERAL NOTES**

- 1.1 All fittings and their dimensions, tolerance, chemical composition, physical properties, heat treatment, hydro test 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 fittings supplied.
- 1.3 Zinc conforming to any grade specified in IS 13229-1991 with latest amendment shall be used for the purpose of galvanizing
- 1.4 **Galvanizing bath** : The molten metal in the galvanizing bath shall contain not less than 98.5 % by mass of zinc.
- 1.5 **Mass of zinc coating** : Minimum mass of zinc coating determined as per IS :6745 shall be 610 – 700 gms/m²
- 1.6 **Freedom from defect** : The zinc coating on internal and external surfaces shall be uniform adhered reasonably smooth and free from such imperfection as flux, ash and drop inclusion , bare patches, black spots, lumpiness runs , rust stains, bulky white deposits and blisters. Rejection and acceptance of these defects shall be in accordance with Appendix A of IS 2629: 1985 with latest amendments.
- 1.7 **Pressure Test**: Vendor shall carry out pneumatic pressure test as per clause 11.1b of 1879- 1987 with latest amendments on each and every fitting. Vendor to submit the internal quality control certificate for the same. Owner shall witness pneumatic testing as per the sampling procedure specified in 1879 with latest amendments.
- 1.8 **Compression Test** : The test shall be conducted to judge the malleability of the pipe fittings and shall be carried out as per clause 12 of 1879-1987 with latest amendments.
- 1.9 **Sampling**: Owners representative of third party agency inspection agency appointed by owner shall witness the test as per clause 14 of 1879 -1987 with latest amendments. However vendor to 100% inspection of visual , dimensional and pressure test. Vendor shall furnish Internal test certificate at the time of final inspection to the owner.

2.0 **MARKING AND DESPATCH**

- 2.1 All fittings shall be marked in accordance with the applicable 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 All fittings shall be dry, clean and free from moisture, dirt and loose foreign materials of any kind.
- 2.4 All fittings shall be protected from rust, corrosion and mechanical damage during transportation, shipment and storage.

3.0 INSPECTION / DOCUMENTS

- i) Inspect shall be carried out as per BPCL Technical Specification and Inspection Plan / QAP.
- ii) BPCL representative shall carry out stage wise inspection during manufacturing / final inspection.
- iii) 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 BPCL Technical Specification and specified code for 100% material, at the time of final inspection of each supply lot of material.
- iv) Even after third party inspection, BPCL reserves the right to Select a sample of tube randomly from each manufacturing batch and have these independently tested. Should the results of these tests fall outside the limits specified in BPCL Technical specification, then BPCL reserves the rights to reject all production supplied from the batch.
- v) For any control test the date and place of inspection shall be provided by the vendor in writing to the BPCL representative along with Production Schedule.

4.0 PACKING

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

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

Representative of BPCL 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 BPCL'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.

TECHNICAL SPECIFICATION
FOR
ISOLATION & APPLIANCE BALL VALVES

<u>Sl.No.</u>	<u>Description</u>	<u>Page No.</u>
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2.0	MATERIAL SPECIFICATION FOR ISOLATION VALVES	1
3.0	MATERIAL SPECIFICATION FOR APPLIANCE VALVES	2

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 **MATERIAL SPECIFICATION FOR ISOLATION VALVES**

2.1 **Technical Data Sheet**

2.1.1 Item-Isolation Ball Valve with Full Bore, NPT Female (Confirming to ANSI B1.20.1) ends for natural gas application).

2.1.2 Sizes : $\frac{1}{2}$ " , $\frac{3}{4}$ " ..

2.1.3 Body : Hot Pressed/ Forged Brass, Nickel/ Chrome Plated.

2.1.3.1 Ball : Hard Chrome/ Nickel Plated Hot Pressed/ Machined Brass Bar with Teflon Seat.

2.1.5 With operating Knob and locking arrangement with sealing wire and lead seal (Without Key). Valve full open/ close position shall be at 90°.

2.1.6 Maximum Operating Pressure : 4.0 Bar (g)

2.1.7 Hydrostatic Test Pressure : 6.0 Bar (g)

2.1.8 Markings

Markings shall be provided & shall include :

Manufacturer's name or trade mark Model designation.

Rate working pressure in Bar.

Direction of flow, if necessary.

2.1.9 Leakage :The permissible external/ internal leakage shall be specified by the vendor, with reference to relevant code. However, in no case the leakage in both the cases shall exceed 1 ml/ min at maximum working pressure specified.

2.1.10 Mechanical Strength

- i) The body of the valves shall be capable of with standing without deformation or leakage 125 Nm torque, as applied to a pipe being connected to the valve.

- ii) Valve shall be capable of withstanding without deformation or leakage 340 Nm bending moment or an angular displacement of 10° whichever occurs first, if applied to a pipe connected to the valve.
- iii) The valves shall be capable of withstanding 25 Nm impact without breakage or leakage.

3.0 **MATERIAL SPECIFICATION FOR APPLIANCE VALVES**

3.1 Technical Data Sheet

3.1.1 Item

Application 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.

3.1.2 Body : Total body including the nozzle shall be of Hot Pressed/ Forged Brass, Nickel/ Chrome Plated.

3.1.3 Ball - Hard Chrome/ Nickel Plated Hot Pressed/ Machined Brass Bar with Teflon Seat.

3.1.4 With a metallic operating/ knob/ lever for full open/ close at 90° position.

3.1.5 Maximum Operating Pressure : 35 milli Bar (g)

3.1.6 Hydrostatic Test Pressure : 1.0 Bar (g)

3.1.7 Markings

Markings shall be provided & shall include :

- i) Manufacturer's name or trade mark
- ii) Model designation
- iii) Rate working pressure in Bar
- iv) Direction of flow, if necessary

3.1.8 Leakage

The permissible external/ internal leakage shall be specified by the vendor, with reference to relevant code. However, in no case the leakage in both the cases shall exceed 1 ml/ min at maximum working pressure specified.

3.1.9

Mechanical Strength

- i) The body of the valves shall be capable of with standing without deformation or leakage 75 Nm torque, as applied to a pipe being connected to the valve.
- ii) Valve shall be capable of withstanding without deformation or leakage 125 Nm bending moment or an angular displacement of 10° whichever occurs first, if applied to a pipe connected to the valve.
- iii) The valves shall be capable of withstanding 25 Nm impact without breakage or leakage.

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	Temperature (°C)	0-48
	3 Design Condition	
3.01	Pressure	-
3.02	Temperature (°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° 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 Painting	
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
FLEXIBLE HOSE PIPE

Item	:	Flexible Hose Pipe (Type-A) Assembly for Natural Gas Service
Applicable Code	:	BS:6501 Part-I : 1991 Specification for Corrugated Hose Assemblies
Nominal Size	:	12mm
Total Length of Hose Assembly	:	350mm end to end
Movement Required	:	Static
Design Pressure	:	0.25 bar(g) to 20°C
Temperature Range	:	0 – 65°C
Cyclic Life	:	30 Bends when tested in accordance with Cl. 14.4 of BS:6501 Part-I
Static Bend Radius	:	25mm
Type & Material of End Fitting	:	¾" NPT CS Female Swivel Nut with Flat Seat Nipple with Rubber Gasket / `O' Ring and second end shall be CS Male ¾" NPT and threads shall be conforming to ANSI B 20.1 CS Fittings shall be conforming to SA 105/ SA 106 Gr. B. CS Fittings shall be galvanised as per IS:4759-1985. <u>Note:</u> TIG welding shall be carried out for welding CS fittings to corrugated hose.
Material of rubber gasket	:	Polymer NBR/nitrite with Thickness 3-4 mm
Material of Hose	:	304S11 conforming to BS:1449 Part-2
Product to be conveyed	:	Natural Gas
Heat Treatment Requirement	:	Parent sheet or the finished hose must undergo annealing

Tests	:	Pneumatic Test at a pressure of 1.0 bar (g) Type testing as per Cl.Nos. 14.1, 14.2, 14.5 & 14.6 of BS:6501 Part-I
Cleaning & Packaging	:	As per Cl.No. 17.0 of BS:6501 Part-I
Test Certificate	:	As per Cl.No. 18.0 of BS:6501 Part-I

INSPECTION / DOCUMENTS

- i) Inspection shall be carried out as per BPCL Technical Specification and Inspection Plan / QAP.
- ii) BPCL representative shall carry out stage wise inspection during manufacturing / final inspection.
- iii) 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 BPCL Technical Specification and specified code for 100% material, at the time of final inspection of each supply lot of material.
- iv) Even after third party inspection, BPCL reserves the right to Select a sample of tube randomly from each manufacturing batch and have these independently tested. Should the results of these tests fall outside the limits specified in BPCL Technical specification, then BPCL reserves the rights to reject all production supplied from the batch.
- v) For any control test the date and place of inspection shall be provided by the vendor in writing to the Owner /Owner representative along with Production Schedule.

PACKING

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

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4.0	TESTING, CLEANING & PACKAGING
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5.0	MARKING
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6.0	PACKAGING
------------	------------------

7.0	INSPECTION / DOCUMENTS
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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 & 14.6of 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

	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	CORRUGATED FLEXIBLE METAL HOSE	DOCUMENT NO. MEC/TS/05/21/045A	Page 6 of 6
			REVISION : A
			EDITION : 1

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) BPCL representative 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 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.

TECHNICAL SPECIFICATION OF STEEL REINFORCED RUBBER HOSE

**STANDARD TECHNICAL
SPECIFICATION
FOR
STEEL REINFORCED RUBBER HOSE**

SPECIFICATION NO.: MEC/TS/05/21/045B

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2.0	MATERIAL
3.0	DIMENSIONS & TOLERANCES
4.0	FEATURES
5.0	MARKING
6.0	PACKAGING
7.0	INSPECTION / DOCUMENTS

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 and uniformly 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 $\pm 1\%$.

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. Representative of BPCL 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. BPCL 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 BPCL 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 BPCL before starting production.
- vii. For any control test or examination required under the supervision of 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.

TECHNICAL SPECIFICATION
FOR
HDPE PIPES

Contents of TS No. MEC/TS/05/62/037

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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 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

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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 boxes 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 from 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 joined 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 tapping 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 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 proceeding 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 fittings 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 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 then 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 severely damaged and stopping the gas flow is imperative. Its application is of a temporary nature and will provide a relief until a permanent repair can be effected. The section of pipe, which has been bent back, will have to be replaced because of the damage caused by the severity of the bend 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 up 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 Electrofusion 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.

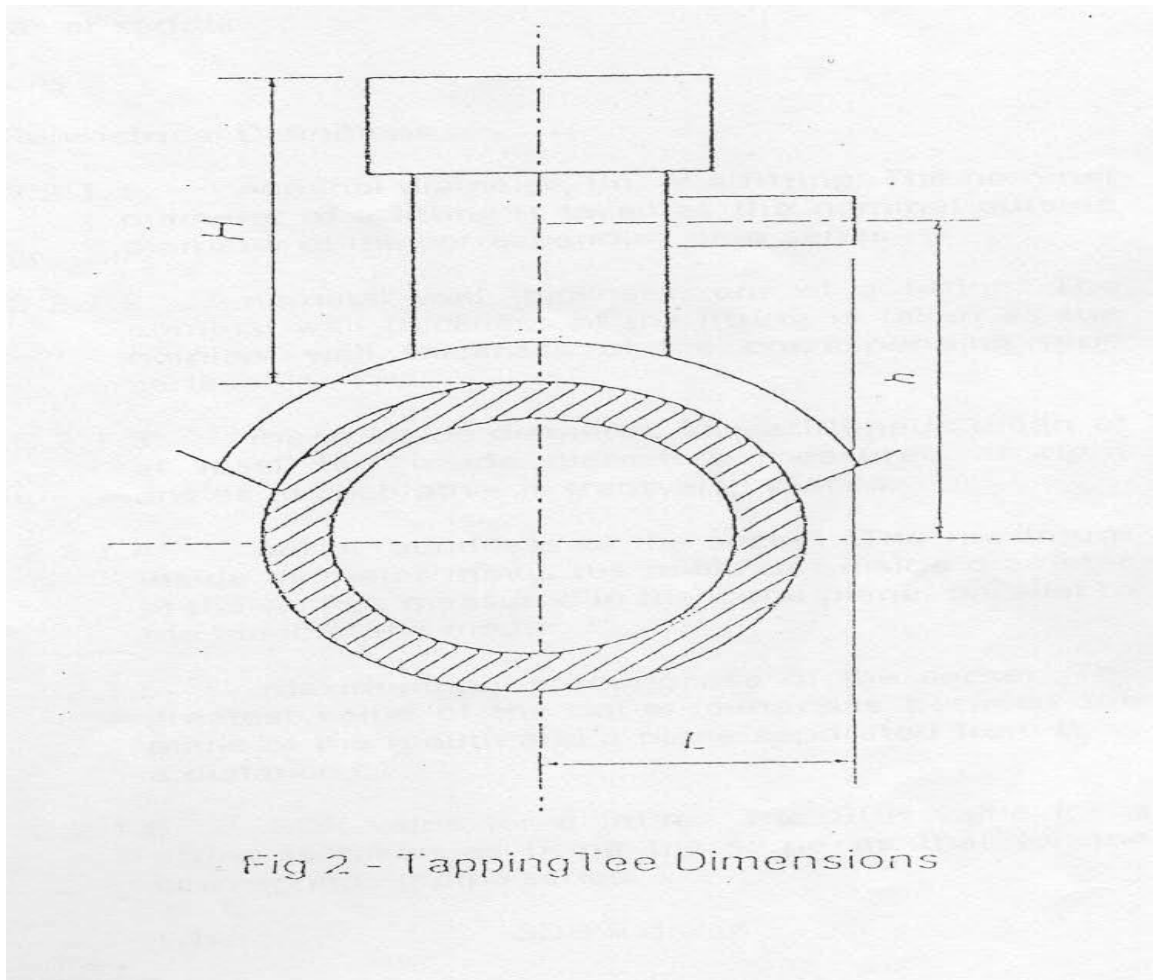
L1 is the depth of penetration of the pipe or of the male end of a spigot fittings.

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 Electrofusion 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.



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. Geometrical Definitions

3.2.1.1 Nominal diameter, d_n , of a fitting:

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, e_n , of a fitting:

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 L_1 .

3.2.1.6 SDR value for a fitting:

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

Where, $SDR = d_n / e_n$

3.2.1.7 Wallthickness,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 th e pressure of th e gas in the piping system.

3.2.2 MaterialDefinition

3.2.2.1 VirginMaterial :

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 OwnReprocessableMaterial :

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 man ufacturer's plant after having been previously processed by th e same manufacturer by a process such as in jecton 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 compon ents of th is standards. The additives shall not have a negative influence on t he performance with respect to feasibility. All additives shall be uniformly dispersed.

3.2.3 DefinitionrelatedtoMaterialCharacteristics

3.2.3.1 LowerConfidenceLimit(LCL):

A quantity with the unit in mega Pascals (MPs), which can be cons idered as a property of th e 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 OverallService(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 MinimumRequiredStrength(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 MeltMassFlowRate(MFR):

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

3.2.4 DefinitionsRelatedtoServiceConditions

3.2.4.1 GaseousFuel:

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

3.2.4.2 MaximumOperatingPressure(MOP)

The maximum effective pressure of the gas in the piping system, expressed in bar, which is allowed in continuous 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 DefinitiononDesignofElectrofusionFittings:

3.2.5.1 ElectrofusionSocketFitting:

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

3.2.5.2 ElectrofusionSaddleFitting:

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

3.2.5.3 TappingTee:

An Electrofusion saddle fitting which contains an integral cutter, to cut through the pipe wall. T he cutter remain s in the body of the saddle after installation.

3.2.5.4 BranchSaddle:

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

3.2.5.5 URegulation :

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

3.2.5.6 IRegulation:

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	$8.00 \leq 1 \text{ cl} \leq 9.99$	5.5 Bar
PE 100	10.0	$10.00 \leq 1 \text{ cl} \leq 11.19$	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	≥ 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	≤ 350		ISO 4437 Annex. A
Water Content (3)	mg/kg	≤ 300		ASTM D 4019
Carbon Black Content	% (m/m)	2,0 ≤.....≤ 2,5		ISO 6964
Carbon Black Dispersion (4)	Grade	≤ 3		ISO DIS 11420
Pigment Dispersion (5)	Grade	≤ 3		ISO DIS 13949
Resistance to Gas Constituents	h	≥ 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 ≥ 250mm				
Or	Mpa	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)				
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 ≥ 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 MDPEPipe:

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

5.3.2 SteelPipe:

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

5.3.2.1 PipeEnd:

One end of the pipe should be bevelled for welding angle of bevel should be $30^{\circ} \pm 5^{\circ}$.

5.3.3 JointingbetweenSteelandMDPEPipes:

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 MD PE Pipes conforming to specification IS:14855/ SDR 11 to threaded G.I. tubing conforming 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 male 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 $23 \pm 2^{\circ}\text{C}$, 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(Includingallformsofsocketfittings)

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 $30 \pm 2^{\circ}\text{C}$.

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 $30 \pm 2^{\circ}\text{C}$.

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 the 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 $\geq$ 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 $\geq$ 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 $\geq$ 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	$0.2 \leq \text{MFR} \leq 1.4$ 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

<u>Sl.No.</u>	<u>Description</u>	<u>Page No.</u>
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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
ISOLATION VALVES

Item	:	PE BALL VALVE
Application	:	Natural Gas Distribution Services
Code	:	ASME B16.40 / EN 1555-4
Rating	:	PE100 SDR 11
Operating Pressure	:	6 bar (g)
Operating Temperature	:	0°C to 60°C
End Connection	:	PE materials (Spigot Type)
Stem Extension	:	Not Required
Valve Design	:	Full Bore
Ball position Indicator	:	Open/Close Limits required

INSPECTION / DOCUMENT

- i) Inspection shall be carried out as per BPCL/consultant's approved Inspection Plan / QAP.
- ii) Third party inspection agency appointed by vendor on prior approval of owner shall carry out stage wise inspection during manufacturing / final inspection.
- iii) 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 owner Technical Specification and specified code for 100% material, at the time of final inspection of each supply lot of material.

PACKING

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

TECHNICAL
SPECIFICATIONFOR
WARNING MATS

SPECIFICATION FOR PE ANTI RODENT WARNING MATS
FOR PIPELINE

Purpose	: For using as a warning sign for Underground Pipeline
Width	: D + 300 mm, D – Dia of Line Pipe
Thickness	: 1.0 mm thick
Material of the mat	: The material shall be of high density Polyethylene of virgin quality and non Biodegradable type. It shall have Non Hazardous, Non Toxic and Anti – Rodent properties.
Colour of the mat	: Golden Yellow with letters printed in RED of non-deletable type with high abrasion resistant.
Art Work	: A sample piece of 30mm wide and 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. Copy of Art work is enclosed at Page 4. The Art work shall be printed in English and local language alternatively at every 1 mtr distance.
Mechanical Properties of HDPE	
Tensile Strength	: Minimum 200 kg/cm ²
Elongation at Break	: Minimum 175%
Bundle Length	: 1.0 mm thick warning mat shall be supplied as 100 mtrs length in each bundle packed in PE Woven sack material.
Tests	: Minimum following test has to be done with each batch of warning mat ➤ Tensile Strength test ➤ Elongation test ➤ Impact Strength test ➤ Color fastness test ➤ Heat Stability test ➤ Print Stability test ➤ Oxidation Induction test ➤ ESCR test ➤ Melt Flow Rate test ➤ Anti-Rodent Test. ➤ UV Stabilizer Test ➤ DSC Scan Test of Raw Material & Finish Goods.
Test Certificates	: Vendor has to submit the all test certificates to Purchaser
Inspection	: The manufacturer has to submit the QAP before commencement of production. Inspection of the material will be done at vendor's works by Third Party Inspection appointed by vendor. Vendor has to submit

all test reports before inspection call. Any test failed during the inspection for the offered lot, the total lot will be rejected.

Documentation

: Vendor shall submit all test reports including document regarding Toxicology data & ROHS compliance, documentary evidence regarding Non-biocide product, value of Lethal Dosage (LD), value of % dermal toxicity, details of active ingredient in the product and final inspection reports along with the supply of materials.

**HIGHLY INFLAMMABLE GAS PIPELINE
BELOWBHARAT PETROLEUM CORP.
LTD.**

BPCL

**IN EMERGENCY PLEASE CONTACT
PHONE NOS.**

**ELECTRICAL &
INSTRUMENTATION SECTION**

TECHNICAL SPECIFICATION

**PERMANENTLY LUBRICATED
TELECOM **HDPE** DUCT & ACCESSORIES**

Contents

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1.0

SCOPE

This specification covers the minimum generic requirement of permanently self-lubricated high Density Polyethylene ducts (PLB HDPE ducts) for use as underground conduits for optical fibre cables and associated accessories, suitable for installation of OFC by blowing technique.

The scope of work shall include supply of PLB HDPE ducts and the accessories as per the specification/ requirements given in this document.

However Optical Fibre Cable shall be laid in a permanently lubricated HDPE pipe using blowing technique.

1.1 Supply of special tools and tackles as mentioned in the bills of quantity.

1.2 Supply of complete technical literature and documentation as defined in Section 10.

1.3 Quality Assurance and testing as described at section 9, to the complete satisfactory of the Owner/ Consultant and/or third appointed agency.

2.0

REFERENCE DOCUMENTS

Unless otherwise specified, this document requires references to the latest standards of the following:

IS 2530	Methods for test for Polyethylene Molding Materials and Polyethylene Compounds
IS 4984	High Density Polyethylene Pipes for water supply
IS 7328	High Density Polyethylene materials for molding and extrusion
IS 9938	Recommended colours for PVC insulation for LF wires and cables
IS 12235 (Part – 9)	Methods of test for unplasticized PVC pipes for potable water supplies – Impact strength at 0°C
IS 14151 (Part – 1)	Polyethylene pipes for sprinkler irrigation systems (Part – I Pipes)
ASTMD 1693	Test method for environmental stress cracking of ethylene plastics.

3.0

PLB HDPE Duct Specification :

3.1 The PLB HDPE duct shall consist of two concentric layers, the outer layer being HDPE, co-extruded with an inner layer of solid permanent lubricant, to reduce the internal coefficient of Friction (ICF). The lubricant shall be of a solid layer of uniform thickness so formulated to provide a permanent, low friction boundary layer between the inner surface of the duct and Optical Fiber cable. The lubricant layer shall be clearly visible in cross-section, concentric with the outer layer.

3.2 Alternatively the duct can be of a homogenous construction (without a separate inner layer) meeting all the requirements of this specification.

3.3 The PLB HDPE duct shall be supplied in a continuous length in coil form, suitable for shipping and handling purposes.

3.4

MATERIAL

3.4.1 **Two Layer Construction**

3.4.2 Outer Layer

The base HDPE rein used for the outer layer of the PLB HDPE duct shall conform to any designation of IS – 7328 or to any equivalent standard meeting the following requirements, when tested as per IS – 2530. However, the manufacturers shall furnish the designation for the HDPE resin as permanently IS – 7328 as applicable.

- a) Density : 0.940 TO 0.958 g/cc AT 27°C
- B) Melt Flow Rate (MFR) : 0.2 to 1.1 g/10 minutes at 190°C & 5 kg load.

3.4.3 Inner Layer

The inner lubrication material shall be of friction reducing, polymeric material which shall be integral with HDPE layer. The lubricant materials shall have no toxic or dermatic hazards for safe handling. In the finished PLB HDPE duct, the co-extruded layer of solid permanent lubricant shall be integral part with HDPE and shall be white in colour and clearly visible in cross-section of duct.

- 3.4.4 The inner layer of solid permanent lubricant shall be continuous all through and shall not come out during storage, usage and throughout the life of the duct.

3.5 **Homogenous Construction:**

The HDPE material used for this construction shall meet the requirements listed in clause 4.1.1, such that the finished duct shall satisfy the internal Co-efficient of friction (ICF) and all other requirements of this specification.

- 3.6 The raw material (s) used for the duct shall meet the following requirements :

- i) The anti-oxidants used shall be physiologically harmless.
- ii) None of the additives shall be used separately or together in quantities as to impair long term physical and chemical properties of the duct.
- iii) Single pass rework material of the same composition produced from the manufacturer's own production shall be used and it shall not exceed 10% in any case.
- iv) The raw material used for extrusion shall be dried the moisture content to less than 0.1%.
- v) Suitable UV stabilizers shall be used for manufacturer of the duct to protect against ultra violet degradation, when stored in open for a minimum period of 8 months.
- vi) The raw material used in the manufacturer of the duct shall be such that the service life of the duct and all its accessories can be expected to be more than 50 years including the life of permanent lubricant.

4.0 **PLB HDPE DUCT ACCESSORIES**

- 4.1 The following accessories are required for jointing the ducts and shall be supplied along with the ducts. The manufacturers shall provide complete design details, procedure for method of installation and type/ grade of the material used for the accessories. The qty. will be as per material requisition (MR).

- a) **Plastic Coupler**

It is used to couple two ducts. The design of this shall be simple, easy to install and shall provide airtight and water tight joint between the two ducts. The coupler shall ensure that the two ducts are butted smoothly without any step formation in the inner surface. The jointing shall meet the air pressure test of 10 kg/cm² for a minimum period of 2 hours without any leakage.

b) **End Plug.**

This is for sealing the ends of the empty ducts, prior to installation of the Optical Fiber Cable and shall be fitted immediately after laying of the duct, to prevent the entry of any dirt, water, moisture, insects/ rodents etc.

c) **Cable Sealing Plug**

This is used to seal the ends of the ducts perfectly, after the cable is installed in the duct, to prevent the entry of dirt, water, moisture, insects/ rodents etc. This is required at all places where cable has come out of the duct either for jointing or entry into the building as required. The sealing plug shall be capable of accommodating standard sizes of optical fibre cable taking into account the variation in diameter due to tolerance limits, etc.

d) **End Cap**

This cap is made of hard rubber, shall be fitted into both ends of duct coil after manufacturing the duct. This shall avoid entry of duct, mud and rainwater into the duct during the transit and storage.

Note: The Accessories in clause 6.1 (b) and (c) shall be tested for air tightness with a pressure of 1 bar for 30 minutes. For carrying out the tests for the above accessories suitable length of duct shall be taken.

4.2

The following additional tools are required for jointing for the ducts and installation for optical fibre cable. These items can be procured as per the Manufacturer/ Supplier's specification, as and when required by the Owner. (This is required if exclusively mentioned in the Material Requisition).

a) **Duct Cutter**

This is required to cut the duct ends squarely without any burr or notch.

b) **C-Spanner**

This is required to tighten Plastic Coupler properly so as to ensure air/watertightness as specified above.

c) **Blowing Equipment**

The equipment used for installing optical fibre cable by blowing technology shall be capable of pushing 1 km (minimum) cable into the duct with powerful air stream generated by a compressor. The compressor shall have the following characteristics:

Pressure	:	Min 8 bar Max. 12 bar
Flow rate	:	10 m ³ / minute

The mechanical feeder of the equipment shall not cause any damage to the sheath/ jacket of the optical fibre cable.

5.0

INSPECTION AND TESTS:

The manufacturer shall perform all inspection and test as per the requirements of this specification and the relevant codes, prior to shipment at this works. Such inspection and test shall be, but not limited to the following:

5.1 Visual Inspection

The ducts shall be checked visually for ensuring good workmanship that the ducts shall be free from blisters, shirks hole, flaking, chips, scratches, roughness, break and other defects. the ducts shall be smooth, clean, round. The ends shall be cleanly cut and shall be square with axis of the duct.

5.2 The colour of the duct shall be green and uniform throughout. Each duct shall contain 4 approximately equi-spaced continuous longitudinal stripes of width 3-mm minimum in white colour. These stripes shall be co-extruded during manufacturing. The material of the stripes shall be same as that of base compound for the duct.

5.2.1 In the case of two layer construction the inner layer (Soil Lubricant) shall be white in colour.

5.2.2 The colours of the duct, stripe and inner layer (in the case of two layer construction) shall be identifiable under normal lighting conditions and generally conform to IS-9938.

5.3 Dimension of Ducts

The nominal size of the ducts shall be 40/33 mm & 32/26 mm and shall meet the following requirements.

	<u>40 mm/ 33 mm</u>	<u>32 mm/ 26 mm</u>
a) Outside diameter	40 mm + 0.4 mm	32 mm + 0.3 mm
b) Wall thickness	3.5 mm ± 0.2 mm	3.0 mm ± 0.2 mm
c) Standard length	1000 ± 100 mtr.	1000 ± 100 mtr.
d) Maximum Outer Diameter of Optical Fiber Cable (OFC) that can be Installed by air blowing Technique	16 mm	12 mm

Note: Selection of duct size will depend on the outside diameter of the Optical Fiber Cable (OFC) to be installed.

5.4.1 Tensile Strength and Elongation

The samples removed from the PLB HDPE ducts when tested as permanently IS-14151 (Part – I) shall meet the following requirements.

Tensile Strength : Min 20 N/mm²

Elongation : Min. 350%

5.4.2 Reversion Test:

The test shall be carried out as per IS-4984. For this purpose, a duct length of 200 mm shall be placed horizontally in an air-oven or a suitable liquid bath on a support at $110 \pm 2^\circ\text{C}$ for 60 minutes so that the dimensional change in duct section are not impeded. After cooling to room temperature the dimensional change of the duct section shall be measured in the longitudinal direction and the deviation from the initial length shall be calculated and stated in percentage. The dimensions shall not changes by more than 3% in the longitudinal direction.

5.4.3 Environmental Stress Crack Resistance Test:

The specimen cut from the PLB HDPE ducts shall meet the environmental stress cracking as described in ASTM D-1693, when tested with 10% Igepal (CO 630) solution at $50 \pm 1^\circ\text{C}$ for 96 hours. There shall be no failure.

5.4.4 Impact Strength Test:

The test has to be carried as per IS-12235 (Part – 9). A sample duct 150 mm in length shall be placed on heavy rigid block whose faces are at an angle of 120° . A striker with a hemispherical nose of 13 mm radius and loaded to a total weight of 10 kg shall be allowed to fall freely in a suitable vertical guides through a height of 1.5 m before striking the duct. The line of fall of the striker shall coincide with the diameter of the duct. The duct shall not crack or split.

5.4.5 Crush Resistance Test :

Samples of duct of $150 \text{ mm} \pm 2 \text{ mm}$ in length shall be subjected to a dead load of not less than 50 kg for one minute and shall be allowed to recover for 5 minutes. The deflection with load on and after recovery period shall not exceed 10% and 2% respectively.

5.4.6 Mandrel Test:

A 150 mm long mandrel of diameter, 3 mm less than the internal diameter of the duct shall be passed through a 5 meter length of duct, freely throughout the length, when the duct is bent to a radius of 5 meters.

5.4.7 Ovality Test:

Ovality is the difference between maximum outside diameter and the minimum outside diameter at the same cross-section of the duct, at 300 mm away from the end. The ovality for 40/33 mm and 32/26 mm ducts, when measured as per IS_4984 shall not exceed 1.4 mm and 1.3 mm respectively.

5.4.8 Coil Set Test :

The PLB HDPE duct shall unroll off the drums without snaking or waving having zero coil set. Thus the duct shall lay straight into the trench without re-coiling. For this purpose, when a minimum length of 50 meters duct taken from the coil and laid on the ground, it shall be straight without any bends or kinks and without deformation, except 5 meters from each end.

5.4.9 Oxidation Induction Test:

The induction time in oxygen when tested with a copper pan as per method in Annexure – I, shall not be less than 30 minutes.

5.4.10 Hydraulic Characteristics :

The duct shall be tested for internal pressure creep rupture test as per IS-4984. For this purpose, a sample length of 10 times the outside diameter of the duct shall be taken. At the end of the test, the sample shall not show signs of localised swelling or leakage and shall not burst during the test duration. The test showing failure within a distance equivalent to the length of end cap from the end shall be disregarded and the test repeated. The test temperature and the duration of the test shall be as follows:

Test	Test Temp $^\circ\text{C}$	Test Duration (Hrs.) (Min, holding time)	Induced Stress (Mpa)
Type Test	80	165	3.5
Acceptance test	80	48	3.8

5.4.11 Internal Co-efficient of Friction:

The internal Co-efficient of Friction when tested as permanently method in Annxurer – II, shall not exceed 0.06, when tested with respect to Nylon jacketed unarmored Optical Fiber Cable i.e., 24 F Fiber or 12 F as required.

5.4.12 Optical Fiber Cable Blowing Test:

For this test an Optical fiber Cable of a diameter nearest to the diameter indicated in this specification, relevant to the size of duct under test shall be installed by blowing of the cable in a length of 1 km of the duct. The duct shall be laid with bends in the horizontal and vertical planes and a raise in the middle. The 1 km section shall include twocouplings at suitable locations.

The OFC shall then be blown out. It shall be inspected for any visual damage. The OFC shall then be blown in again.

It shall be possible to blow in the Optical Fiber Cable through the 1 km duct, each time in not more then 30 minutes. There shall be no visible damage to OFC.

The test will be conducted on two samples out of the five submitted for Type Approval.

5.4.13 Owner/ Consultant reserves the right to perform stage – wise inspection and witness tests as indicated above at manufacturer's works prior to shipment. Manufacturer shall give reasonable access and facilities required for inspection to the Owner / Consultant Inspector.

Owner/ Consultant reserved- the right to require additional testing at any time to confirm or further investigation a suspected fault. The cost incurred shall be to manufacturer's account. In no case shall any action Owner/ Consultant or his Inspector relive the manufacturer of his responsibility for material, design, quality etc. Inspection and test performed / withered by the Owner/ Consultant Inspector shall in no way relieve the manufacturer's obligation to perform the required inspection and test.

5.4.14 Test Certificate

Manufacturer shall submit all the test report of the test performed as per above requirement.

The certificates shall be valid only when signed by Owner/ Consultant Inspector. Only the certificate material shall be dispatched from manufacturer works.

6.0 **IDENTIFICATION MARKINGS**

The duct shall be prominently marked with indelible link, with the following information at intervals every meter to enable identification of the pipe. The size of ink markings shall be distinct, clearly and easily visible.

- ⌚ BPCL Name
- ⌚ BPCL Logo
- ⌚ Manufacturer's Name (Also can be abbreviated form)
- ⌚ Name of the duct with size
- ⌚ Machine number/ specific serial number of the duct
- ⌚ Date of manufacturing
- ⌚ Sequential length marking at every meter.

7.0 **TYPE APPROVAL AND ACCEPTANCE TEST :**

7.1 All the tests mentioned in this document shall be carried out on the 5 standard lengths of ducts and the samples must pass these tests before according the type approval. The supplier shall furnish 5 standard length for carrying out these tests for according type approval. Bulk manufacturer and supply shall start only after issue of type approval. The type approval certificate shall clearly indicated the type/ grade/ source of high-density polyethylene raw material, the size of the duct and the construction of the duct i.e., Two layer of Homogenous.

7.2 Fresh type approval shall be obtained whenever grade/ source of raw material HDPE resin or Solid Lubricant is changed.

7.3 **Acceptance Tests**

7.3.1 The acceptance tests shall be carried out on samples from the lot as per Table – 1 for Dimensional and Visual requirements. The requirements for Tensile Strength & Elongation, Reversion Test, Environmental Stress Crack resistance, Impact Strength, Crush resistance, Oxidation Induction Test, Hydraulic Characteristics and internal Co- efficient of Friction shall be carried out as per Table – 2.

7.3.2 The Owner at his discretion at any point of time can modify the acceptance tests and the sampling plan.

8.0 **STORAGE**

All the material shall be stores in the manufacturer's premises in such a manner that it will not affect the performance of the product.

9.0 **QUALITY ASSURANCE PROGRAM & TESTING**

9.1 **Quality Assurance Program**

- a) Vendor shall submit the details for Quality Assurance Program followed by him beginning with raw materials, fabricated components, assemblies, etc., to finished product (AS Applicable). Vendor shall obtain and forward the Quality Assurance Program for equipment supplied by Sub-contractor.
- b) The Owner/ Consultant and/ or third appointed agency reserves the right to inspect and test duct and accessories etc. at all stages of production and testing. The inspection and testing shall include but not be limited to materials, sub-assemblies, prototypes, produced units, guaranteed, performance specifications etc.
- c) For factory inspection and testing, vendor shall arrange all the is required e.g., quality assurance personnel spaces, test gear etc., for successful carrying out of the job by the Owner's respectively at vendor's cost at the vendor's/ Manufacturer 's works.
- d) Owner's representatives shall have free entry and access to any and all parts of the Vendor's facilities associated with manufacturing and testing of the system at any given time.
- e) It shall be explicitly understood that under no circumstances shall any approval of the Owner or his representatives relieve the vendor of his responsibility of material, design, quantity assurance and the guaranteed performance of the system and its constants.
- f) Vendor shall invite the Owner/ Consultant, at least 30 days in advance, of the date on which material shall be ready for inspection and testing. All relevant documents and manuals approved engineering drawings, etc shall be provided to the Owner's / consultant's representative's well in advance of the start of inspection

and Testing.

- g) Owner/ Consultant shall, after completion of inspection and testing to their satisfactory, issues factory acceptance certificate to release duct / accessories for shipment. No. Duct / accessories shall be shipped under any circumstances unless a factory acceptance certificate has been issued for it, unless agreed otherwise by Owner/ Consultant.

h) **PLB HDPE Duct Testing**

Factory testing shall be conducted for acceptance of the duct at the manufacturing facility, wherefrom duct is offered for this project before final acceptance, as per the approval test plan

i) **Accessories Testing :**

Accessories shall be tested before final acceptance, as per the approved test plan.

j) **Test Instruments :**

- i) Vendor shall arrange all test equipment's/ instruments, manpower, test-gear, accessories etc. necessary for testing.
- ii) All technical personnel assigned by vendor shall be fully conversant with the system specifications and requirements. They shall have the specific capability to make the system operative quickly and efficiently and shall not interface or be interfered by other concurrent construction and commissioning activities in progress. They shall also have the capability to incorporate any minor modification/ suggestions put forward by Owner/ Consultant.

- iii) Power supply required for testing shall be arranged by the vendor

iv) Test Plane

Vendor shall submit to owner and consultant 'Test Plans' well in advance of commencement of actual testing.

The plans shall include:

- Functional and performance description (in short) and tests to be conducted and purpose of test.
- Test procedures (including time schedule for the tests) and identification of test inputs details and desired test results.

v) Test report

The observation and test results obtained during various tests conducted shall be compiled and documented to produce test reports by vendor. The test reports shall be given for each equipment / items and system as a whole. The report contain the following information to a minimum/

vi) Test Results

- Comparison of tests results with anticipated test result as given in test plans and reasons for deviations if any,
- The data furnished shall prove convincingly that:
- The system meets the Guaranteed performance objective.
- Mechanical/ Optical/ Electrical limits were not exceeded.
- Failure profiles during the tests are well within the specified limits.

10.0 **VENDOR DATA REQUIREMENTS AND DOCUMENTATION**

10.1 All the documents shall be in English language only.

10.2 Six sets of documents shall be supplied with final submission.

10.3 With the initial bid, the following documents shall be submitted

- i) Duct Construction Details and Duct Life.
- ii) Accessories Details.
- iii) Technical Literature etc.

10.4 Following documents shall be supplied to Owner/ Consultant in order to start Factory Acceptance Testing

a) For Review Approval

- i) Detailed Testing procedure for Duct.
- ii) Detailed test procedure for accessories
- iii) Quality assurance program
- iv) Any other data/ documents not specifically mentioned but required for the satisfactory completion of the work

b) For Information

- i) Detail technical Literature and manuals for duct & accessories
- ii) Installation, Maintenance & Operation Instruction Manual for all the supply items

11.0 **PACKAGE AND DELIVERY**

The store shall be supplied in coils of suitable size for delivery in such a manner that they arrive at their destination in a safe and undamaged condition and will permit the loading, unloading and handling of the stores using standard moving equipment. The minimum inner bending diameter of technical coiled duct shall be 25 times the outer diameter of the cut. The material used for packaging wrapping sealing, moisture, resistant, corrosion prevents etc. as per applicable shall be of recognized brands and shall conform to best standards for packaging. The packing shall protect the material from impact vibration rough handling rain, dust, damp, insects, rodents etc., Each packing should have packing slip and test dispatch clearance documents.

Table – 1

SCALE OF SAMPLING FOR VISUAL AND DIMENSIONAL, REQUIREMENTS

No. of coils (Duct) in the Lot	Sample No.	Sample Size	Cumulative Sample Size	Acceptance No.	Rejection No.
(1)	(2)	(3)	(4)	(5)	(6)
Up to 150	First	13	13	0	2
	Second	13	26	1	2
151 to 280	First	20	20	0	3
	Second	20	40	3	4
281 to 500	First	32	32	1	4
	Second	32	64	4	5
501 to 1200	First	50	50	2	5
	Second	50	100	6	7
1201 to 3200	First	80	80	3	7
	Second	80	160	8	9
3201 to 10000	First	125	125	5	9
	Second	125	250	12	13
10001 to 35000	First	200	200 400	7	11
	Second	200		18	19

Criteria:

The number of ducts given for the first sample in Column 3 shall be examined for dimension and visual requirements. A duct failing to satisfy any of these requirements shall be considered as defective. The lot shall be deemed to have satisfied these requirements, if the number of defectives found in the first sample are less than or equal to the corresponding acceptance number given in Column 5. The lot shall be deemed not to have met these requirements if the number of defectives found in the first sample is greater than or equal to the corresponding rejection number given in Column 6. If, however, the number of defectives found in the first sample, lies between the corresponding acceptance and rejection numbers given in Column 5 and 6, the second sample of the size given in Column 3 shall be taken and examined for these requirements. The lot shall be considered to have satisfied these requirements, if the number of defectives found in the cumulative sample is less than or equal to the corresponding acceptance number given in Column 5 otherwise not.

TABLE – 2

SAMPLING FOR ACCEPTANCE TESTS

A separate sample size for each of the tests shall be taken as stipulated at random from the samples already examined for dimensions and visual inspection. All the ducts in each of the sample size shall be tested for compliance for the requirements for as per clause 5.4 of technical specification:

- (a) Tensile Strength & Elongation
- (b) Reversion Test
- (c) Environmental Stress Crack Resistance
- (d) Impact Strength
- (e) Crush Resistance
- (f) Oxidation Induction Test
- (g) Hydraulic Characteristics
- (h) Internal Co-efficient of Friction

The lot shall be considered to have met the requirements of these tests, if none of samples tested fails.

No. of Coils	Sample Size
Up to 150	3
151 to 1200	5
1201 to 35000	8

OXIDATION INDUCTION TEST FOR PLB HDPE DUCT

- 1.0 A short length of completed duct (approximately 30 cm) shall be sealed at the ends and placed in an oven at temperature of $68 \pm 1^{\circ}\text{C}$ for 8 hours. The sample shall then be allowed to cool at room temperature for at least 16 hours. The sample shall be clean and dry. The sample shall then be tested by means of a Differential Scanning Calorimeter (DSC) or by Differential Thermal Analyser (DTA).
- 2.0 **INSTRUMENT TEST PROCEDURE :**
- 2.1 **Cell cleaning:** The cell shall be held at approximately 400°C for 10 minutes in Nitrogen. The cell shall be cleaned after standing over night and between testing of different formulations.
- 2.2 **Temperature Calibration:** This has to be done according to the instrument manual. The temperature scale should be adjusted until the determined melting point of pure Indium metal is 156.6°C at a heat rate of 5°C per minute or any other heat rate as indicated in the manual of the equipment is permitted.
- 2.3 **Copper Pan Preparation:** Prepare fresh oxide coatings by holding the pan in the flame of Fisher burner until it begins to glow (about 3 seconds). Remove the pan from the flame and immediately cool in a gentle stream of air. A fresh pan shall be used for each test, and the copper shall be of electrolyte grade.
- 2.4 **Sample Preparation:** Take the sample weighing about 5 mg from the duct conditioned as indicated above. Position the sample in the center of the copper pan. Cover with clean 316 stainless steel screen (40 mesh) and crimp the pan.
- 2.5 **Nitrogen Purge:** Place the sample pan and reference pan in instrument cell. Flush for 5 minutes with cylinder of nitrogen (99.6% extra dry grade) at 60 ± 10 cc per minute.
- 2.6 **Oxidation Test:** Rapidly increase the temperature of the sample ($20^{\circ}\text{C}/\text{min}$ or greater) from 100°C or lower initial temperature to $199 \pm 1^{\circ}\text{C}$. After thermal equilibrium is obtained (steady recorder signal) switch to 80 ± 20 cc per minute oxygen flow and simultaneously start time-base recording. The oxygen used for the test should be equivalent to or better than 99.9% extra dry grade.

2.7

Induction Period: The oxygen induction point shall be recorded as time zero, and the chart speed shall be sufficient to provide a clearly discernible slope at the start of the exothermic reaction. The test in the pure dry oxygen atmosphere shall continue until the exothermic peak is produced. The intersection of the tangent of the exothermic sloped line with the extended base line will be drawn. The time from time zero to this intersection point is read from the base line and recorded as the oxidative induction time.

INTERNAL CO-EFFICIENT OF FRICTION TEST FOR PLB HDPE DUCT

1. SCOPE:

These procedure details the method employed to determine internal friction properties of the duct.

2. APPARATUS :

Extensometer machine, circular test fixture of diameter 750 mm (capable of having secured to it), 25 kg weight, optical fibre cable and pulley wheel.

3. METHOD:

- a) A suitable length of the duct, per-conditioned at $23 \pm 2^{\circ}\text{C}$ for 2 hours, shall be secured to the text fixture such that the sample completes a 450°C wrap. With one end extending vertically 200 mm towards the floor.
- b) A suitable length of optical fibre cable shall be inserted into the sample.
- c) The extensometer and the test fixture shall be aligned and secured from movement.
- d) The 25 kg tail weight shall be attached to the optical fibre cable extending from the 200 mm vertical extension of the sample such that there is a minimum free travel of 150 mm for the weight.
- e) The other end of the optical fibre cable shall be attached via a pulley, to the extensometer such that the planes of travel are in no direction diagonal and there shall be slack remaining in the optical fibre cable.
- f) The extensometer shall be operated, and the maximum load applied, in lifting the 25 kg weight to a minimum travel of 150 mm shall be noted.
- g) Extensometer conditions
Load : kg or Newtons
Speed : 500 mm / minute
Mode : Tension

4. The co-efficient of friction shall be calculated by the following equation:

$$\text{Internal Co-efficient of Friction (ICF)} = \log_e (T1/T2) / Q$$

Where, T1 = Pulling force in kg;

T2 = 25 kg

Q = Angle of the subtending arc between T1 & T2 in radians (i.e. $450^{\circ} = 7.85398$ radians)

**SPECIFICATION
FOR
PIPELINE MARKERS**

CONTENTS

<u>SL.NO.</u>	<u>DESCRIPTION</u>
1.0	SCOPE
2.0	REFERENCE CODES AND DRAWINGS
3.0	GENERAL
4.0	AERIAL MARKERS
5.0	KILOMETRE MARKERS
6.0	PIPELINE WARNING SIGN
7.0	ROW BOUNDARY MARKERS
8.0	DIRECTION MARKERS
9.0	NAVIGABLE WATERWAY PIPELINE CROSSING WARNING SIGN
	REFERENCE DRAWINGS

1.0 **SCOPE**

1.1 This specification covers the minimum requirements for supply, fabrication and erection of pipeline markers to be installed by CONTRACTOR at various locations along the route of a cross-country pipeline.

1.2 This specification shall be read in conjunction with the conditions of all specifications and documents included in the CONTRACT between COMPANY and CONTRACTOR.

2.0 **REFERENCE CODES**

Reference has been made in this specification to the latest revision of the following code :

AP I RP 1109 : Recommended practice for marking liquid petroleum pipeline facilities.

3.0 **GENERAL**

3.1 CONTRACTOR shall supply, fabricate and install the pipeline markers along the pipeline route. The locations of markers as indicated in the approved drawings shall be treated for guidance purposes only and the exact location of the markers shall be based on AS BUILT drainage and as directed by COMPANY.

3.2 The pipeline markers shall be fabricated, painted (Painting shall be in accordance with the Standard Specification for Shop & Field Painting) and installed in accordance with the standard drawings included herein. Before start of fabrication of the markers, CONTRACTOR shall prepare and submit for BPCL's approval the detailed scheme for the marker plates as applicable for the project.

3.3 The pipeline markers shall be installed, as far as possible, at locations such that to cause no hindrance to the regular use of the land or to the traffic.

4.0 **AERIAL MARKERS**

Aerial markers shall in general be installed along the pipeline at every five (5) kilometres intervals and at places specified by BPCL.

5.0 **KILOMETRE MARKERS**

Kilometre markers shall in general be installed along the pipeline between the aerial markers at every one (1) kilometre interval. Markers shall indicate cumulative distance in kilometres from the reference station, as directed by COMPANY. A kilometre marker is not required if the relative length between its location and any pipeline warning sign is less than 200 metres.

PIPELINE WARNING SIGN

Pipeline Warning Sign shall in general be installed at

- National and State Highway Crossings (2 Nos.)
- Other Road Crossings (1 No.)
- Railway Crossings (2 Nos.)
- Minor Water Crossings (less than 15m width) (1 No.)
- Minor Water Crossings (above 15m width) (2 Nos.)
- Major Water Crossings (2 Nos.)

- Valve Station (1 No.)
- And at any other location as shown in the approved drawings and as directed by the COMPANY.

Pipeline Warning Sign shall identify the existence of the pipeline and display the name of BPCL with an emergency telephone number, as shown in Standard Drawing No. MEC/TYP/05/21/10/003 for details.

7.0 **ROW BOUNDARY MARKERS**

Right-of-Way boundary markers shall be fabricated and installed as per the drawings at every 250 metres interval along the entire pipeline route. These shall be installed on either side of the pipeline alignment to define the ROW boundary limits. These shall also be installed at pipeline turning points to maintain the continuity of the ROW limits. Refer Standard Drawing No. MEC/TYP/05/21/10/001 for details.

8.0 **DIRECTION MARKERS**

Direction markers as shown in Drawing No. MEC/TYP/05/21/10/006 shall be installed to identify the significant turning points of the pipeline during aerial traverse. One direction marker shall be installed at each turning point, in addition, two more direction markers shall be installed along the pipeline alignment, one on either side of the turning point at 200m from the turning point.

9.0 **SPECIAL MARKERS**

As directed by Company, Special Marker shall be installed at Location where the following changes take place :

- Change in pipeline diameter and wall thickness.
- Change in type of pipe.
- Change in class locations for pipeline conveying gas.

The above data may be provided on other types of marker (except RoU boundary marker), if the relative distance between the two does not exceed 100 m.

10.0 **NAVIGABLE WATERWAY PIPELINE CROSSING WARNING SIGN**

The Navigable Waterway Pipeline Crossing Warning Sign shall be fabricated in accordance with Standard Drawing No. MEC/TYP/05/21/10/004. Such Warning Sign shall be installed one on each bank of navigable water courses at the pipeline crossing location, in lieu of the Pipeline Warning Sign described in clause 6.0 of this specification.

SPECIFICATION FOR HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT

CONTENTS

<u>SL. NO.</u>	<u>DESCRIPTION</u>
1.0	SCOPE
2.0	REFERENCES
3.0	REQUIREMENT OF HEALTH, SAFETY & ENVIRONMENT (HSE) MANAGEMENT SYSTEM TO BE COMPLETED BY BIDDERS.
4.0	DETAILS OF HSE MANAGEMENT SYSTEM BY CONTRACTOR
5.0	RECORDS

ANNEXURE-A
ANNEXURE-B
ANNEXURE-C
ANNEXURE-D
ANNEXURE-E

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 BPCL & 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 BPCL'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 BPCL. 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

BPCL 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 BPCL 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 BPCL representative shall be resolved forthwith by Contractor. Compliance report shall be submitted to BPCL 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 BPCL. The compliance of any observation shall be arranged urgently. Contractor shall assist BPCL 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 BPCL.

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; BPCL 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).

Sr. No.	VIOLATION OF HSE NORMS	PENALTY AMOUNT	REPORTING AUTHORITY
NON ADHERENCE OF WORK PERMIT CONDITIONS			
1.	Working without proper Authorisation /Permit (Cold work)	Rs 6000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
2.	Hot work without proper Authorisation/ Permit	Rs. 12000/- per occasion and delisting / holiday listing of 3 years if repeated.	Engineer-in-charge, CGD Head or their authorized representative

3.	Violation of any of the conditions specified in the permit	Rs 2000/- per permit.	Engineer-in-charge, CGD Head or their authorized representative
4.	Use of mechanically propelled equipment/engine/generator set without/ with faulty spark arrestor	Rs. 1000/- per equipment	Engineer-in-charge, CGD Head or their authorized representative
5.	Non-display of name board, permit etc., at site	Rs 600/- per location Where job is being executed. Penalty will be repeated if not rectified within 3 days.	Engineer-in-charge, CGD Head or their authorized representative
VIOLATION OBSERVED WHILE WORKING AT HEIGHT (Mainly applicable for LMC works or wherever required as per site conditions)			
6.	Working at height without safety belt arrangement as required i.e. without safety belt / Non use of double lanyard safety belt.	Rs 1000 / per person	Engineer-in-charge, CGD Head or their authorized representative
7.	Throwing up/down any material from height or not making proper provision to bring down material safely from height	Rs. 1000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
8.	Non standard/unsafe platform/ladder	Rs. 2000/- per case per day	Engineer-in-charge, CGD Head or their authorized representative
9.	Non standard/unsafe Scaffolding	Rs. 2000/- per case per day	Engineer-in-charge, CGD Head or their authorized representative
10.	Use of Uncertified Scaffolding	Rs. 2000/- per case per day	Engineer-in-charge, CGD Head or their authorized representative
NON USE OF PERSONAL PROTECTIVE EQUIPMENT			
11.	For not using Non Respiratory Personal Protective Equipment (Helmet, goggles, gloves, safety belts, Boiler suit etc, Shoes .)	Rs. 1000/- Per day/item/person	Engineer-in-charge, CGD Head or their authorized representative
12.	For not providing Respiratory Personal Protective Equipment prescribed in Work permit/job safety plan /B.A. set/ canister mask/B.A. compressor etc)	Rs. 5000/- per case per day	Engineer-in-charge, CGD Head or their authorized representative

VIOLATION OBSERVED IN ELECTRICAL WORK			
13.	Non use of ELCB , using poor joints of cable,using naked wire without top plug into the socket , laying wire/cables on the roads, carrying outelectrical jobs by incompetent person	Rs 5000/- per item per day	Engineer-in-charge, CGD Head or their authorized representative
14.	Non deployment of the Licensed electricians forelectrical job.	Rs. 2000/- per person	Engineer-in-charge, CGD Head or their authorized representative
15.	Working/ on live electrical circuits without work permit/authorization	Rs. 5000/- per case per day	Engineer-in-charge, CGD Head or their authorized representative
VIOLATIONS IN EXCAVATION WORK			
16.	•Unsatisfactory fencing / barricading •not providing proper shoring / strutting / properslope and - not keeping the excavated earth at least 1.5 Maway from excavated area	Rs. 2000/- per item per day	Engineer-in-charge, CGD Head or their authorized representative
VIOLATIONS OBSERVED IN ROAD SAFETY			
17.	Driving owner or Contractor's vehicle withoutauthority from transport operations.	Rs. 1000/- per case	Engineer-in-charge, CGD Head or their authorized representative
18.	Over speeding of jeeps / buses, rash driving,wrong side parking.	Rs. 2000/- per item	Engineer-in-charge, CGD Head or their authorized representative

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19.	Driving hydra/Crane/fork lift above its speed limiter Driving hydra without being escorted by cleaner who is sitting left side of the driver to guide him	Rs. 1000/- per case	Engineer-in-charge, CGD Head or their authorized representative
20.	Entry of contractor's vehicle in No Entry Area without proper authorization.	Rs. 1000/- per case	Engineer-in-charge, CGD Head or their authorized representative
21.	Entry of any person in barricaded area marked with tape.	Rs. 1000/- per person	Engineer-in-charge, CGD Head or their authorized representative
23.	Sitting or allowing sitting along with the driver on fork lift.	Rs. 500/- per case	Engineer-in-charge, CGD Head or their authorized representative
24.	Vehicle Accident- i.e. overturning, falling in pits, damaging equipment, hitting another vehicle etc.	Rs 5000/- per case plus replacement/repair charges incurred by OWNER for owner owned material	Engineer-in-charge, CGD Head or their authorized representative
NON DEPLOYMENT OF REQUIRED MANPOWER			
25.	Non-deployment of safety supervisor / supervisor responsible for safety at work site required as per Special Safety Conditions	Rs 2000 per person per day	Engineer-in-charge, CGD Head or their authorized representative
26.	Failure to maintain safety register and record by Contractor Safety Supervisor or Supervisor responsible for safety	Rs. 2000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
27.	Failure to have weekly safety site inspection / audit and monthly safety meeting and maintain record (by contractors themselves)	Rs. 2000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative

OWNER	STANDARD TECHNICAL SPECIFICATION		
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28.	Failure to conduct tool box meeting every day and maintain the records of the same.	Rs. 500/- per day	Engineer-in-charge, CGD Head or their authorized representative
29.	Failure to submit the monthly HSE report by 5 th of next month to Engineer-in-charge	Rs. 200/- per day	Engineer-in-charge, CGD Head or their authorized representative
VIOLATION OF STATUTORY REQUIREMENT			
30.	Acting in contravention to any of the provision mentioned in Factories Act 1948 and/or the rules framed there under including all amendments thereto.	Rs. 1000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
31.	Failure to maintain records as per statutory requirement like 1. Form No. 1A – for the shed/s constructed by contractor 2. Form No. 6 – Certificate of fitness 3. Form No. 10 – Register of workers attending machinery 4. Form No. 11 – Report of Examination of Hoist/Lift/Lifting tackles. 5. Form No. 13 – Report of Examination of any pressure vessel brought by the contractor at site. 6. Form No. 16 – Notice of periods of works for adult workers 7. Form No. 17 – Register of adult workers 8. Form No. 23 – Special certificate of fitness 9. Form No. 29 – Muster Roll	Rs. 10000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
OCCURENCES OF INDUSTRIAL ACCIDENTS			
32.	Failure to furnish a first information report (FIR) as per prescribed Pro-Forma within 4 hours of the incident.	Rs. 1000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
33.	Failure to arrange immediate investigation / evidences / documents of the incident and furnish within 24 hours to OWNER Engineer-InCharge.	Rs. 1000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative

OWNER	STANDARD TECHNICAL SPECIFICATION		
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34.	Keep and maintain proper records of all incidents occurred at work site	Rs. 1000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
35.	Failure to report to OWNER supervisor on - the - job, medical centre and area safety officer any injury to his employees or any near miss or any hazardous/ dangerous incident at work site or hiding of any accident or near miss.	Rs. 5000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
36.	Negligence on contractor's part which has resulted in an Injury/fire Lost Time Injury Fatality	Rs.1,00,000/- per person Rs. 5,00,000/- per person	Engineer-in-charge, CGD Head or their authorized representative
37.	Negligence on contractors part which has resulted in Minor Fire/Explosion/ etc Major Fire (Reportable)	Rs 1,00,000/- Rs 2,00,000/-	Engineer-in-charge, CGD Head or their authorized representative
VIOLATION OF LABOUR LAWS			
38.	Working beyond statutory limits by contractor's workers	Rs. 1000/- per person per day	Engineer-in-charge, CGD Head or their authorized representative
39.	Deployment of contractor's employees including supervisors without receiving necessary training on safety for working.	Rs. 5000/- per person per day and holiday listing of contractor for 6 months if repeated	Engineer-in-charge, CGD Head or their authorized representative
40.	Deployment of contractor's employees including supervisors without undergoing their medical examination, by the authorized medical professional having qualification of MBBS + AFIH. Deployment of workers on high risk jobs like working in confined space, working at height, working under water, etc. without being examined and certified as medically fit for such jobs by the doctors who are authorized to certify for such jobs.	Rs. 1000/- per person	Engineer-in-charge, CGD Head or their authorized representative

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41.	Non subjecting to periodic medical examination after every six months after deployment of workers including supervisors on the job by the certifying surgeon as per Rule 73V of Maharashtra Factories Rule 1963.	Rs. 1000/- per person	Engineer-in-charge, CGD Head or their authorized representative
42.	Deployment of child or adolescent	Rs. 10,000/- per person	Engineer-in-charge, CGD Head or their authorized representative
43.	Use of untested and uncertified pressure vessel.	Rs. 5000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
44.	Use of untested and uncertified lifting tools/tackle	Rs. 5000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
VIOLATION IN MATERIAL HANDLING			
45.	Improper material handling/ Manually handling of heavy material when it is require using mechanical equipment/use of substandard/defective material handling trolleys/hand cart.	Rs. 1000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
46.	Failure to submit duly filled pre use check list for any new machine or equipment brought at site	Rs. 1000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
47.	Inadequate supervision at work site (absence of supervisor/designated employee as supervisor from site for more than 30 Minutes when work is in progress)	Rs. 2000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
SAFETY PERFORMANCE DISPLAY BOARD			

OWNER	STANDARD TECHNICAL SPECIFICATION		
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48.	Safety performance score board not displayed.	Rs. 100/- per day	Engineer-in-charge, CGD Head or their authorized representative
SAFETY PERFORMANCE DISPLAY BOARD			
49.	Unsafe handling of compressed gas cylinders No trolley or jubilee clips or double gauge regulator or flash back arrestor on both gas lines & both ends or improper storage / handling or cylinders without caps when not in use/damaged hoses)	Rs. 500/- per item per occasion	Engineer-in-charge, CGD Head or their authorized representative
VIOLATIONS DURING RADIOGRAPHY PROCESS (Applicable for Carbon Steel laying & Station Piping work)			
50.	Radiography without authorization	Rs. 10000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
51.	Non barricading the area during radiography	Rs. 10000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
52.	Non announcement on PA system/alerting people working in vicinity, before start of Radiography jobs	Rs. 1000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
MISCELLANEOUS			
53.	Damage to fire hydrant & monitors, fire extinguishers including non return of extinguishers	Cost incurred by OWNER for repair/replacement	Engineer-in-charge, CGD Head or their authorized representative

54.	Poor House-keeping	Rs. 5000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
55.	Removal of grating/cover/lid on any opening infloor or vessel.	Rs. 1000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
56.	Use of dangerous portable tools/hand tools like grinding machine, drilling machine, pneumatic excavators/drill by unskilled worker.	Rs. 1000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
57.	Operating/allow to operate any machine without having guard on its dangerous/rotating part of the machine or an equipment.	Rs. 1000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
58.	Horseplay at work site	Rs1000 /- per occasion	Engineer-in-charge, CGD Head or their authorized representative
59.	Shifting of debris from one location to another/ dumping debris at unauthorized place.	Rs. 10000/- per occasion	Engineer-in-charge, CGD Head or their authorized representative
60.	Use of mobile in plant areas	Rs 1000/- per person per occasion.	Engineer-in-charge, CGD Head or their authorized representative

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 BPCL. BPCL shall have the liberty to independently investigate such occurrences and Contractor shall extend all necessary help and co-operation in this regard. BPCL shall have the 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 trailers 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 **Health, 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 BPCL. 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 BPCL / 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 (CE marked and conforming to EN361), protective goggles, gloves, ear muffs, respiratory protective devices, etc. All these gadgets shall conform to applicable IS Specifications / CE 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 BPCL & 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. BPCL 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, BPCL 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 totake 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 Arrestor / 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 BPCL.

- 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:
 - l) 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 BPCL.

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. BPCL 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 BPCL 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 mm² 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 25M 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. BPCL 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 possess 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. BPCL / 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

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 BPCL 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 BPCL 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 BPCL.

INSPECTION

The contractor shall carryout daily HSE inspection and record observations at a central location. These inspection records shall be freely accessible to BPCL representatives. The contractor shall also assist BPCL 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 BPCL. The Contractor shall participate in the pre-start meeting with BPCL 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 out 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 hot 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 BPCL requirements. Compliance of instructions on HSE shall be done by Contractor and informed urgently to BPCL.
- Ensure that resident Engineers/Site-In-Charge of the Contractor shall amend all the Safety Committee/HSE meeting arranged by BPCL only in case of his absence from site, a second senior most person shall be nominated by him in advance and communicated to BPCL.
- Display at site office and work locations caution boards, list of hospitals for emergency services available.
- Provide posters, banners, for safe working to promote safety consciousness
- Carry out audits/inspection at sub Contractor work as per approved HSE documents & submit the reports for BPCL's review.
- Assist in HSE audits by BPCL and submit compliance report.
- Generate & submit HSE records/ reports as per HSE Plan.
- Appraise BPCL 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

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)

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 Scissors	1 Piece
10.	Adhesive Plaster (1.25 cm x 5 m)	1Spool
11.	Eye pads in Separate Sealed Packet	4 Pcs.
12.	Tourniquet	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.

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 given. Type of extinguisher shall clearly be marked on it.

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.

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 be injured.
(B) CONCRETING	⌚ Air pollution by cement	⌚ May affect Respiratory System	⌚ Wear respirators or cover mouth and nose with wet cloth.
	⌚ Handling of ingredients	⌚ Hands 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 rays	 Radiation can damage eyes and skin.	 Use specified shielding devices and other PPE of correct specifications  Avoid throat 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 Electrocutation 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 access to Fire extinguishers  Do not use elevators for evacuation during fire  Maintain lightning 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 heat.  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 Electrocutation	 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 stored 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 the 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 EQUIPMENTS	 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 than 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.

HSE CHECKLIST CUM COMPLIANCE REPORT (1/6)

Project: _____

Date: _____

Inspection By: _____

Contractor : _____

Owner : _____

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

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)

SUPPLEMENTARY ACCIDENT / INCIDENT INVESTIGATION REPORT

Supplementary to Report No: _____(Copy enclosed)

Project: _____
Name of Work : _____
Contractor: _____

Site: _____
Date: _____
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 : BPCL.....
:

1 COPY
3 COPIES

NEAR MISS INCIDENT – SUGGESTED PROFORMA

Name of Site : _____	Report No: _____
Name of Work : _____	Date : _____
	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 : BPCL.....
:

1 COPY

MONTHLY HEALTH, SAFETY & ENVIRONMENT (HSE) REPORT
(To be submitted by each Contractor)

Actual work start Date: _____
 Project: _____
 Name of the Contractor: _____
 Name of Work: _____

For the Month of: _____
 Report No: _____
 Status as on: _____
 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 /Engineer-in-charge
 (Signature and Name)

To : BPCL
 :

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.
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 FromHrs. To..... Hrs.	Initiator (Supervisor of Contractor)	Issuing Authority (Safety Officer) of Contractor	Verification by CONSULTANT with date

Additional safety instructions, if any.

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	
☐	☐	isolated from power / steam / air	☐	☐	water flushed &/or steamed
☐	☐	isolated from liquid or gases	☐	☐	Manways open & ventilated
☐	☐	depressurized &/or drained	☐	☐	cont. inset gas flow arranged
☐	☐	blanked / blinded / disconnected	☐	☐	adequately cooled
☐	☐		☐	☐	radiation sources removed
☐	☐		☐	☐	Proper lighting provided
☐	☐		☐	☐	
☐	☐		☐	☐	

(B) Expected Residual Hazards					
Y	NR		Y	NR	
☐	☐	lack of O ₂	☐	☐	combustible gas / liquid
☐	☐	corrosive chemicals	☐	☐	pyrophoric iron / scales
☐	☐	Heat / steam / frost	☐	☐	high humidity
☐	☐		☐	☐	
☐	☐		☐	☐	H ₂ S / toxic gases
☐	☐		☐	☐	electricity / static
☐	☐		☐	☐	ionizing radiation
☐	☐		☐	☐	

(C) Protective Measures					
Y	NR		Y	NR	
☐	☐	gloves	☐	☐	ear plug / muff
☐	☐	protective clothing	☐	☐	dust / gas / air line mask
☐	☐	Grounded air educator / blower / AC	☐	☐	attendant with SCBA / air mask
☐	☐	Fire fighting arrangements	☐	☐	safety harness & lifeline
☐	☐		☐	☐	
☐	☐		☐	☐	goggles / face shield
☐	☐		☐	☐	personal gas alarm
☐	☐		☐	☐	rescue equipment / team
☐	☐		☐	☐	communication equipment
☐	☐		☐	☐	

[illegible]

(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 :

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 BPCCL

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 :

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 :

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)

**QUALITY ASSURANCE PLAN
FOR
PE PIPES**

PROJECT: City Gas Distribution
QAP NO.: MEC/U999/05/28/M/001/PE/SU/0001/QAP
Page 1 of 4

Sl. No.	Component/ Operation	Type/ Method of Check	Extent of Check	Equipment Used	Ref. Standard	Acceptance Norms	Format of Record	Agency			Remarks	
								M	T	EIC / BPCL		
A	RAW MATERIAL											
(i)	Density	Review of TC	For each lot/ batch of Raw material used	Electronic Balance	IS:7326:1992 raw material mfr. Test Certificate	As per clause 8.3 of IS 14885:2001	RMTC	V/P	W	R	Review of Raw Material Test Certificate will be provided	
(ii)	Melt Flow Rate	Review of TC		MFR Tester	IS:2530:1963 & raw material mfr. Test Certificate	As per clause 8.4 of IS 14885:2001	RMTC	V/P	W	R		
(iii)	Thermal stability (OIT)	Review of TC		OIT Tester	IS 14885:2001	As per clause 8.5 of IS 14885:2001	RMTC	V/P	W	R		
(iv)	Pigment Dispersion	Review of TC		Dispersion Tester	IS 14885:2001	As per clause 5.4 of IS 14885:2001	RMTC	V/P	W	R		
(v)	Volatile matter content	Review of TC		Electronic Balance & Oven	IS 14885:2001	As per clause 8.6 of IS 14885:2001	RMTC	V/P	W	R		
(vi)	Resistance to Gas Constituents	Review of TC		-	IS 14885:2001	As per clause 5.5 of IS 14885:2001	RMTC	R	R	R		
(vii)	Anti oxidant	Review of TC		-	IS 14885:2001	As per clause 5.2 of IS 14885:2001	RMTC	R	R	R		
(viii)	U.V. Stabilizer	Review of TC		-	IS 14885:2001	As per clause 5.3 of IS 14885:2001	RMTC	R	R	R		
(ix)	Classification of PE compound	Review of TC		-	IS 14885:2001	As per clause 4.2 of IS 14885:2001	RMTC	R	R	R		
(x)	Calibration	Review of Certificates	-	-	Certificates	Certificates	-	V/R	R	R		
B	In process inspection											
1	Appearance											
(a)	Colour	Visual	Randomly as per Table 10 of IS 14885	Visual	The colour of the pipe shall be Orange	As per clause 4.4 of IS 14885:2001	Test Report	P	W	W/R		
(b)	Finish of the pipe	Visual		Visual	IS 14885:2001	As per clause 7 of IS 14885:2001	Test Report	P	W	W/R		
2	Dimension of Pipe											
(a)	Outside Diameter	Measurement		PI Tape/ Vernier Caliper	IS 14885:2001	As per IS 14885:2001	Test Report	P	W	W/R		
(b)	Wall Thickness	Measurement		Ball Ended Micrometer	IS 14885:2001	As per IS 14885:2001 as per Table 4 & 5	Test Report	P	W	W/R		

**QUALITY ASSURANCE PLAN
FOR
PE PIPES**

PROJECT: City Gas Distribution
QAP NO.: MEC/U999/05/28/M/001/PE/SU/0001/QAP
Page 2 of 4

Sl. No.	Component/ Operation	Type/ Method of Check	Extent of Check	Equipment Used	Ref. Standard	Acceptance Norms	Format of Record	Agency			Remarks
								M	T	EIC / BPCL	
(c)	Ovality	Measurement		Vernier Caliper	IS 14885:2001	As per IS 14885:2001	Test Report	P	W	W/R	
3	Marking	Visual		Visual	IS 14885:2001	Indelible marking by Ink Jet Printing as per clause 10 of IS 14885:2001 as given below	Test Report	P	R	R	
4	Length	Measurement		As per PO	IS 14885:2001	As agreed by the purchaser	Test Report	P	R	R	
C	Final Inspection										
1	Colour	Visual	As per Table 10 of IS 14885	Visual	The colour of the pipe shall be Orange	As per clause 4.4 of IS 14885:2001	Test Report	P	W	W/R	
2	Finish of the pipe	Visual		Visual	IS 14885:2001	As per clause 7 of IS 14885:2001	Test Report	P	W	W/R	
3	Dimension of Pipe										
(a)	Outside Diameter	Measurement		PI Tape/ Vernier Caliper	IS 14885:2001	As per IS 14885:2001	Test Report	P	W	W/R	
(b)	Wall Thickness	Measurement		Ball Ended Micrometer	IS 14885:2001	As per IS 14885:2001 as per Table 4 & 5	Test Report	P	W	W/R	
(c)	Ovality	Measurement		Vernier Caliper	IS 14885:2001	As per IS 14885:2001	Test Report	P	W	W/R	
4	Marking	Visual		Visual	IS 14885:2001	Indelible marking by Ink Jet Printing as per clause 10 of IS 14885:2001 as given below	Test Report	P	R	W/R	
5	Length	Measurement		As per PO	IS 14885:2001	As agreed by the purchaser	Test Report	P	R	W/R	
6	Hydraulic Pressure resistance for 165 Hrs 80°C (Plain Pipe)	Visual	As per Table 11 of IS 14885	Hydrostatic Pressure Tester	IS 14885:2001	As per clause No. 8.1 No failure or leakage for 165 Hrs at 5.5 MPa induced stress as per Table 7 of IS 14885:2001	Test Report	P	W	W/R	
7	Hydraulic Pressure resistance for 165 Hrs 80°C (63mm dia and above) (Notched Pipe)	Visual		Hydrostatic Pressure Tester	IS 14885:2001	As per clause No. 8.1 No failure or leakage for 165 Hrs at 4.6 MPa induced stress as per Table 7 of IS 14885:2001	Test Report	P	W	W/R	

**QUALITY ASSURANCE PLAN
FOR
PE PIPES**

PROJECT: City Gas Distribution
QAP NO.: MEC/U999/05/28/M/001/PE/SU/0001/QAP
Page 3 of 4

Sl. No.	Component/ Operation	Type/ Method of Check	Extent of Check	Equipment Used	Ref. Standard	Acceptance Norms	Format of Record	Agency			Remarks
								M	T	EIC / BPCL	
8	Squeeze – Off Test (Type Test)	Visual		Hydrostatic Pressure Tester	IS 14885:2001	As per clause No. 8.9 No failure or leakage for 165 Hrs at 5.5 MPa induced stress as per Table 7 of IS 14885:2001	Test Report	P	W	R	Review internal test report
9	Hydraulic Pressure resistance for 1000 Hrs 80°C (Plain Pipe) (Type Test)	Visual		Hydrostatic Pressure Tester	IS 14885:2001	As per clause No. 8.1 No failure or leakage for 1000 Hrs at 5.0 MPa induced stress as per Table 7 of IS 14885:2001	Test Report	P	W	R	Review with RM supplier's TC
10	Hydraulic Pressure resistance for 100 Hrs 20°C (Plain Pipe) (Type Test)	Visual		Hydrostatic Pressure Tester	IS 14885:2001	As per clause No. 8.1 No failure or leakage for 100 Hrs at 12.5 MPa induced stress as per Table 7 of IS 14885:2001	Test Report	P	W	R	Review with RM supplier's TC
11	Reversion	Measurement		Vernier Caliper & Oven	IS 14885:2001	As per clause No. 8.2 IS 14885:2001 reversion shall not be greater than 3%	Test Report	P	W	W/R	
12	Density	Measurement	As per Table 11 of IS 14885	Electronic balance	IS:7328:1992 raw material mfr. Test	As per clause 8.3 of IS 14885:2001	Test Report	P	W	W/R	
13	Melt flow Rate	Measurement		MFR Tester	IS:2530:1953 & raw material mfr. Test Certificate	As per clause 8.4 of IS 14885:2001, Change of MFR by processing shall not be more than 25%	Test Report	P	W	W/R	
14	Pigment Dispersion	Visual		Dispersion Tester	IS 14885:2001	As per clause 5.4 of IS 14885:2001	Test Report	P	W	W/R	
15	Thermal stability (OIT)	Measurement		OIT Tester	IS 14885:2001	As per clause 8.5 of IS 14885:2001	Test Report	P	W	W/R	
16	Tensile yield strength	Measurement		Tensile & Elongation Tester	IS 14885:2001	As per clause 8.7 of IS 14885:2001	Test Report	P	W	W/R	
	Elongation at break	Measurement		Tensile & Elongation Tester	IS 14885:2001	As per clause 8.7 of IS 14885:2001	Test Report	P	W	W/R	
17	Volatile Matter Content	Measurement		Electronic Balance & Oven	IS 14885:2001	As per clause 8.6 of IS 14885:2001	Test Report	P	W	W/R	

**QUALITY ASSURANCE PLAN
FOR
PE PIPES**

PROJECT: City Gas Distribution
QAP NO.: MEC/U999/05/28/M/001/PE/SU/0001/QAP
Page 4 of 4

Sl. No.	Component/ Operation	Type/ Method of Check	Extent of Check	Equipment Used	Ref. Standard	Acceptance Norms	Format of Record	Agency			Remarks
								M	T	EIC / BPCL	
18	Resistance to Weathering	Review	-	-		As per supplier's TC	RMTC	R	R	R	
19	Calibration	Review of Certificates	-	-	Certificates	Certificates	-	V/R	R	R	
20	Supply, Packing Handling and Transportation of PE Pipe	Visual	-	-	IS 14885:2001	As per clause 11 of IS 14885:2001	Test Report	P	W	W/R	

Legend:

M – Manufacturer of PE Pipes , T – Third Party Inspection Agency , EIC – Project Management Consultant , R – Document Review , P – Perform , W – Witness, V – Verification of documents , RMTC – Raw Material Test Certificate

NOTES:

1. In case of volatile matter ≥ 250 mg/kg and ≤ 350 mg/kg, Water Content Test as per EN: 12118 / ISO: 760 shall be performed and witnessed by TPI and reviewed by EIC / BPCL.
2. All Type tests shall be reviewed with raw material suppliers' test certificate
3. All external labs, if used for testing, shall be NABL accredited.
4. EIC shall check the material while opening and the raw material shall be loaded in the hopper in their presence. Additionally, EIC of BPCL reserves the right to inspect randomly or review the record prior to giving clearance for dispatch.
5. Contractor has to review all the test reports before submitting to BPCL

For CONTRACTOR/ SUB-CONTRACTOR

(Stamp & Signature)

SPECIFICATION
FOR
QUALITY ASSURANCE SYSTEMS
REQUIREMENTS

SPECIFICATION NO. MEC/S/05/62/66

CONTENTS

<u>Sl.No.</u>	<u>Description</u>	<u>Page No.</u>
1.0	INTRODUCTION	1
2.0	DEFINITIONS	1 - 2
3.0	CONTRACTORS SCOPE OF WORK	2 - 4
4.0	QUALITY ASSURANCE REQUIREMENTS	4 - 7

ATTACHMENTS

<u>TITLE</u>	<u>NUMBER</u>
FORMAT FOR QUALITY PLAN	FORMAT 00001
FORMAT FOR OBSERVATION ON	FORMAT 00002

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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 BPCL, at the stage of bidding and shall be resolved with BPCL, 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 BPCL 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 disposition of an existing non-conformity.

Corrective Action

Action taken to eliminate the causes 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 transform inputs into outputs.

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 BPCL 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 delivery of contracted scope of work. Participation of BPCL in review/ approval of quality plan/ 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 BPCL on all these documents shall be sought before start of work.

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

Bidder shall facilitate BPCL during 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 nominate an overall incharge of the contract titled as "Project Manager" for the scope of work of agreed contract. The name of this person shall be duly intimated to BPCL including all subsequent changes, if any. BPCL shall correspond only with the project manager 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 consented by BPCL 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 plan format such 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 shall be assumed to be detailing bidder's understanding and planning for the contract/ offered scope of work. The bidder shall plan 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 BPCL.
- 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 decides 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 BPCL 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.

OBSERVATION OF QUALITY ASPECTS

Job No. and Description Issued to : M/s		No. : Date :
Location of Work : Item of Work :		
Details of Observation(Deficiency)	Recommended Course of Action	
	Time Allowed for Correction :	
Issued by : _____ Name of Signature of Engineer in Charge		
Corrective Action taken report by Contractor/ Vendor :		
Date :		Name and Signature
Distribution (before resolution) : Engineer in charge	GA Head BPCL	
Verification of Resolution by BPCL :		
Date :		Name of Signature
Distribution (before resolution) : Engineer in charge	GA Head BPCL	

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	BPCL's Review/ Audit Requirement

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

DRAWINGS

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CAUTION

WORK IN PROGRESS

LAYING OF NATURAL GAS PIPELINE

BPCL : OWNER'S NAME

CONTRACTOR NAME:

DATE OF COMMENCEMENT

DATE OF COMPLETION :

EMERGENCY PHONE NOS:

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BPCL'S LOGO

SECTIONOIL & LOCATIONDELHI DESIGNEDARNOLD DRAWNSUNIL

CHECKED AND VERIFIEDV.K.AGRAWAL

APPROVED

SIG (V.K.AGRAWAL) DATE14.12.2011

SCALE N.T.S. DRG.NO . MEC/23QH/05/25/M/000/011

SHEET 1 OF 1V

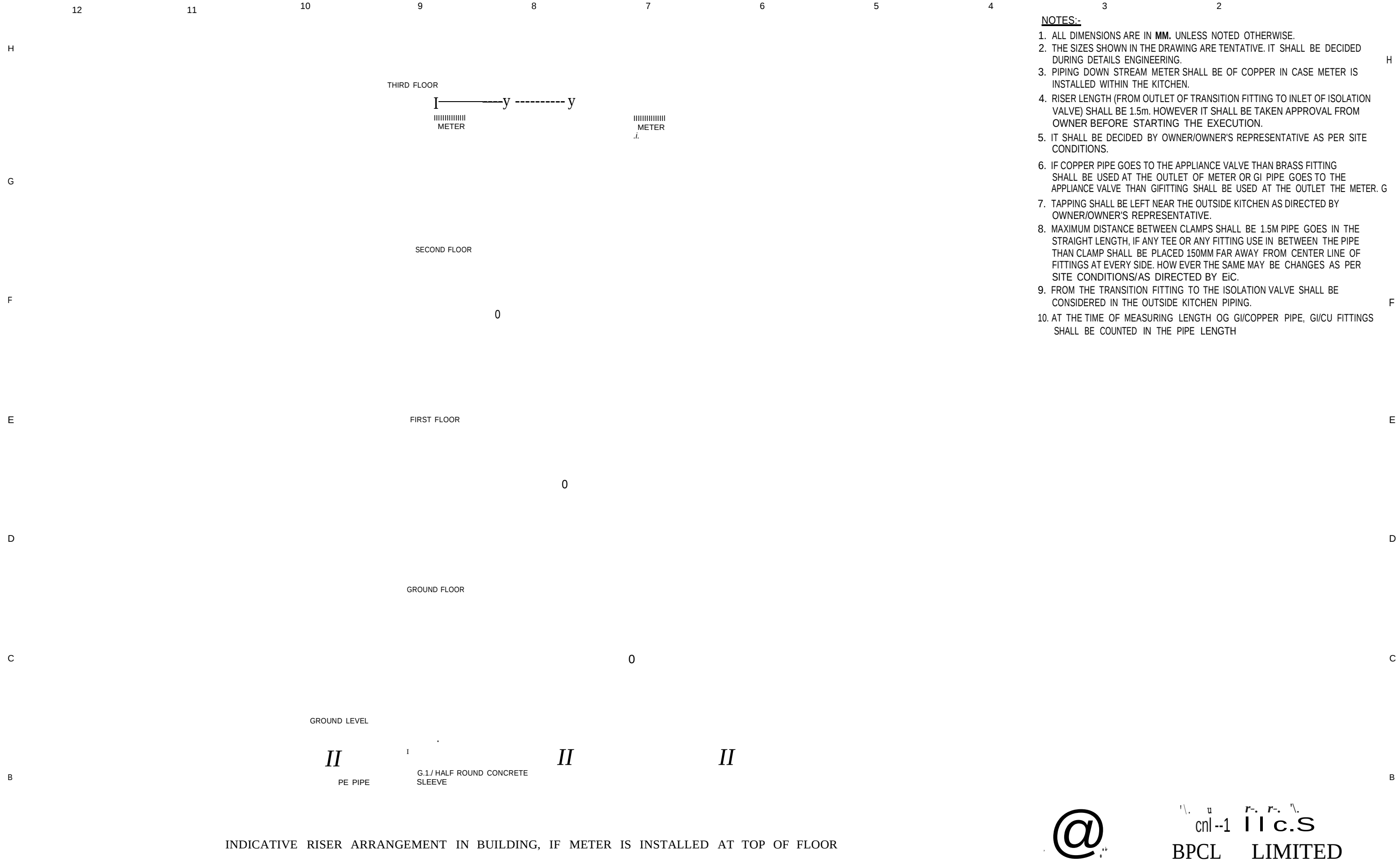
CNG & CITY GAS DISTRIBUTION PROJECT

CAUTION BOARD

CONCURRED BY

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NOTES:-

1. ALL DIMENSIONS ARE IN MM. UNLESS NOTED OTHERWISE.
2. THE SIZES SHOWN IN THE DRAWING ARE TENTATIVE. IT SHALL BE DECIDED DURING DETAILS ENGINEERING.
3. PIPING DOWN STREAM METER SHALL BE OF COPPER IN CASE METER IS INSTALLED WITHIN THE KITCHEN.
4. RISER LENGTH (FROM OUTLET OF TRANSITION FITTING TO INLET OF ISOLATION VALVE) SHALL BE 1.5m. HOWEVER IT SHALL BE TAKEN APPROVAL FROM OWNER BEFORE STARTING THE EXECUTION.
5. IT SHALL BE DECIDED BY OWNER/OWNER'S REPRESENTATIVE AS PER SITE CONDITIONS.
6. IF COPPER PIPE GOES TO THE APPLIANCE VALVE THAN BRASS FITTING SHALL BE USED AT THE OUTLET OF METER OR GI PIPE GOES TO THE APPLIANCE VALVE THAN GIFITTING SHALL BE USED AT THE OUTLET THE METER.
7. TAPPING SHALL BE LEFT NEAR THE OUTSIDE KITCHEN AS DIRECTED BY OWNER/OWNER'S REPRESENTATIVE.
8. MAXIMUM DISTANCE BETWEEN CLAMPS SHALL BE 1.5M PIPE GOES IN THE STRAIGHT LENGTH, IF ANY TEE OR ANY FITTING USE IN BETWEEN THE PIPE THAN CLAMP SHALL BE PLACED 150MM FAR AWAY FROM CENTER LINE OF FITTINGS AT EVERY SIDE. HOW EVER THE SAME MAY BE CHANGES AS PER SITE CONDITIONS/AS DIRECTED BY EIC.
9. FROM THE TRANSITION FITTING TO THE ISOLATION VALVE SHALL BE CONSIDERED IN THE OUTSIDE KITCHEN PIPING.
10. AT THE TIME OF MEASURING LENGTH OG GI/COPPER PIPE, GI/CU FITTINGS SHALL BE COUNTED IN THE PIPE LENGTH



BPCL LIMITED

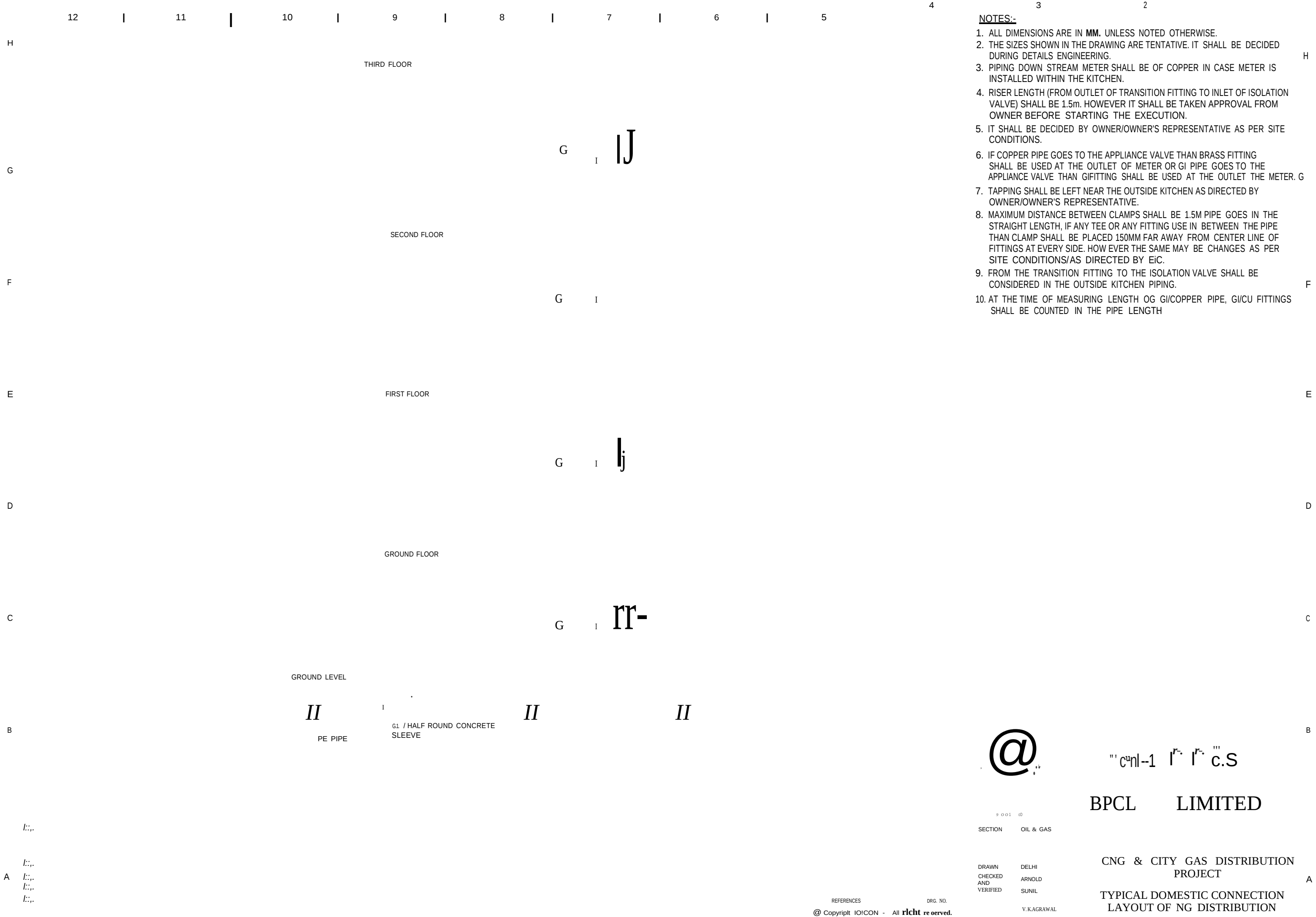
SECTION	OIL & GAS
LOCATION	DELHI
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CNG & CITY GAS DISTRIBUTION PROJECT

TYPICAL DOMESTIC CONNECTION

REFERENCES

DRG. NO.



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IT IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS
UNLESS EXPRESSLY PERMITTED BY IEON.

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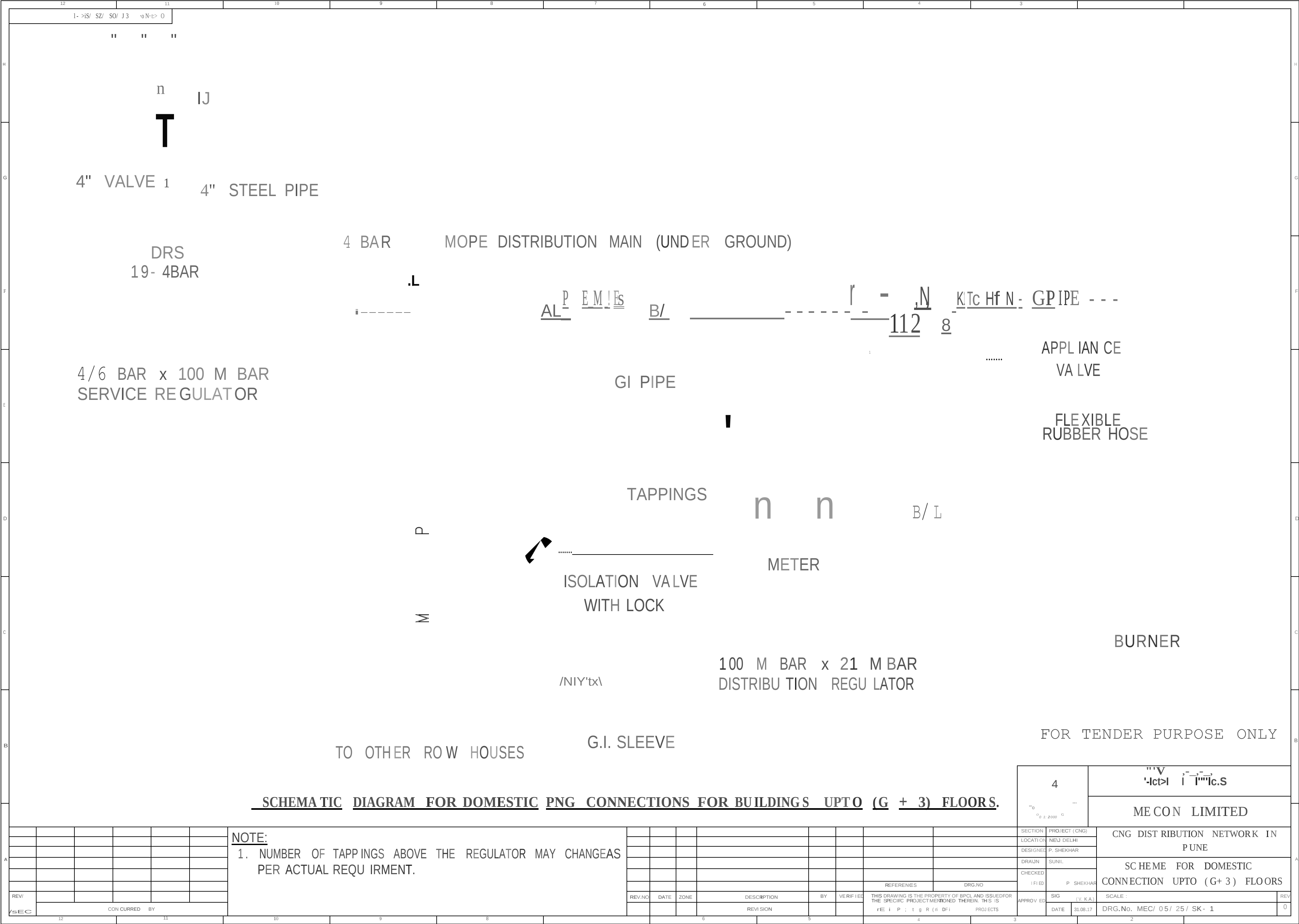
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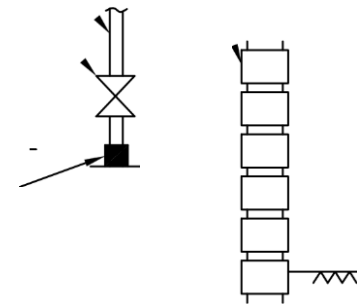
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NOTE:
1. NUMBER OF TAPPINGS ABOVE THE REGULATOR MAY CHANGEAS PER ACTUAL REQU IRMENT.

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SECTION	PROJECT (CNG)	SCHEME FOR DOMESTIC CONNECTION UPTO (G+ 3) FLOORS	
LOCATION	NEW DELHI		
DESIGNED	P. SHEKHAR		
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CHECKED	FILED		
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H	SELECTED EXCAVATED MATERIAL TO BE REPLACED AND COMPACTED IN 200mm LAYERS. TOPSOIL (APPROX 150mm IN DEPTH) TO BE TURFED (25-55mm IN DEPTH) AND WIRE NETTING WITH ENICAMAT OF ANZO NOBEL OR EQUIVALENT E INSTRUCTED ROCK GABIONS CONSISTING PACTED HARDCORE AGGREGATE (APPROX 600mm) BE INSTALLED OVER FULL WIDTH OF DISTURBED AREA													
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