GODAVARI GAS PRIVATE LIMITED

(GGPL)

(A JOINT VENTURE OF APGDC&HPCL)

TECHNICAL SPECIFICATIONS

VOLUME III OF III

TENDER NO. GGPL/KKD/C&P/MDPE/2520/07/VS

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1.0 GENERAL INFORMATION

1.1 Introduction

M/s GGPL.(GGPL) is a JV Company of APGDC and HPCL. GGPL is developing infrastructure to provide PNG (Piped Natural Gas) as fuel for Domestic, Industrial & Commercial sectors and CNG (Compressed Natural Gas) to private & commercial vehicles in East and West Godavari Dist.

1.2 Nature of Contract

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

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. Contractor will submit the Construction/ Execution procedures before commencement of work.

2.2 In principle permission for laying of the pipe line from the concerned land owning authority (i.e. PWD/NH/Municipal Authorities etc.)shall be obtained by GGPL. and handed over to the contractor. All Liasioning during execution of pipe line laying with the authorities such as Municipal Authorities/NH/PWD/Panchayat Raj, etc., local officials, traffic police, police, Electricity Board, BSNL, RTO etc. and any other utility companies / agencies such as OFC operators etc. are in the scope of the contractor. The scope also includes Liasioning with Society / individual land owners for smooth execution of pipeline laying. Repairing/replacement of all damaged utilities if any, and payment of any compensation (if claimed by the incumbent owner/other utility agencies) is in scope of the contractor.

2.3 All the route alignment drawings of main pipeline (125/90/63/32mm) shall be provided by GGPL/consultant. However preparation of routing drawing at site for individual as well as apartment premises, shall be done by the contractor as per site condition and shall be submitted to GGPL/consultant for approval. Execution shall start after due approval.

2.4 Receiving, loading, transporting, unloading and and stacking of MDPE pipes issue by GGPL as free issue material from GGPL designated storage yard within East and Wes Godavari Dists. limit but upto maximum 60Km from the working site. All toll taxes etc are also included in the scope.

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 actual site condition / approved pipeline route by EIC/authorities.

2.7 DELETED

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 to its original stage.

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

2.10 To make trenches with stable slopes but restricting minimum disturbance to aboveground / 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 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 Supplying &Installation of pipe fittings like elbow, tee, reducers, Tapping saddles, joints, connectors, transition fittings, valves, sleeves etc. including construction of supports, valves pits, inspection chambers along with all materials 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 of good quality GI sleeves, concrete casing pipes, sand and other material, fittings to be supplied by the Contractor as per provisions of tender.

2.16 Supplying and laying of warning mat (with tracer wire) and bricks over the PE pipe.

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

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

2.19 Nitrogen purging (including supply), commissioning & gas charging of tested

pipeline as per approved procedure.

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

2.21 Obtaining satisfactory completion certificates for the restoration work done from the concerned authorities.

2.22 Supply and laying of the above ground GI installation in the building/ flat/apartment of consumer.

2.23 Collecting Free Issue materials like Regulators, meters & other associated fittings and installing the same including supply of fittings, as required. Supply & laying of copper tube, isolation valves & appliance valves.

2.24 Supply, fabrication and installation of Warning Plate marker.

2.25 Testing of total GI & copper installation.

2.26 Commissioning of total GI & Copper installation, wherein gas is made available.

2.27 Returning surplus Free Issue Material to GGPL store after reconciliation of free issue material and submission of final Reconciliation Document to the satisfaction of GGPL/MECON.

2.28 Extending branch pipes from the existing and handed over GI piping network and completing the connection upto kitchen.

2.29 Studying the existing reticulated LPG system, collecting documents for existing system, carrying out modification in existing piping connections as required, changing of meters & regulators (as required), testing the piping system

2.30 Handing over the completed works to GGPL for their operation / usage purposes.

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

2.32 Preparation and submission of As-built drawings, details of crossings, Measurement sheets and deviation statements on completion / commissioning of work by way of drawing, sketches and tables.

3.0 MATERIAL, LABOUR, PLANT AND EQUIPMENT

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

Materials like MDPE pipe, Regulators and Meters will be issued to the Contractor as Free Issue Materials, from the designated store(s) of GGPL. 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 up to 60km.

3.2 Supplied by the Contractor

Contractor will supply GI pipe, Copper pipe, GI sleeves, valves, PE fitting sand 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 GGPL / MECON informed. The inspection of bought out items would be carried out by GGPL / MECON / Third Party Inspection.

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

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

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

3.2.1 Equipment & Machinery

All vehicular type machinery shall be in good working order and shall not cause spillage of oil or grease. To avoid damage to paved surfaces the Contractor will provide pads of timber or thick rubber under the hydraulic feet or outrigger 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 2nos.), 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. Contractor has to arrange on his own all equipment for trenchless crossings such as HDD, Moiling& rock cutting equipment, PE fusion equipment at the site whenever required.

Contractor must also have to arrange his own equipment for restoration work like water tanker and jumping jack compactor for compaction of backfilled trenches and roller and other required equipment/ machinery for asphalting/ road works.

For carrying out GI and Copper works, contractor shall deploy proper machinery for GI pipe thread cutting and copper pipe bending. All

safety precaution must be taken.

Contractor shall provide and ensure that the working crew is equipped with proper harness, petzl, safety helmet, safety shoe etc.

In case there is non-availability of approved equipment, tools and tackles during the work at site, suitable penalties may be levied, as per the contract.

3.2.2 Imported Backfill and Material

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

For supply of sand in trench for rocky terrain, no separate charges are payable and is included in price schedule item for excavation of hard rock/Morrum.

Also supply of sand in valve chambers, Normal chambers & Built up surface, if required, as per the instruction of EIC, is not separately payable.

In case specified trench depths are not achieved & if directed by Engineer-in-charge Contractor to provide GI casing pipes and cement concrete, as envisaged in the contract.

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.
- Material required for installation of valve chambers.
- Electrical power, water etc. which is required for execution shall be arranged by the contractor.
- All minor items not expressly mentioned in the Contract but which are necessary for the satisfactory completion and performance of the Work under this Contract.

3.2.4 Manpower

The contractor shall provided the skilled labour, fitters, jointers along with tools necessary for the proper execution.

3.2.5 Acquisition, Receipt, & Storage of Materials

For materials being supplied by owner, the contractor shall collect all materials from GGPL 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 physical 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 store with permanent locking arrangement, preferably near site 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 at a given day. Further the contractor is required to undertake and submit an inventory of materials every month to Owners/Owners Representative .

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

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, GGPL'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 GGPL'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 harness, petzl, 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 immediately reported.

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 Health Safety and Environment (HSE) technical specification.

8.0 ROUTE SURVEY

8.1 Routing drawing will be prepared by the contractor after conducting route survey. The same will be submitted and work at site will be taken up after approval is accorded by GGPL / MECON for the submitted route and respective sizes.

8.2 The scope also includes preparation of drawing, for any change in route, re-route alignment drawing shall also be prepared by contractor. Any change in routing from the issued drawings due to site constraint will be notified and only after approval of the changed route, the job shall be carried out.

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 GGPL on site. All work will be executed through the EIC and site control will be exercised by Site Engineer of GGPL/MECON. The contractor shall ensure that technical quality standards are maintained, that construction is carried out cost effectively and that a customer-friendly and good public image of GGPL is maintained.

9.2 Contractor shall designate a RCM who will be the single point coordinator to interact with EIC/Consultant/TPIA. RCM will have POA from the company so that he can attend review meetings, receive materials, sign documents, claims and receive payments etc. Contractor shall submit the organization chart indicating in-charges of project, store, QA/QC and shall take approval from the owner for the same.

9.3 The contractor will appoint his own supervisors of minimum number instructed by EIC. These personnel will be responsible to the Site Engineer (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/phones to ensure that they can be contacted at all times. The contractor will also nominate one person who can be contacted if necessary after the working hours, for the duration of the project. The contractor's supervisors will have sufficient access to transport at all times so as to enable them to visit sites and attend meetings with MECON/ GGPL as is required. For day to day work, SE of MECON/ GGPL shall issue work instructions, other communication to the contractor's supervisors. No deviation from the approved technical specification / issued construction drawings shall be undertaken without written approval.

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

Telephone, Mobile phones, printers/Scanning/Xerox machines, Computer with e-mail facility, transportation facility

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. Restoration of the abandoned trial pits and trenches shall be the contractor's responsibility. No payments shall be made for such type of jobs.

It is contractor's responsibility to interact with other utility agencies regarding their existing utilities and finalize the route along with these agencies and Owner/Owner's representative

There will be no additional payments in respect of abandoned trenches incurred because of insufficient or inadequate trial pits, or any associated lost time or delays.

10.2 Protection of Structures and Utilities

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

10.3 Interference with Traffic, Street Drainage and General Public

The Work shall be executed in such a manner as to cause 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, levelled 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.

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 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 centre line 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 only to the minimum. Suitable crossing shall be provided and maintained wherever necessary to permit general public, property owners or his tenants to cross or move stock or equipment from one side of the trench to another side. Trenching shall be made with sufficient slopes on sides in order to minimize collapsing of the trench. On slopes wherever there is danger of landslides, the pipeline trench shall be maintained open only for the time strictly necessary. GGPL 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	2.5m
ii)	Uncased/ Cased Road Crossing	1.5m
iii)	Rail/ Road Cased Crossing	1.5m
iv)	Normal Areas	1.0m

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 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 GI casing pipe, concrete casing of pipes. This will be provided without extra cost to GGPL, unless otherwise specified in the contract.

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 approved drawings/procedure No payment will be made for extra width of trench for any reason.

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.

11.4 Clearances

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

• 150-300 mm where the gas pipe crosses other assets, other than electric cables, whereupon the clearance shall be 300 mm.

• 300mm where the gas pipe is on a similar alignment to the other assets.

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

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 GGPL 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 GGPL. 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 MECON/ GGPL.

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 GGPL. For all roads, paths, walkways etc. that are open-cut, the Contractor shall provide temporary diversions properly constructed to allow the passage of normal traffic with the minimum of inconvenience and interruptions. The paving shall be restored to its original condition after the pipeline is installed.

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 GGPL.

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

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 GGPL 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 GGPL 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 PE 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 made to pass through just below the cover slab. Also an encasing of concrete or steel sleeve shall be provided for the MDPE pipe for protection. The sleeve material shall be as per specification

and of reputed make. The sleeve will be procured and laid by the Contractor. 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 portion between the pipe and the sleeve as well as between 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.

Valves shall be installed at locations shown on the drawing 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 so as to avoid any stree on 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 for approval. These details will be further incorporated into As-Built Drawings.

14.0 JOINTING OF POLYETHYLENE PIPE

The procedure for jointing of PE pipe and fittings is enclosed. Only Bar coded electro-fusion machine (Automatically Readable) with in-built memory to store the jointing data that can read the bar code of the fittings, shall be used for jointing of MDPE pipe / fittings.

Unless it is unavoidable, manual feeding electro-fusion machines should not used 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 SEs. Contractor shall ensure that the machine are always available at site and no stoppage of work takes place 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 joining, the Contractor shall place packing sand under the pipes on both sides of the joint to keep the pipes in line and at the correct alignment during the jointing process. Alignment clamps with the correct size shells should be used to align the pipe during the electro-fusion cycle.

The Contractor shall ensure that polyethylene pipe is only cut with an approved PE pipe cutting tool. Before fusion is attempted, 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 PE 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.

Contractor shall arrange generator for power supply for fusion machine. Taking power connection from electric poles, connections 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.

15.0 BACKFILLING

Backfilling shall be done after ensuring that appurtenance have been properly fitted and the pipe is following the ditch profile at the required depth that will provide the required cover and has a bed which is free of extraneous material and which allows the pipe to rest smoothly and evenly. Dewatering shall be carried out prior to backfilling. No backfilling shall be allowed if the trench is not completely dewatered.

Prior to backfilling it should be ensured that the post padding where required of compacted thickness 150mm is put over and around the pipe immediately after lowering.

Backfilling shall be carried out immediately after the post padding (wherever required) is completed in the trench, inspected and approved by GGPL/MECON, so as to provide a natural anchorage for the pipe, avoiding, sliding down of trench sides and pipe movement 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 GGPL/ MECON 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 GGPL.

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 GGPL. 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 is decided 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 MECON/ GGPL and shall be thoroughly compacted. Special compaction methods as required may be adopted. All costs incurred thereupon shall be borne by the Contractor.

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

After laying of PE pipe lines, back filling with available soft soil up to depth of minimum 300mm, placing brick as per given drawing or instruction ofGGPL / MECON, back filling with available soil up to minimum depth of 300mm above bricks, putting approved warning mat of 0.5mm thick and 250 mm wide with traceability provision (as per attached specification) and as approved drawing and procedure. The warning mat it to be unrolled centrally along the pipe length and thereafter further backfilling will commence. Continuity of the tracing wire in the warning mat is to be ensured by crimping the tracer wire of two warning mat at the joints with due overlap. 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/ PC cutting has been done during excavation for laying, the area shall be back filled and compacted immediately so that no inconvenience is caused to the general public. Electro-fusion of joints is to be undertaken immediately after lowering and the activity shall not be kept pending for lack of Electro-fusion jointing. The backfilling shall be considered complete only after the joint in completed. Debris and other surplus material shall be removed immediately after the backfilling.

16.0 MOILING:

The Moiling shall be carried out as per the requirement specified by GGPL/ MECON, and approved procedures. The contractor has to carry out thorough survey of the underground utilities before going for the Moiling, 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 moiling work, is in contractor's scope. The type of moiling to be carried out i.e., Manual/ Machine with or without casing shall be at the discretion of GGPL / MECON. A prior approval is to be taken before starting the Moiling.

For manual Moiling, the contractor shall ensure that the size of the hole to the extent possible, is maintained at maximum 20% of the size of the casing / carrier pipe whichever is applicable. After completion of Manual Moiling the hole shall be properly compacted / filled with soil by watering and by approved procedures, the pits shall be backfilled, compacted & restored . The rate for such crossing work by using casing pipe & carrier pipe or only carrier pipe shall be payable as per Schedule of Rates. No separate payment shall be made for pulling the carrier pipe.

The rates for Moiling, 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 Moiling operation shall be immediately notified and rectified by the contractor without any cost implication to GGPL.

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

17.0 HORIZONTAL DIRECTIONAL DRILLING

The HDD techniques are required to be carried out by the Contractor where conventional trenching/Moiling 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 MECON/ GGPL. Execution of the work shall be based on the MECON/ GGPL approved drawings. The contractor has to do the thorough survey of the underground utilities before commencement of HORIZONTAL DIRECTIONAL DRILLING in order 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 attract penalties as per contract.

The type of HDD to be carried out i.e. conventional (with or without casing) shall be at the discretion of GGPL/ MECON. 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 GGPL.

18.0 Deleted

19.0 RESTORATION

Wherever the restoration is required, the roads, footpaths including roads and footpaths inside colonies) shall be restored to original condition, and the same shall be done as per concerned local authorities norms and to the satisfaction of the concerned local Authority. For 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 that 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 restoration of roads shall be carried out as per specifications given by the concerned authority (i.e., PWD/NH/Municipal Corporation etc..) as per applicable SOR item 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 borne by the contractor.

20.0 TESTING

Pressure testing will be carried out with compressed air. Compressed dry 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 around 1.5 times of MAOP **or** 9.0 bar(g)and there shall be no unaccountable pressure loss during the test period.

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

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

Tie-in joints may be tested at working pressure following commissioning.

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

21.0 PURGING

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

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

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

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

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

22.0 VALVE PIT

The valve pit shall be constructed in accordance with approved drawing, payment shall be as per relevant price schedule item.

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

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.

23.0 Warning plate markers

23.1 Warning plate Marker: As per typical Drawings is enclosed shall be installed at regular intervals as per the instructions of the EIC immediately after laying of the pipeline. The installation of the type of the Pole 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. Supply & Installation of the markers shall be paid as per the SOR.

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

24.0 ASSISTANCE IN COMMISSIONING

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

25.0 STANDARD OF WORK

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

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

26.0 RECORDING (AS-BUILT DRAWINGS)

The Contractor will be required to submit computerized as-built drawings duly certified by EIC in A0/ A1 sheet form at 1:200 scale with FOUR sets of prints plus two sets soft copy(In CD). The as-built drawing shall be submitted area wise as directed. 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 50 meters. If there is any chance in alignment/orientation and offset distance etc. of the pipeline in between the above said 50 meters, the same shall be clearly mentioned in the as laid.

The as built drawing shall be as per the legends provided by EIC.

Details & offset distances from other utilities present should be given in as built drawing. If there is any change in the depth of pipeline, the same shall be clearly marked with details in these 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.

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

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

27.0 Civil and Structural Works

The contractor has to supply the adequate materials and skilled manpower for the completion of all the civil & structural works . The contractors shall also ensure 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 GGPL.

TECHNICAL SPECIFICATION

FOR

INSTALLATION OF ABOVE GROUND GI /CU PIPING

FOR

DOMESTIC, COMMERCIAL AND INDUSTRIAL CONSUMERS

CONTENTS

1.0 GENERAL INFORMATION

1.1 INTRODUCTION

The main intent of the specification is for laying MDPE Pipes, supply of MDPE Fittings and 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 / commercial 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.

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 GGPL /MECON.

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 'appliance valve', making openings and making provisions for fixing clamps, making temporary but stable platforms / scaffolding / rope ladder etc., required for installation of pipes / fittings at all heights / multi storied flats and locations. Providing safety equipment to workers / plumbers.

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

2.5 Contractor shall procure all material, except free issue material from the outlet of PE/GI transition fitting upto the Domestic/Commercial customers" Appliance valve" for satisfactory completion to the owner/Owner's representative.

2.6 Installation of GI pipes of ½", ¾", 1"& 1 1/2"dia. between transition fittings and Meter in customer's kitchen which would include NPT threading by machine threading of pipes, and jointing of fittings such as elbows, tees, connectors, regulators, meters, isolation valves etc., as per laid procedures and specification including supply of GI fittings &Teflon tapes for sealing of joints. Painting of GI Pipes & fittings as per specification.

2.7 The entire riser assembly shall be made of threaded riser assembly. Isolation valve shall be placed in riser as may be required in line with the site condition, so as to provide independent operation for a block of flats/rooms/houses. For all kitchens, irrespective of consenting or uninterested customers, each lateral shall be laid upto an approachable distance (<=300 mm) of the intended kitchen area before installing the isolation valve, so as to ensure easy operation of the isolation valve and avoidance of arrangement of hanging supports for future extension of the lateral. All lateral which are not being laid upto a kitchen, must be plugged with end cap/plug. However, to the extent possible, the isolation valve in the lateral should be approachable from inside the house as well as from outside the house. This is to ensure that isolation valve can be attended even if the corresponding customer is not available or the house is locked.

2.8 Installation of Isolation valve before the gas meter and installation of Copper pipes of ½" (12 mm) OD from the downstream of Meter upto the appliance valve near to the customers appliance, including the installation of brass fitting at the downstream of meters along with application of lacquer paint etc. to the satisfaction of SE.

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

2.10 Signing of Joint Meter Records (JMRs).

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

2.12 Testing & Commissioning of installations including purging as per specification and handling over the installation of GGPL / customer to the entire satisfaction of GGPL / MECON.

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

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

2.15 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.

2.16 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 GGPL.

2.17 Following activities are also in contractor scope

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

3.0 MATERIAL, LABOUR, PLANT AND EQUIPMENT

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

Free Issue Materials shall be issued to the Contractor from the designated store(s) of GGPL. Contractor shall be responsible for lifting the free issue materials i.e. meters , regulators from Owner's storage point(s) and transporting the same to work site(s) upto 60 km at his own cost.

3.2 Supplied by the Contractor

The contractor has to supply all GI pipes, GI Fittings, Fittings, Clamps, Cu pipes, Appliance Valves ½" and isolation Valves ½" to 1 ½", GI 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 GGPL / MECON informed. The inspection of bought out items would be carried out by GGPL / MECON / Third Party Inspection or as instruction by EIC.

3.2.1 Plant and Equipment

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

3.2.2 Sealant, grout

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

3.2.3 Clamps, Rawl Plugs, Screws, Nozzles etc.

The Clamps, Rawl 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 given in the contract.

3.2.4 Consumable Items

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

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

3.2.5. Other Materials

The contractor shall supply the following items where required.

- All materials required for formwork, NPT threading, testing etc. - All signs, barricades, lights and protective equipment.
- All material required for working at higher floor levels (i.e., scaffolding, Ladder, safety belts etc.).

Special consumable such as grease for maintenance of domestic appliances 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.

4.0 Acquisition, Receipt, & Storage Of Materials

For materials supplied by owner, the contractor shall collect all materials from GGPL. 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. 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 for reference. It may vary in case of individual and multi storied flats. A general scheme of distribution to small commercials consumers is indicated in the sketch enclosed herewith for reference.

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

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

5.4 The schedule of items of SOR have been described in brief and shall be held to be complete in all respect including safety requirements as per given in this tender, 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 multi storied flats.

6.0 PROGRESS OF WORK

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

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

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

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

7.0 WORK SHEETS

7.1 The quantities and other details will be checked by MECON/ GGPL's site engineer and the same shall be incorporated in measurement sheets by the contractor. These will be signed &dated by the contractor, MECON/GGPL.

7.2 The certified measurement sheet will be a part of the billing.

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

7.0 PERMISSIONS / APPROVALS

Contractor shall be responsible for obtaining approval from concerned authorities, if required for completion of the work. Contractor must take the prior appointment from the resident for carrying out the work.

8.0 REFERENCE SPECIFICATION, CODES AND STANDARDS

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

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

9.0 SAFETY

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

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

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

10.0 RIGHT-OF-USE SURVEY AND MARKING

The route of the pipeline to be installed shall be decided with consent of the consumer and SE. 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 GGPL..

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

The contractor will be responsible for contacting the customer and making the necessary arrangements for access, and appointments to carry out the work. GGPL 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 MECON/ GGPL necessary to protect the public.

11.0 PROTECTION OF STRUCTURES AND UTILITIES

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

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

12.0 G.I ABOVE GROUND SERVICE PIPE

The GI service pipe installation work includes all work necessary to connect from the PE / GI transition fitting on the down-stream of the PE service, to the customers appliance, including the installation of appliance valve and isolation valves, Meters, Regulator shall be paid as per SOR Items 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. Meters &regulators shall be provided by GGPL..

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. Approval must be obtained for every fresh lot of the clamps, brackets, regulators boxes and other consumables prior to start of installation.

All riser and lateral pipe shall be clamped to the building at intervals not exceeding 1.5 meter. If any tee or fittings lies in between the pipe then clamp shall be placed 150 mm far away from center line of fittings on both sides. However, the same may be changed as per site conditions/as directed by SE. Minimum gap between pipe and wall shall be 25 mm. The joints/fittings of the GI installations shall be painted only after carrying out testing of the installation.

While taking branch /lateral from the riser, an isolation valve to be provided. This valve is to be provided closer to an approachable area (like utility area) of the building for which the branching is intended. Inside customer premises, another isolation valve is to be provided before the meter.

Where pipe passes through a balcony floor, the floor surface shall be made slightly elevated around the service pipe or its surrounding sleeve to prevent the accumulation 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 bevelled 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 contractor shall ensure that gas supply shall not be provided to the customer in any concealed piping.

13.0 COPPER ABOVE GROUND SERVICES PIPE

The copper piping will be provided inside all kitchen at the downstream of the the gas meter. The Copper service pipe installation work includes all work necessary to connect from the downstream of Meter upto the appliance valve prior to the customers appliance, including the installation of valves, including application of lacquer paint etc. The contractor shall be required to provide all equipment, tools, and material necessary to execute the work in an efficient and effective manner.

Amongst other things he will be required to provide ladders, scaffolding pipe, drills for concrete and other masonry, drills for timber and laminated surfaces inside customer's property, bending tools, clamps, sleeves to facilitate the pipe passing through floors and walls, etc. Meters &regulators shall be provided by GGPL.

During installation the COPPER pipe is to be cut to proper length with a tube cutter, the burrs removed with a file, cleaning of outside surface of pipe & inside surface of fitting, applying flux to the tube and fitting around the outer / inner ends, inserting the tube in to the fitting, applying heat to the assembled joints using conventional Blow torch to melt Solder wire and lacquering. Lacquer is to be applied to the copper tubes by mixing lacquer with thinner in approved proportions and applied by dipping method or with brush. It should be applied only once at a time and drying time of minimum one hr. is to be given.

Contractor shall supply closed type approved clamps for fixing COPPER pipes suiting to the site conditions and the same shall be painted, if required, before fixing, as per the painting specifications.

Contractor has to take prior approval of SE for quality of the clamps, solder, flux, lacquer, thinner 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.

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

All copper piping shall be clamped to the building at intervals not exceeding 500mm. The solder wire shall be of reputed company , lead free as per BS 29453: 1994 (Soft solder alloys) and supplied in coils. Solder for use wit Cu tube & fittings generally melt within the temperature range of180^0C to 250^0C. The contractor has to furnish the certificate of confirmation of standards before start of work.

14.0 TESTING OF GI INSTALLATION

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

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

14.3 The GI pipe shall be painted with one coat prior to installation in riser,

however the ends / joints shall be painted only after carrying out testing of the installation.

14.4 The 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.

14.5 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. For the installation to be tested by manometer or diaphragm gauge the meter shall not be dismantled/removed and testing shall be carried out at 100 m bar with holding period of 15 min with no pressure drop.

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

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

14.8 Valves, if any, supplied by GGPL, shall not be used for testing purpose

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

15.0 INSPECTION

Any defect noticed during the various stages of inspection shall be rectified 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.

16.0 PURGING & COMMISSIONING

Payment for the tapping of live mains and GI piping prior to the actual purge is included in normal laying & testing. The connection may involve the fitting of a temporary bypass, disconnection etc.

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

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

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. LEL detector to be maintained at site for determining gas percentage. 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.

17.0 INSTALLATION OF METERS

The work in this section includes :

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

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

17.3 Firmly securing the meters on the wall with good quality supply of proper rawl plugs, screws etc. In case the rawl plugs are not holding than wooden blocks or other fixing arrangements like cement etc. to be used for proper grouting.

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

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

17.6 The meter installation will be preferred in open/ventilated space so as to prevent Gas accumulation and easy dispensation of Gas to atmosphere in case of any smell / leakage of Gas. The meter installation will not be provided in any confined space in the customer premises.

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

18.0 PAINTING OF GI PIPES

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

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

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

Engineer-in-Charge at his discretion, may call for tests for paint formulations. Contractor 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 subjected to inspection and certification by Engineer-in-Charge at all times. After installation of the entire piping system, final touching shall be done to the satisfaction of EIC.

19.0 BOX FOR SERVICE REGULATOR

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

The box brackets are to tightly secure to the wall with good quality proper Rawl 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.

20.0 CONVERSION OF DOMESTIC APPLIANCES - NOT APPLICABLE

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 GGPL. '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.

21.0 RESTORATION

Contractor has to restore the area where ever he has carried out drilling, clamping etc. to its original condition to the satisfaction of the consumer and to ensure no passage to the premises and seepage. If the work was carried out in Govt. Flats (PWD), contractor has to restore the area according to CPWD specifications. For government flats the contractor has to obtain a clearance certificate from 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 subbase is to be adjusted according to the slab / block thickness. The slabs or brick work should be laid on moist bedding material, which should be graded sand, mortar or mortar mix. The slabs or brick work should be tapped into position.

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

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

The contractor will be responsible for the maintenance of all restoration carried out, for the duration of the contract guarantee period.
The contractor is to ensure the restoration work is properly supervised, and that the material used is suitable for the purpose and proper. Where the required standards are not achieved the contractor will be required to replace the defective reinstatement work.

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

22.0 SUBMISSION OF FINAL RECORDS

Contractor shall submit the following documents in three sets each:

a) Total list of houses & commercial establishments allotted, giving details of connections provided & reasons where connection could notbe given / completed.
b) The details recorded in measurement cards of every domestic house.
c) Details of BP no. for each meter.

d) Details of houses where extra piping done along with materials used.
e) Total material consumption report.
f) Material reconciliation with respect to the materials issued.
g) Test reports & test certificates of gauges etc.
h) Any other documents / records required.

TECHNICAL SPECIFICATION
FOR
MEDIUM DENSITY
POLYETHYLENE FITTINGS
AND
ELECTRO-FUSION
FOR
NATURAL GAS DISTRIBUTION

C O N T E N T S

SCOPE AND FIELD OF APPLICATION

This specification elaborates the requirements for Electrofusion fittings in the nominal size range 20 to 125 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.

1.0 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.

2.0 EQUIPMENT

2.1 The control box input supply is to be from a nominal 240V generator, which is normally of 2.5kVA or 5 kVA capacity. The Nominal output of the generator is to be 240V + 15%, -10% between no load and full load. Control box are to include safety devices to prevent excessive voltages being present at the control box output. The safety devices shall operate in less than 0.5 s

Note that extension leads are not to be used on the control box outlet connections.

Warning : Control boxes are not intrinsically safe and must therefore not be taken to trench.

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

2.2 Electro Fusion Jointing Method / Procedure

Preparation

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

Note that the fitting should not tobe 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.

2.3.1 Records : Records of appropriate servicing and calibration shall be kept.

2.3.2 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.

2.4 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 used are namely top loading and under clamping around the pipe. In a trench a minimum clearance of 150 mm is required.

2.5 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 (min 150mm) around the pipe .

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 and remove the swarf.

Connect the electro fusion control box input leads to the generator

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

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

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

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

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

Check that there is sufficient fuel for the generator to complete the joint .
Start the generator and check that it is functioning correctly
Switch on the control box if applicable

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

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

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

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

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

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

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

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

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

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.

2.6 STOPPING THE GAS FLOW

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

2.7 SQUEEZE - OFF

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

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

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

d. Where the pipe walls are compressed the polyethylene pipe will be

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

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

2.8 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 affected. The section of pipe, which has been bent back, will have to be replaced because of the damage caused by the severeness of the band back operation. The need of any bend back operation is most likely to occur as a consequence of damage caused to a PE service pipe.

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

3.0 SYMBOLS & DEFINITIONS

3.1 Symbols for Electro fusion Fittings

3.1.1 Symbols for Electro fusion Socket Fittings

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

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

D2 is the minimum bore comprising the minimum diameter of the flow channel through the body of the fitting. L1 is the depth of penetration of the pipe or of the male end of a spigot fittings.

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

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

3.1.2. Symbols for Electro fusion Tapping Tees

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

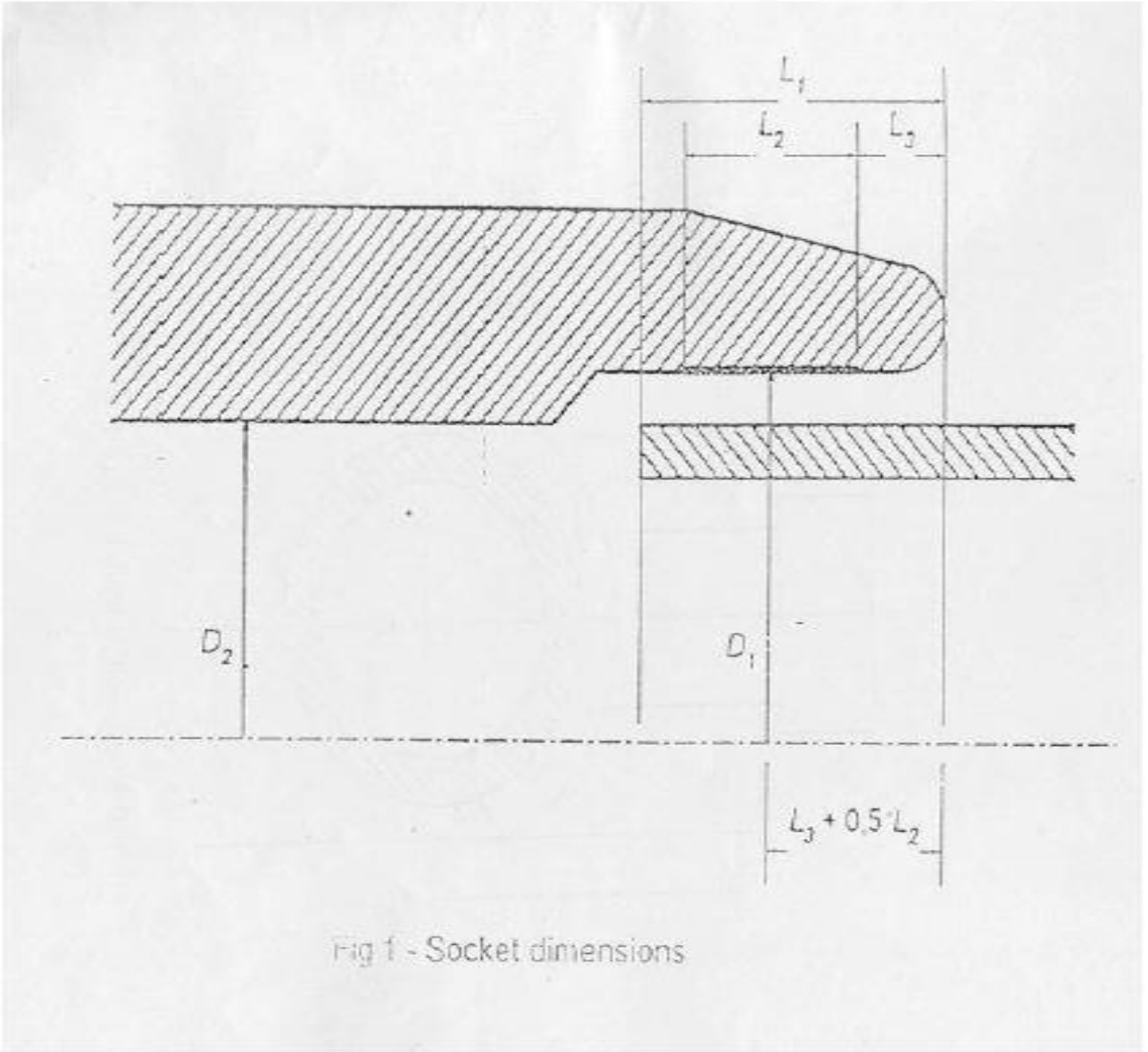

Fig 1 - Socket dimensions

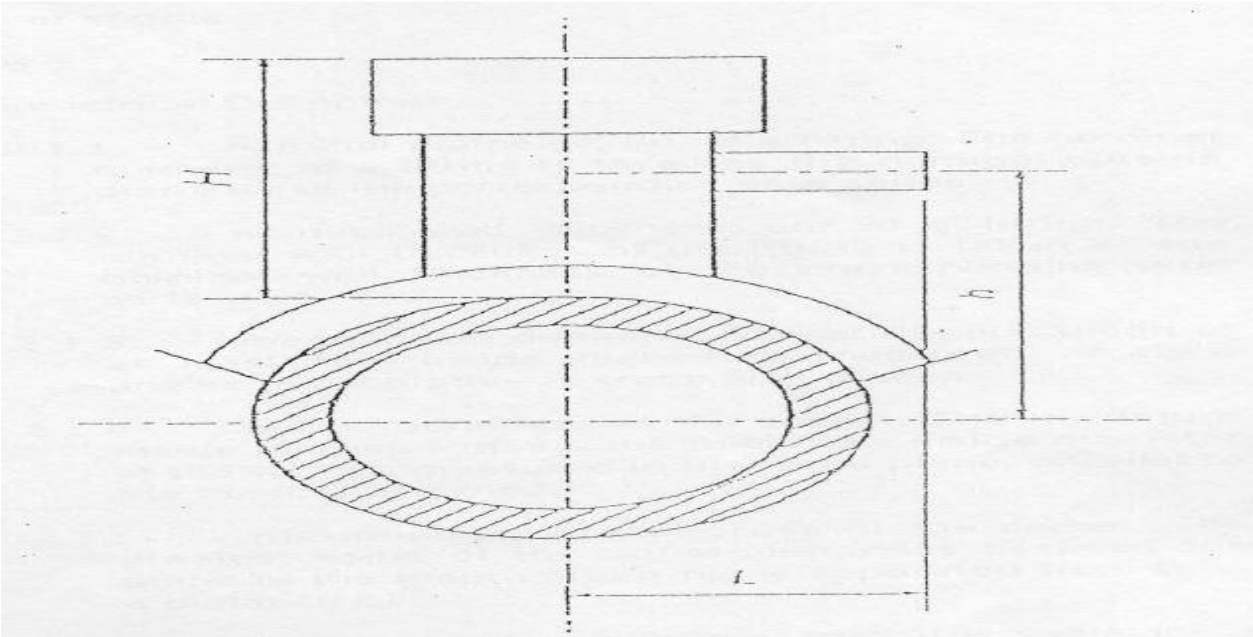

Fig 2 - Tapping Tee Dimensions

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

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

3.2 Definitions

3.2.1. Geometrical Definitions

3.2.1.1 Nominal diameter (dn) 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 (en) 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 L1.

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 = dn/en

3.2.1.7 Wall thickness, E of a fitting:

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

3.2.2 Material Definition

3.2.2.1 Virgin Material :

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

3.2.2.2 Own Reprocessable Material :

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

3.2.2.3 Compound:

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

3.2.3 Definition related to Material Characteristics

3.2.3.1 Lower Confidence Limit (LCL):

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

3.2.3.2 Overall Service (Design) Coefficient (C):

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

3.2.3.3 Minimum Required Strength (MRS):

The value of the LCL rounded down to the next lower value of the R 10 series when the lcl is less than 10 Mpa, or to the next lower value of the R 20 series when the lcl is greater than or equal to 10 Mpa.
Note: R10 and R 20 series are the Renard number series according the ISO 3 and ISO 497

3.2.3.4 Melt Mass Flow Rate (MFR):
A value relating to the viscosity of the molten material at a specified temperature and rate of shear.

3.2.4 Definitions Related to Service Conditions

3.2.4.1Gaseous Fuel:

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

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

20 * MRS

Note: It is given by the equation:
MOP = C*(SDR-1)

3.2.5 Definition on Design of Electrofusion Fittings:

3.2.5.1 Electrofusion Socket Fitting:

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

3.2.5.2 Electrofusion Saddle Fitting:

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

3.2.5.3 Tapping Tee:

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

3.2.5.4 Branch Saddle:

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

3.2.5.5 U Regulation :

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

3.2.5.6 I Regulation:

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

4.0 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 ≤ 1 cl ≤ 9.99	5.5 Bar

PE 100	10.0	10.00 ≤ 1 cl ≤ 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/10min	+/- 20% of value nominated	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 2Mpa	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	0^{o} C	ISO DIS 13478
Full Scale (FS) test : d≥250mm		Multiplied by 1:5	0^{o} C	ISO DIS 13477
Or S4 test : In principle according to all diameters(7)	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)		
Resistance to slow crack growth en>5mm	h	165	80^{o} C,8,0bar(f) (9) 80^{o} C,9,2bar(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 respectivesizes.

- 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 heatingcoil.

5.1 Electrofusion Socket Fittings

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

5.2 Tapping Tees

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

5.3 Transition Pieces

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

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

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

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

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

6.0 ELECTRICALCHARACTERISTICS

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

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

All fittings shall have mechanically shrouded malo electrical terminals. The fittings terminals connections shall be suitable for use with voltage less than or equal to 48 volts. Considerations should be given to the design of the shroud with respect to impact damage. When hollow terminal pins are used, the hole at the top of the pin shall be less than 1 mm diameter. The terminal pin material shall be corrosion resistant and the surface finish shall beN7.

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

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

The heating element wire shall not be disturbed during assembly.

7.0 DIMENSIONS

7.1 Measuring Temperature

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

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

7.2 Dimensional Stability

7.2.1 Couplers (Including all forms of socket fittings)

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

7.2.2 Tapping Tees and BranchSaddles:

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

TABLE 3 : SOCKET DIMENSIONS

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

Notes:

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

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

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 DN50

** Flange size DN100

*** Flange size DN 150

\+ Flange size DN250

++ Flange size DN 250

8 PERFORMANCEREQUIREMENTS

8.1 Mechanical Characteristics

Fittings shall be tested using pipes, which conform to ISO 4437, Test samples shall be assembled in accordance with ISO DIS11413, following the technical instruction of the manufacturer and using fusion equipment conforming ISO DIS 12176.2.

When tested in accordance with the test methods as specified in table –

6 using the indicated parameters, the fittings have mechanical characteristics confirming to the requirements given in Table6.

TABLE 6: MECHANICAL PROPERTIES

Characteristics	Units	Requirements I	Test	Parameters	Test Method
Hydrostatic strength at 20°C	H	Failure time 100	End caps orientation conditioning time. Type of test circumferential (hoop) stress pipe PE 80, PE 100, Test temperature.	Type a) free 1 h 9 Mpa, 12.4 Mpa, 20°C	ISO DIS 9356
Hydrostatic strength at 80°C	H	Failure time 165	End caps orientation conditioning time. Type of test circumferential (hoop) stress pipe PE 80, PE 100, Test temperature.	Type a) free 12 h water-in-water 4.6 Mpa 5.5 Mpa 80°C	ISO DIS 9356
Hydrostatic strength at 80°C	H	Failure time 1000	End caps orientation conditioning time. Type of test circumferential (hoop) stress pipe PE 80, PE 100, Test temperature.	Type a) free 12 h water-in-water 4 Mpa, 5 Mpa, 80°C	ISO DIS 9356
Cohesive resistance	mm	Length of initiation of brittle fracture L/3	Test temperature choice of method	23°C	ISO 13954 (A) ISO 13955 (A) ISO 13956 (B)

Characteristics	Units	Requirements I	Test	Parameters	TestMethod

Impact strength (B)		No failure No leakage	Test temperature Falling height Mass of the striker	20°C 23°C 5m 5kg	ISO DIS 13957
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 Socke tFittings

(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 Table8.

TABLE 8 : Physical Characteristics of Fittings

Property	Units	Requirements	Test Parameters	Test Method
Thermal Stability	Minutes	> 20	200 °C (1)	ISO TR 10837
Melt Mass- flow Rate (MFR)	g/10 min	0.2 □MFR □1.4 and after processing maximum deviation of □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 tappingtee:
   - The means of attachment (tools and/ or underclamp).
   - 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 inmm
c) Material and Designation
d) The date of manufacturer (code may b eused)
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 airtightplastic 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 electrofusionends shall be included in the completepackage

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 6.0 Bar(g) Pressure.

TECHNICAL SPECIFICATION

FOR

POLYETHYLENE PIPES

CONTENTS

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 100mtrs, Length
- 125mm OD - In each Coils of 50 mtrs. length

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)

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 along with their credentials/

past records for carrying out all required tests.

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

f) Any accreditation certificates obtained or applied for.

2.6 MARKING

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

TECHNICAL SPECIFICATION

FOR

GI PIPES

TECHNICAL SPECIFICATIONS FOR GI PIPES

Service	:	Natural Gas
Working Pressure	:	6 bar (g)
Test Pressure	:	9 bar (g)
Working Temperature	:	0°C to 50°C
Material Description	:	IS:1239 (Part-I) Heavy Duty, Continuous Welded.
Min. Tensile Strength	:	30 kgf/sq.mm
Min. Elongation	:	6%
Tolerance	:	+ Not limited, - 10%
Protective Coating Electro Galvanising	:	Galvanized uniformly to protect from corrosion as per IS:4736/ ASTM A53 or by
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 AS3 or by electro galvanising.

1.5 Zinc conforming to any grade specified in IS13229-1991 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.

2.4 Pipes shall be protected from rust, corrosion and mechanical damage during

transportation, shipment and storage.

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

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

2.6 Steel end protectors to be used on galvanised pipes, shall be galvanised.

3.0 INSPECTION / DOCUMENTS

i) Inspect shall be carried out as per GGPL. Technical Specification and Inspection Plan / QAP.

ii) GGPL representative or third party inspection agency appointed by GGPL 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 GGPL. 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, GGPL 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 GGPL Technical specification, then GGPL 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.

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 compiled with at the time delivery.

TECHNICAL SPECIFICATION

FOR

COPPER PIPES

TECHNICAL SPECIFICATION FOR COPPER PIPES

Service	Natural gas
Working Pressure	21 mbar (g)
Hydrau;ic Test Pressure	35 bar (g) for 10 sec as per EN 1057 (latest)
Working Temperature	0^0C to 50^0C
Material Description	BS EN 1057 (latest) grade Cu – DHP or CW024A
Min. Tensile Strength	250 N/sq.mm
Min. Elongation	30%
Tolerance	+.5mm,-0
Chemical Composition	Cu % including silver : Min 99.9% Phosphorous % : 0.015 to 0.040%
Manufacture	The tubes shall be solid drawn by the process of melting, extrusion and thereafter bright annealing. The ends shall be cut clean square with axis of the tube in no case shall tubes be redrawn from old or used tubes.
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 length of 3 meters.

1.4 Freedom from defect : The tubes shall be free from internal and external fins, flaws

skin defects , blowholes, etc. or other irregularities which might restrict the free flow of fluid and shall be so designed that resistance to the flow of fluid through the tubes is minimized.

All tubes will be supplied 100 % Eddy current tested as per ASTM E243 and BS EN 1057. Eddy current testing is a computer aided test, wherein the tubes passes through a probe and an electromagnetic field is created around the peripheral of the tube to detect any flaw or blow hole which may not visible to the naked eye. The manufacturer must have in house Eddy current testing facilities to supply to GGPL. GGPL reserve right to witness the Eddy current facility at the manufacture's factory premises.

1.5 Drift Expanding Test: Drift expanding test shall be carried out as per EN 1057. The OD of the tube end shall be expanded by 30% using a conical mandrel (at angle 450) with no wrinkles, cracks, break, or any form of defect should occur on the tube during test & after the test.

1.6 Carbon Film Test: Cu tubes to be tested for carbon film test and the manufacture will certify that the tubes meet requirement of clause 8.5 of BS EN 1057

1.7 Carbon Content Test: Cu tubes to be tested of carbon content test to ensure a carbon level to avoid the formation of carbon film during installation. Max carbon level shall be permitted as per clause 6.5 of BS EN 1057

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.

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

3.0 INSPECTION / DOCUMENTS

i) Inspect shall be carried out as per GGPL. Technical Specification and Inspection Plan / QAP.

ii) GGPL representative or third party inspection agency appointed by GGPL 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 GGPL Technical Specific ratio and specified code for 100% material, at the time of final inspection of each supply lot of material.

iv) Even after third party inspection, GGPL 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 GGPL Technical specification, then GGPL 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

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 compiled with at the time delivery.

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 certificate (physical property chemical composition & heat treatment report) shall also be furnished for the fittings supplied.

1.3 Zinc conforming to any grade specified in IS13229-1991 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 clause11.1b 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 to 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.

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 GGPL. Technical Specification and Inspection Plan / QAP.

ii) GGPL representative or third party inspection agency appointed by GGPL 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 GGPL. 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, GGPL 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 GGPL Technical specification, then GGPL 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.

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 compiled with at the time delivery.

TECHNICAL SPECIFICATION

FOR

COPPER FITTINGS

Table of Contents

1.0 SCOPE

This specification covers the requirements for Copper Capillary fittings (End feed). Unless modified by this specification requirement European EN 1254 Part-I shall be valid.

2.0 MATERIAL

i) The material used for the manufacturer of Copper Capillary Fittings shall confirm to BS EN 1254 - 1: latest Half hard
ii) Material used for the solder should conform to BS 219 & BS EN 29453 or equivalent and should be lead free.

3.0 DIMENSIONAL TOLERANCES

Dimensions tolerances of various types of copper capillary fittings (End feed) shall be as per BS 864 Part-2 (latest) & EN 1254 (Open tolerances on dimensions shall be +/- 0.1 mm).

The tolerances as specified in EN 1254 in nominal diameter are as follows (Ref Table 2).

Nominal Diameter	**Tolerance on the mean diameter with respect to the nominal diameter**		**Resulting Difference**	**Diametrical**
D	**Outside Dia of male end (mm)**	**Inside dia of Socket (mm)**	**Max. (mm)**	**Min. (mm)**
12mm	+.0.04 -.0.05	+0.15 -0.06	0.20	0.02

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

Nominal Dia mm D	Minimum wall thickness (mm) wrought coppers
12	0.6

End connection of the Fitting must be capable of end feeding. Internal solder ring type fitting is not acceptable

4.0 CARBON IN BORE

The internal surface of copper capillary fittings for soldering or brazing shall not contain any detrimental film nor present a carbon level high enough to allow the formation of such a film during installation. The maximum total carbon level on internal surfaces shall not exceed 1.0 mg/dm2 when tested in accordance with the specification.

5.0 CHEMICAL PROPERTIES

Each heat no. of the copper fitting will be tested for chemical properties to conform to non-arsenical copper DHP grade C 106 as per BS EN 1057 &BS 2871 to have the following chemical composition :

Copper Percentage	: Min 99.9%
Phosphorus Percentage	:0.015 to 0.040%

6.0 FREEDOM FROM DEFECTS

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

7.0 PRESSURE TEST

All fittings shall be leak tested at the option of BGL at a pressure of 1 bar (g) for a period of 2 minutes and no leakage is permitted during this period Manufacturer's Test Certificate is necessary with supply.

STRESS CORROESION RESISTANCE TEST

A Stress Corrosion Resistance is to be carried out as per method defined in ISO 6957 using test solution of pH 9.5 but without pickling

8.0 MARKING

Each tube shall be embossed with manufacturers name or trade mark BS 864 or EN 1254. Each packing containing fittings shall carry the following stamped or written in indelible ink.

a) Manufacturers name or trade mark

b) Designation of tubes

c) BS Symbol mentioning as 864 or EN 1254 to be used.

9.0 INSPECTION / DOCUMENTS

i) Inspect shall be carried out as per GGPL. Technical Specification and Inspection Plan / QAP.

ii) GGPL representative or third party inspection agency appointed by GGPL shall carry out stage wise inspection during manufacturing / final inspection.

iii) Vendor shall furnish all the material test certificates, proof of approval / license from specified authority as per specified standard, if relevant, internal test / inspection reports as per GGPL. 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, GGPL 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 GGPL Technical specification, then GGPL reserves the rights to reject all production supplied from the batch.

v) Vendor shall prepare and submit the detail drawing of required copper fittings for approval by GGPL before starting production

vi) 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.

STANDARD SPECIFICATION

FOR

BRASS FITTINGS

Sl.No. **C O N T E N T S**

Description

TECHNICAL SPECIFICATION FOR BRASSFITTINGS

1.0 SCOPE

This specification covers the requirements for Brass Fittings. The fittings should be suitable for use with normal working pressure of 100m bar & maximum working pressure of 200m bar. Unless modified by this specification, requirement of BS:746 shall be valid.

All pressure mentioned in this specification are Gauge Pressures.

2.0 MATERIAL

The material used for the manufacturer of Brass fittings shall confirm to IS:319 or EN 1254-1(latest). Free cutting extruded brass rod. Vendors shall use materials having valid BIS or BS monogram.
Material used for the solder should conform to BS EN 29453 and should be lead free. Solder material shall be generally melting within the temperature range 180 to 250 c Threading on the Brass Fitting shall be done by BS 21

3.0 DIMENSIONALTOLERANCES

i) Dimensions tolerances of various types of fittings shall be as perBS:746.

Diameter	Tolerance on mean Diameter w.r.t. the nominal diameter		Resulting Diametrical Difference	
D	Outside Dia of male end	Inside dia of male end	Max (mm)	Min(mm)
12 mm	+0.04	+0.15	0.20	0.02
	-0.05	+0.06		

ii) Union nuts shall be of hexagonal type.
iii) The Minimum wall thickness of a fitting shall be in accordance as given below

4.0 THREADS

i) Fittings shall be threaded to dimensions & the tolerances as specified in BS:21 unless specified otherwise.
ii) Provisions for tightening shall be made on all straight fittings.
iii) All male & female threads are tapered.

iv) Chamfering

The outlet of the fittings shall have a chamfer, the chamfer shall have an included angle of 90° ± 5° for internal threads & 70° ± 10° for external threads.

5.0 FREE FROMDEFECT

Thefittingsshallbefreefrominternalfinsorotherirregularitieswhichmightrestrictthe free flow of fluid & shall be so designed that resistance to the flow of fluid through the

fittings is minimized.

Carbon in Bore
The internal surface of brass capillary fittings for soldering or brazing shall not contain any detrimental film nor present a carbon level high enough to allow the formation of such a film during installation. The maximum total carbon level on internal surface shall not exceed 1.0 mg/dm2 when tested in accordance with specification. Test shall carried out as per EN 1254-1

Resistance to Dezincification
The fitting shall be manufactured form alloys containing more than 10% Zinc. So fittings shall be required to be resistant to dezincification it shall be carried as perEN -1254-1

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

6.0 PRESSURETEST

All fittings shall be leak tested at a pressure of 1 bar (g) for a period of 5 minutes & no leakage is permitted during this period.

7.0 MARKING

Each fittings shall be embossed with manufacturers name or trade mark. Each packing containing fittings shall carry the following stamped or written in indelible ink.

a) Manufacturers name of trademark
b) Designation of fittings
c) Lot number

8.0 INSPECTION/DOCUMENT

i) Inspection shall be carried out as per Technical Specification.

ii) Purchaser's representative or Third party inspection agency appointed by the Purchaser shall carry out stage wise inspection during manufacturing/ final inspection.

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

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

TECHNICAL SPECIFICATION

FOR

PE BALL VALVES

Contents

Item:	:	PE BALLVALVE
Application	:	Natural Gas Distribution Services
Code	:	ASME B16.40**/**EN1555-4
Rating	:	PE100SDR11
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 client/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 SPECIFICATION

FOR

ISOLATION & APPLIANCE BALL VALVES

Sl.No.	**Description**
1.0	INTENT OFSPECIFICATION
2.0	MATERIAL SPECIFICATION FOR ISOLATIONVALVES
3.0	MATERIAL SPECIFICATION FOR APPLIANCEVALVES

1.0 INTENT OFSPECIFICATION

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 ISOLATIONVALVES

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 : ½", ¾" 1'', 11/2''

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

2.1.4 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 at90°.

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 105 Nm, 225 Nm & 340 Nm torque for½", ¾" & 1" respectively, as applied to a pipe being connected to the valve.

ii) Valve shall be capable of withstanding without deformation or leakage 75 Nm, 100 Nm, 125 Nm bending moment for ½", ¾" & 1" respectively for an angular displacement of10° whichever occurs first, if applied to a pipe connected to the valve.

iii) The valves shall be capable of withstanding 25Nm impact without breakage or leakage.

3.0 MATERIAL SPECIFICATION FOR APPLIANCEVALVES

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 trademark
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 1ml/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 100Nm torque, as applied to a pipe being connected to the valve.

ii) Valve shall be capable of withstanding without deformation or leakage 75Nm 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.

TECHNICAL SPECIFICATION

FOR

WARNING MATS

SPECIFICATION FOR THE WARNING MATS

Purpose	For using as a warning sign for underground natural gas pipeline
Width	250mm ±2mm for underground gas pipeline
Thickness	0.5mm thk. (500 microns ±8%)
Tracer wire	Double copper wire-with anti corrosive coating, in sinusoidal wave pattern
Material of the mat	Yellow colour and black text
Art work	A sample piece of 30mm wide and 200mm long of every batch shall be checked by immersing in 20% solution of ammonium sulphate for period of 2 weeks at a temp. Of 15 degree C for colour intactness of the strip. Art work would be finalised after placement of order.

Mechanical properties of HDPE:-

1. Tensile strength - min. 1.8kg/sq.cm
2. Elongation-Min.125%

- Bundle length: 0.5mm thick warning mat shall be 100m
- Test certificates: Vendor has to submit all test certificates
- Inspection: Manufacturer has to submit the QAP

LAYING

The warning mat may be laid between a depth of 300-400mm from the ground level. Care must be taken so that no damage takes place in the tracing wire. All measures must be taken for maintaining the continuity of the tracing wire. For this purpose, an overlap length of 200mm must be provided between two separate mats. The overlap length of the mats must be crimped by using SS studs.

TECHNICAL SPECIFICATION FOR FLEXIBLE HOSE PIPE

Item	:	Flexible Hose Pipe(Type- A)Assembly for Natural Gas Service
Applicable Code	:	BS:6501Part-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) at 20°C
Temperature Range	:	0 –65°C
Cyclic Life	:	30 Bends when tested in accordance withCl.14.4 ofBS:6501Part-I
Static Bend Radius	:	25mm
Type & Material of End Fitting	:	¾" NPTCS Female Swivel Nut with Flat Seat Nipple with Rubber Gasket/`O'Ring and second end shall be CS Male ¾" and NPT and threads shall be conforming to ANSI B20.1 CS Fittings shall be conforming to SA105/SA106Gr.B. CS Fittings shall be galvanized as per IS:4759-1985. Note: TIG welding shall be carried out for welding CS fittings to corrugated hose.
Material of rubber gasket	**:**	Polymer NBR/nitrite with Thickness3-4mm
Material of Hose	:	SS316 conforming to BS:1449Part- 2 (latest) & 0.3mm thickness
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) TypetestingasperCl.Nos.14.1,14.2,14.5&14.6ofB S:6501Part-I
Cleaning & Packaging	:	As per Cl.No.17.0 of BS:6501Part-I
Test Certificate	:	As per Cl.No.18.0 of BS:6501Part-I

INSPECTION /DOCUMENTS

i) Inspect shall be carried out as per GGPL Technical Specification and Inspection Plan/QAP.

ii) GGPL representative or third party inspection agency appointed by GGPL shall carryout stage wise inspection during manufacturing/final inspection.

iii) Vendorshallfurnishallthematerialtestcertificates,proofofapproval/ licencefromspecifiedauthorityasperspecifiedstandard,ifrelevant,internaltest/inspectionreportsasperGailGasLtd.TechnicalSpecification and specified code for 100% material, at the time of final inspection of each supply lot of material.

iv) Even after third party inspection, GGPL 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 GGPL. Technical specification, GGPL 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.

SPECIFICATION

FOR

QUALITY ASSURANCE SYSTEMS REQUIREMENTS

CONTENTS

1.0 INTRODUCTION

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

In case of any conflict between this specification and other provisions of the contract/ purchase order, the same shall be brought to the notice of , at the stage of bidding and shall be resolved with , 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 Owner for delivery of some products (including service). The word is considered synonymous to supplier, contractor or vendor.

Correction

Action taken to eliminate the detected non-conformity.

Refers to repair, rework or adjustment and relates to the 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.

Special Process

Processes requiring pre-qualification of their process capability.

3.0 CONTRACTORS SCOPE OFWORK

3.1 Prior to award of contract

The bidder shall understand scope of work, drawings, specifications and standards etc., attached to the tender/ enquiry document, before he makes an offer.
The bidder shall submit milestone chart showing the time required for each milestone activity and linkages between different milestone activities alongwith overall time period required to complete the entire scope of work.
The bidder shall develop and submit manpower and resource deployment chart.
The bidder shall submit, alongwith the bid, a manual or equivalent document describing/ indicating/ addressing various control/ check points for the purpose of quality assurance and the responsibilities of various functions responsible for quality assurance.

3.2 After the award of contract
The bidder shall submit the schedule for submission of following documents in the kick-off meeting or within two weeks of the placement of order, whichever is earlier.

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

Various documents submitted by the bidder shall be finalised in consultation with . Here it shall be presumed that ones a bidder has made an offer, he has understood the requirements given in this specification and agrees to comply with them in totality unless otherwise categorically so indicated during pre-award stage through agreed deviation/ exception request. All Quality Assurance Plan (QAP) documents shall be reviewed by concerned functional groups of 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 Owner 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 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 Owner 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 SYSTEMREQUIREMENTS 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.

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 including all subsequent changes, if any After award of work, the bidder may review augmentation of manpower and resources deployment chart (submitted earlier), detail it out, if so consented by Owner and resubmit the same as "issued for effective implementation of the project".

4.2 The bidder shall plan the contract scope of work on quality 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 ofwork.

4.3 The bidder is required to review the contract at all appropriate stages to evaluatehiscapabilitieswithrespecttotimelyandqualitycompletionofall activities pertaining to contracted scope of work and shall report for constraints, if any to Owner.

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

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

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 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 have a system meeting the requirements of this specification. In all such eventualities, bidder may lend his system to sub-contractor for the contract such that sub-contractor effectively meets the requirements of this specification. In all such cases shall be duly informed.

4.7 Bidder shall establish adequate methodology such that the materials supplied by the Owner/ shall be adequately preserved, handled and made use of for the purpose for which they are provided.

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

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

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

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

4.16 Bidder shall prepare sufficient records for various processes carried out by him for delivery of contract scope of work such that requirements of this specification are objectively demonstrable. In case Owner finds that enough objective evidence/ recording is not available for any particular process, bidder shall be obliged to make additional records so as to provide sufficient objective evidence. The decision of Owner shall be final and binding on suchissues.

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

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

OBSERVATION OF QUALITY ASPECTS

FORMAT – 00002

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

Date: Name andSignature</td></tr>
<tr><td colspan="4">Distribution (before resolution) :
ProjectManager ChiefBusinessExecutive Inspection Resident Construction
Owner Bangalore Manager, Site</td></tr>
<tr><td colspan="4">Verification of Resolution by :

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

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

Note:

1) Thebidderensuresthatthefilledupformatconformstominimumrequirementson QualityPlan/QualityAssurance, specified by on drawings/ standards/ specifications/write-up.

2) The bidder confirms that document is issued for information/approval of owner for the project implementation

SPECIFICATION FOR

HEALTH, SAFETY AND ENVIRONMENT (HSE)

MANAGEMENT

CONTENTS

1.0 SCOPE

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

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

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

2.0REFERENCES

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
- JobSpecifications
- Relevant IS Codes (referAnnexure-A)
- Reporting Formats (referAnnexure-B)
- Statutoryrequirements

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

Management Responsibility

TheContractshouldhaveadocumentHSEpolicytocovercommitmentoftheorganization to ensure health, safety and environment aspects in theirlineofoperations

The HSE management system of the Contractor shall cover HSE requirement includingbutnotlimitedtowhatspecifiedunderclause1.0&2.0mentionedabove

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 theabove:

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 & raining at least weekly once. He / She shall possess are cognized 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 50 (for every 500 or less)	One additional safety engineer/Officer whose function will be as mentioned above
Contractor shall indemnify and hold harmless OWNER/ & their representatives from any and all liabilities arising out of non fulfilment 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 /Owner's approval

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/workplace.

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.

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

/vehicle on full time basis very close to theworksite

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

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

The Contractor shall ensure participation of his Resident Engineer/Site-in-Charge in the Safety Committee/HSE Committee meetings arranged by OWNER/ . The compliance of any observation shall be arranged urgently. Contractor shall assist OWNER 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 requirementsoftheownerasnotifiedfromtimetotime.Cigarettes,lighters,autoignitiontools or appliances shall not be allowed inside the plant complex. Smoking shall be permitted only inside smoking booths expressly designated &authorized by the Owner

The Contractor shall adhere consistently to all provisions of HSE requirements. In case of non-compliance or continuous failure in implementation of any of HSE provisions; OWNER/ 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. 10lakhs

0.2 %(Zerodecimaltwopercent)ofthecontractvalueforLSTK,EPC,EPCCorPackagecontracts withanoverallceilingofRs.1,00,00,000/-(Rupees one crore)

SL.NO	VIOLATION OR HSE NORMS	PENALTY AMOUNT
1.	For not using personal protective equipment (Helmet, shoes, goggles, gloves, full body harness, face shield, boiler suit etc.)	Rs.250/-per day/item/person
2.	Working without work permit clearance	Rs.5000/occasion
3.	Unsafe electrical practices (not installing ELCB, using poor joints of cables, using naked wire without top plug into socket, laying wire / cables on the roads, electrical jobs by incompetent person,etc.)	Rs.3000/per item per day
4.	Working at height without full body harness, using non-standard / rejected scaffolding and not arranging fall protection arrangement as required like Safety Nets	Rs.1000/per case per day
5.	Unsafe handling of compressed gas cylinders (No trolley, jubilee clips double gauge regulator, improper storage / handling)	Rs.100/per item per day
6	Use of domestic LPG for cutting purpose	Rs.1000/per occasion
7	No fencing/barricading of excavated areas	Rs.1000/per occasion
8	Not providing shoring/strutting/proper slope and not keeping the excavated earth at least 1.5m away from excavated area	Rs.5000/per occasion
9	Non display of caution boards, list of hospitals, emergency services available at work locations	Rs.500/ per occasion
10	Traffic rules violations like over speeding of vehicles, rash driving, wrong parking, not using seat belts, vehicles not fitted with reverse warningalarms.	Rs.1000/per occasion
11	Absence of Contractor's top most executiveatsiteinthesafetymeetingswhenevercalledby /Owner	Rs.1000/per occasion
12	Failure to maintain safety records by Contractor Safety personnel.	Rs.1000/per month
13	Failure to conduct daily safety site inspection, HSE meeting and HSE audit at predefined frequencies.	Rs.1000/per month
14	Failure to submit the monthly HSE report by 5th of subsequent month to Engineer-in-Charge	Rs.1000/per month

15	Poor House Keeping	Rs.1000/per occasion and Rs.1000/per day for further delay
16	Failure to report & follow up accident (including Near Miss) reportingsystem.	Rs.10,000/per occasion
17	Degradation of environment (not confining toxic spillsoil / lubricants onto ground)	Rs.1000/per occasion
18	Not medically examining the workers before allowing them to work at height, not providing ear muffs while allowing them to work in noise polluted areas, made them to work in air polluted areas without respiratory protective devices,etc	Rs.1000/per occasion
19	Violation of any other safety condition as per job HSE plan, work permit and HSE conditions of contract (using crowbar on cable trenches, improper welding booth, not keeping fire extinguisher ready at hot work site, unsafe rigging practices, non-availability of First-Aid box,etc.)	Rs.1000/per occasion
20	Any violation not covered above.	To be decided by /Client

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

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

House Keeping

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 identifiedlocation(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 structural, pipes& piping materials shall be stacked properly for erection.

f. Water logging on rods shall not be allowed.

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

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

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

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

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

Healthy, Safety and Environment

a) The Contractor shall provide safe means of access to any working place including provision of suitable and sufficient scaffolding at various stages during all operations of the work for the safety of his workmen, and OWNER/ . 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 / Owner. The necessary HSE measures devised shall be in place prior to start of an activity by the contractor.

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

The Contractor shall ensure that all their staff, workers and visitors including

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

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

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 &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./SafetyDeptt.is not required. 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, Engineers may cancel the permit and stop the work till satisfactory compliance is arranged. Contractors are expected to maintain a register for issuance of permit and extensions thereof including preserving the used permits for verification during audits etc.

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

Contractor shall ensure that Full body harnesses conforming EN361 and

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

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

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.

Contractor shall ensure that flash back arrestors conforming to BS:6158 or equivalent are installed on all gas cylinders as well as at the torch end of the gas hose, while in use. All cylinders shall be mounted on trolleys and provided with a closing key. The burner and the hose placed downstream of pressure reducer shall be equipped with Flash Back Arrester/Non ReturnValve 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.

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 atnight.

ContractorshallensureinstallationofSafeLoadIndicator(SLI)onallcranes(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 / Owner.

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

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-ionizingradiation 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)shallbe 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 beused.

l) Contractor shall ensure the following facilities at worksites:

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

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

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

p) 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 areselected.

Emphasize on recycling of waste materials such as metals, plastics, glass, paper, oil & solvents. The waste that cannot 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 thewastes.

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

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 theladder.

The contractor shall ensure that the scaffolds used during construction activities shall be strong enough to take the designed load. Owner / 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 t
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 elec. 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& tack lessed 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 / Owner for records. Availability of at least one competent

licensed electrician shall be ensured at site round the clock to attend to the normal / emergency jobs.

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

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

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

vi) Properhouse keeping shall be done around the electricalinstallations.

vii) All temporary installations shall be tested before energising, to ensure properearthing,bonding, suitability of protection system, adequacy of feeders/cablesetc.

viii) All welders shall use hand gloves irrespective of holdervoltage.

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 / localpanels.

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 amonth)

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 armouredcable.

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 insulationdamage.

x) Minimum depth of cable trench shall be 750 mm for MV & control cables and 900 mm for HV cables. These cables shall be laid over a sand layer and covered with sand, brick & soil for ensuring mechanical protection. Cables shall not be laid in waterlogged area as far as practicable. Cable route markers shall be provided at every 25 M of buried trench route. When laid above ground, cables shall be properlycleatedorsupportedonrigidpolesofatleast2Mhigh.

Minimum head clearance of 6 meters shall be provided at road crossings.

xi) Underground road crossings for cables shall be avoided to the extent feasible. In any case no underground 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 beused.

xiii) An independentearthing facility should preferably be established within the temporary installation premises. All appliancesand 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 copperlugs.

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 greencolour.

xvi) Separate core shall be provided for neutral. Earth / Structures shall not be used as a neutral in anycase.

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.

Workmenshallbemadeawareofcorrectmethodsforlifting,carrying,pushing&pullingof 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 shallbe 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 inhands.

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. /Ownerreservetherighttoaskthecontractortosubmittestreports.

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 communicationsothatanyuntowardincidentcanbereportedimmediatelyandassistance sought bythem.

All health & safety information shall be communicated in a simple & clear language easily understood by the local workforce.

Unsuitable Land Conditions

Contractor shall take appropriate measures and necessary work permits / clearances if work is to be done in or around marshy areas, river crossings, mountains, monuments,etc.

Under Water Inspection

Contractor shall ensure that boats and other means used for transportation, surveying &investigation works shall be certified seaworthy by a recognized classification society. It shall be equipped with all life saving devices like life jackets, adequate fire protection arrangements and shall posses communication facilities like cellular phones, wireless, walkie-talkie. All divers used for seabed surveys, underwater inspections shall have required authorized license, suitable life saving kit. Number of hours of work by divers shall be limited as per regulations. / Owner shall have the right to inspect the boat and scrutinize documents in thisregard.

TOOL BOX MEETING (TBM)

\Contractor shall conduct daily TBM with workers prior to start of work and shall maintain proper record of the meeting. A suggested format is given below. The TBM is to be conducted by the immediate supervisor of the workers.

TOOLBOX MEETING RECORDING SHEET

Date & Time

Subject

Presenter

Hazards involved

Precautions to be taken

Worker's Name	Signature	Section

Remarks, if any

The topics during TBM shall include

- Hazards related to work assigned on that day and precautions to betaken.
- 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 / Owner whenever demanded.

TRAINING

Contractor shall ensure that all his personnel possess appropriate training to carry out the assigned job safely. The training should be imparted in a language understood by them and should specifically be trained about

- Potential hazards to which they may be exposed at theirworkplace
- Measures available for prevention and

elimination of these hazards The topics during training shall cover, at the minimum;

- Education about hazards and precautionsrequired
- Emergency and evacuationplan
- HSErequirements
- Fire fighting andFirst-Aid
- Use of PPEs
- Local laws on intoxicating drinks, drugs, smoking inforce

Records of the training shall be kept and submitted to / Owr

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 ofradiocommunicationetc.fromanagencyacceptabletoOwner/.

INSPECTION

The contractor shall carryout daily HSE inspection and record observations at a central location. These inspection records shall be freely accessible to Owner / representatives. The contractor shall also assist Owner / 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 authorizationpermit.

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 othercontractors.

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 theOwner.

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- Aidmeasures.

g) Properbarricading/cordoningoftheoperationalunits/plantsshall 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.

i) 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 executionof

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 retardanttarpaulin.

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 bedone.

m) Clearance shall be obtained from all parties before starting hot tapping, patchwork on live lines and work on corroded tankroof.

n) Positive isolation of line/equipment by blinding for welding/cutting/grinding shall be done. Closing of valve will not be considered sufficient forisolation.

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 theOwner.

q) Plant air should not be used to clean any part of the body or clothing or use to blow off dirt on thefloor.

r) Gas detectors should be installed in gas leakage prone areas as per requirement of Owner's plant operationpersonnel.

s) An experienced full time safety personnel shall be exclusively deployed to monitor safety aspects in runningplants.

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 timeaccident.

04 DETAILS OF HSE MANAGEMENT SYSTEM BY CONTRACTOR

On Award of Contract

The Contractor shall prior to start of work submit his Health. Safety and Environment Manual of procedure and HSE Plans for approval by OWNER. The Contractor shall participate in the pre-start meeting with OWNER 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 monitoringeach.

- Organizations structure alongwith responsibility and authority records/ reports etc. on HSEactivities.

During job execution Implement approved Health, Safety and Environment management procedure including but not limited to as brought our under para 3.0. Contractor shall also ensure to:

- Arrange workmen compensation insurance, registration under ESI Act, third party liability insurance etc. as applicable.

- Arrange all HSE permits before start of activities (as applicable) like her work, confined space, work at heights, storage of Chemicals/explosives materials and its use and implement all precautions mentioned therein

- Submit timely the completed check list on HSE activities, Monthly HSE report, accident report, investigation report, etc. as per OWNER requirements. Compliance of instructions on HSE shall be done by Contractor and informed urgently to OWNER.

- Ensure that resident Engineers/Site-In-Charge of the Contractor shall amend all the Safety Committee/HSE meeting arranged by OWNER/ only in case of his absence from site, a seconds senior most person shall be nominated by him in advance and communicated to OWNER.

- Display at site office and work locations caution boards, list of hospitals for emergency services available.

- Provided posters, banners, for safe working to promote safety consciousness

- Carryout audits/inspection at sub Contractor work as per approved HSE documents & submit the reports for OWNER review.

- Assist in HSE audits by OWNER/ and submit compliance report.

- Generate & submit HSE records/ reports as per HSEPlan.

- Appraise OWNER on HSE activities atsite.

05 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 a theight	HSE-6
7.	Permit for working in confined space	HSE-7
8.	Permit for radiation work	HSE-8
9.	Permit for demolishing/dismantling	HSE-9

ANNEXURE-A

A. I.S. CODES ONHSE

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:2925Industrial 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 Safetyfootwear

IS:6994 (Part-I) Industrial Safety Gloves (Leather & CottonGloves)

IS:7293 Safety Code for working with construction Machinery IS: 8519 Guide for selection of industrial safety equipment for body

IS: 9167 Ear protectors

IS: 11006 Flash back arrestor (Flame arrestor)

IS:1101 General and safety requirements for machine tools and their operation

IS: 11057 Specification for Industrial safetynets

IS: 11226 Leather safety footwear having direct moulded rubbersole

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

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 BS 1651
Hand Gloves	:	BS 6344, ANSI S 31.9
Ear Muffs	:	ANSI Z 89.1 / 89.2, AS 1808, BS 5240, DIN 4840 ANSI Z 87.1
Hard Hat	:	ANSI Z 89.1
Goggles	:	BS 4667, NIOSH ANSI Z 49.1
Face Shield	:	P-1 (Compressed Gas Association 1235 Jefferson Davis Highway, Arlington VA 22202 - USA)
Breathing Apparatus	:	
Welding & Cutting	:	
Safe handling of	:	

ANNEXURE-B

DETAILS OF FIRST AID BOX

SL. NO	DESCRIPTION	*QUANTITY*
1.	Small size Roller Bandages, 1 inch wide (Finger Dressing small)	6 Pcs.
2.	Medium size Roller Bandages, 2 inch wide (Hand and Foot Dressing)	6 Pcs.
3.	Large size Roller Bandages, 4 inch wide (Body Dressing Large)	6 Pcs.
4.	Large size Burn Dressing (Burn Dressing Large)	4 Pkts.
5.	Cotton wool (20 gms packing)	4 Pkts.
6.	Antiseptic Solution Dettol (100 ml.) or Savlon	1 Bottle
7.	Mercurochrome Solution (100 ml.) 2% in water	1 Bottle
8.	Ammonia Solution (20 ml.)	1 Bottle
9.	A Pair of Scrissors	1 Piece
10.	Adhesive Plaster (1.25 cm x 5 m)	1Spool
11.	Eye pads in Separate Sealed Packet	4 Pcs.
12.	Tourniqut	1 No.
13.	Safety Pins	1 Dozen
14.	Tinc. Iodine / Betadin (100 ml.)	1 Bottles
15.	Ointment for burns (Burnol 20 gms.)	1 Bottole
16.	Polythene Wash cup for washing eyes	1 No.
17.	Potassium Permanganate (20 gms.)	1 Pkt.
18.	Tinc. Benzoine (100 ml.)	1 Bottole
19.	Triangular Bandages	2 Nos.
20.	Band Aid Dressing	5 Pcs.
21.	Iodex / Moov (25 gms.)	1 Bottole
22.	Tongue Depressor	1 No.
23.	Boric Acid Powder (20 gms.)	2 Pkt.
24.	Sodium Bicarbonate (20 gms.)	1 Pkt.
25.	Dressing Powder (Nebasulf) (10 gms.)	1 Bottole
26.	Medicinal Glass	1 No.
27.	Duster	1 No.
28.	Booklet (English & Local Language)	1 No. each
29.	Soap	1 No.
30.	Toothache Solution	1 No.
31.	Eye Ointment	1 Bottle
32.	Vicks (22 gms.)	1 Bottle
33.	Forceps	1 No.
34.	Cotton Buds (5 nos.)	1 Pkt.
35.	Note Book	1 No.
36.	Splints	4 Nos.
37.	Lock	1 Piece
38.	Life Saving/Emergency/Over-the Counter Drugs	As decided at site
	Box size : 14" x 12" x 4"	

Note :The medicines prescribed above are only indicative. Equivalent medicines can also be used.
A prescription, in this regard, shall be required from a qualified Physician.

ANNEXURE - C

TYPE OF FIRES VIS-À-VIS FIRE EXTINGUISHERS

Fire Purpose	Fire Extinguishers				
	Water	Foam	CO_2	Dry Powder	Multi (ABC)
Originated from paper, clothes, wood	√	√	Can control minor surface fires	Can control minor surface fires	√
Inflammable liquids like alcohol, diesel, petrol, edible oils, bitumen	x	√	√	√	√
Originated from gases like LPG, CNG, H_2	x	x	√	√	√
Electrical Fires	x	x	√	√	√

Legend : √ Can be used
X Not to be used

Note :Fire extinguishing equipment must be checked atleast once a year and after every use by an authorized person. The equipment must have an inspection label on which the next inspection date is giver:. Type of extinguisher shall clearly be marked on it.

ANNEXURE - D

Indicative List of Statutory Acts & Rules Relating to HSE

The Indian Explosives Act and Rules

The Motor Vehicle Act and Central Motor Vehicle Rules

The Factories Act and concerned Factory Rules

The Petroleum Act and Petroleum Rules

The Workmen Compensation Act

The Gas Cylinder Rules and the Static & Mobile Pressure Vessels Rules.

The Indian Electricity Act and Rules

The Indian Boiler Act and Regulations

The Water (Prevention & Control & Pollution) Act

The Water (Prevention & Control of Pollution) Cess Act

The Mines & Minerals (Regulation & Development) Act

The Air (Prevention & Control of Pollution) Act

The Atomic Energy Act

The Radiation Protection Rules

The Indian Fisheries Act

The Indian Forest Act

The Wild Life (Protection) Act

The Environment (Protection) Act and Rules

The Hazardous Wastes (Management & Handling) Rules

The Manufacturing, Storage & import of Hazardous Chemicals Rules

The Public Liability Act

The Building and Other Construction Workers (Regulation of Employment and Condition of service) Act

Other statutory acts Like EPF, ESIS, Minimum Wage Act

ANNEXURE - E

CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES

ACTIVITY	*TYPE OF HAZARD*	EFFECT OF HAZARD	PREVENTIVE MEASURES
(A) EXCAVATION Pit Excavation up to 3.0m	¾ Falling into pit	¾ Personal injury	¾ Provide guard rails/barricade with warning signal. ¾ Provide at least two entries/exits. ¾ Provide escape ladders.
	¾ Earth Collapse	¾ Suffocation / Breathlessness ¾ Buried	¾ Provide suitable size of shoring and strutting, if required. ¾ Keep soil heaps away from the edge equivalent to 1.5m or depth of pit whichever is more. ¾ Don't allow vehicles to operate too close to excavated areas. Maintain at least 2m distance from edge of cut. ¾ 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. ¾ Battering/benching the sides.
	¾ Contact with buried electric cables ¾ Gas/ Oil Pipelines	¾ Electrocution ¾ Explosion	¾ Obtain permission from competent authorities, prior to excavation, if required. ¾ Locate the position of buried utilities by referring to plant drawings. ¾ Start digging manually to locate the exact position of buried utilities and thereafter use

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			mechanical means.
	¾ Same as above plus ¾ Flooding due to excessive rain/ underground water	¾ Can cause drowning situation	¾ Prevent ingress of water ¾ Provide ring buoys ¾ Identify and provide suitable size dewatering pump or well point system
	¾ Digging in the vicinity of existing Building/ Structure	¾ Building/ Structure may collapse ¾ Loss of health & wealth	¾ Obtain prior approval of excavation method from local authorities ¾ Use under-pining method ¾ Construct retaining wall side by side
	¾ Movement of vehicles / equipments close to the edge of cut.	¾ May cause cave-in or slides ¾ Persons may get buried	¾ Barricade the excavated area with proper lighting arrangements ¾ Maintain at least 2m distance from edge of cut and use stop block to prevent over-run. ¾ Strengthen shoring and strutting
	¾ Same as above plus ¾ Frequent cave-in or slides	¾ May cause severe injuries or prove fatal	¾ Battering/benching of sides ¾ Provide escape ladders
	¾ Flooding due to Hydrostatic testing	¾ May arise drowning situation	¾ Same as above plus ¾ Bail out accumulated water ¾ Maintain adequate ventilation
	¾ Improper handling of explosives	¾ May prove fatal	¾ Ensure proper storage, handling & carrying of explosives by trained personnel. ¾ Comply with the applicable explosive acts& rules.
	¾ Uncontrolled explosion	¾ May cause severe injuries or prove fatal	¾ Allow only authorized persons to perform blasting operations. ¾ Smoking and open

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			flames are to be strictly prohibited.
	¾ Scattering of stone pieces in atmosphere	¾ Can hurt people	¾ Use PPE like goggles, face mask, helmets etc.
	¾ Entrapping of persons/ animals.	¾ May cause severe injuries or prove fatal	¾ Barricade the area with red flags and blow siren before blasting.
	¾ Misfire	¾ May explode suddenly	¾ Do not return to site for at least 20 minutes or unless announced safe by designated person.
	¾ Failure of pile-driving equipment	¾ Can hurt people	¾ Inspect Piling rigs and pulley blocks before the beginning of each shift.
	¾ Noise pollution	¾ Can cause deafness ¾ and psychological imbalance	¾ Use personal protective equipments like ear plugs, muffs, etc.
	¾ Extruding rods / casing	¾ Can hurt people	¾ Barricade the area an install sign boards ¾ Provide first-aid
	¾ Working in the vicinity of 'Live-Electricity'	¾ Can cause electrocution / asphyxiation	¾ Keep sufficient distance from Live-Electricity as per IS code. ¾ Shut off the supply, if possible ¾ Provide artificial/rescue breathing to he injured.
	¾ Air pollution by cement	¾ May affect Respiratory System	¾ Wear respirators or cover mouth and nose with wet cloth.
	¾ Handling of ingredients	¾ Hand s may get injured	¾ Use gloves and other PPE.
	¾ Protruding reinforcement rods.	¾ Feet may get injured	¾ Use Safety shoes. ¾ Provide platform above reinforcement for movement of workers.
	¾ Earthing of electrical mixers,	¾ Can cause electrocution / asphyxiation	¾ Ensure earthing of equipments and proper functioning of

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
	vibrators, etc. not done		electrical circuit before commencement of work.
	¾ Falling of materials from height	¾ Persons may get injured	¾ Use hard hats ¾ Remove surplus material immediately from work place ¾ Ensure lighting arrangements during night hours.
	¾ Continuous pouring by same gang	¾ Cause tiredness of workers and may lead to accident.	¾ Insist on shift pattern ¾ Provide adequate rest to workers between subsequent pours.
	¾ Revolving or concrete mixer/ vibrators	¾ Parts of body or clothes may get entrapped.	¾ Allow only mixers with hopper ¾ Provide safety cages around moving motors ¾ Ensure proper mechanical locking of vibrator
	¾ Same as above plus ¾ Deflection in props or shuttering material	¾ Shuttering / props may collapse and prove fatal	¾ Avoid excessive stacking on shuttering material ¾ Check the design and strength of shuttering material before commencement of work ¾ Rectify immediately the deflection noted during concreting
	¾ Passage to work place	¾ Improperly tied and designed props / planks may collapse	¾ Ensure the stability and strength of passage before commencement of work ¾ Do not overload and under the passage.
	¾ Curtailment and binding of rods	¾ Persons may get injured	¾ Use PPE like gloves, shoes, helmets, etc. ¾ Avoid usage of shift tools
	¾ Carrying of rods for short distance/ at	¾ Workers may injure their hands and shoulders	¾ Provide suitable pads on shoulders and use safety

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
	heights		gloves. ¾ Tie up rods in easily liftable bundles ¾ Ensure proper staging.
	¾ Checking of clear distance/ cover with hands	¾ Rods may cut or injure the finger	¾ Use measuring devices tape, measuring rods, etc.
	¾ Hitting projected rods and standing on cantilever rods	¾ Persons may get injured and fall down	¾ Use safety shoes and avoid standing unnecessarily on cantilever rods ¾ Avoid wearing loose clothes
	¾ Falling of material from height	¾ May prove fatal	¾ Use helmets ¾ Provide safety nets
	¾ Transportation of rods by trucks / trailers	¾ Protruded rods may hit the persons	¾ Use red flags/lights at the ends ¾ Do not protrude the rods in front of or by the side of driver's cabin. ¾ Do not extend the rods 1/3rd of deck length or 1.5 m which is less
	¾ Welding radiates invisible ultraviolet and infrared says	¾ Radiation can damage eyes and skin.	¾ Use specified shielding devices and other PPE of correct specifications ¾ Avoid throated tungsten electrodes for GTAW.
	¾ Improper placement of oxygen and acetylene cylinders	¾ Explosion may occur	¾ Move out any leaking cylinder ¾ Keep cylinder in vertical position ¾ Use trolley for transportation of cylinders and chain them ¾ Use flash back arrestors
	¾ Leakage / cuts in hoses	¾ May cause fire	¾ Purge regulators immediately and then turn off ¾ Never use grease or

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			oil on oxygen line connections and copper fittings on acetylene lines ¾ Inspect regularly gas carrying hoses ¾ Always use red hose for acetylene & other fuel gases and black for oxygen.
	¾ Opening-up of cylinder	¾ Cylinder may burst	¾ Always stand back from the regulator while opening the cylinder ¾ Turn valve slowly to avoid bursting ¾ Cover the lug terminals to prevent short circuiting.
	¾ Welding of tanks, container or pipes storing flammable liquids	¾ Explosion may occur	¾ Empty & purge them before welding ¾ Never attach the ground cable to tanks, container or pipe storing flammable liquids ¾ Never use LPG for gas cutting
	¾ Ionizing Radiation	¾ Radiations may react with the skin and can cause cancer, skin irritation, dermatitis, etc.	¾ Ensure safety regulations as per BARC/AERB before commencement of job. ¾ Cordon off the area and install Radiation warning symbols ¾ Restrict the entry of unauthorized persons ¾ Wear appropriate PPE and film badges issued by BARC/AERB
	¾ Transportation and Storage of Radiography source	¾ Same as above	¾ Never touch or handle radiography source with hands ¾ Store radiography source inside a pit in an exclusive isolated

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			storage room with lock and key arrangement. The pit should be approved by BARC/AERB ¾ Radiography source should never be carried either in passenger bus or in a passenger compartment of trains. ¾ BARC/AERB have to be informed before source movement. ¾ Permission from Director General of Civil Aviation is required for booking radio isotopes with airlines.
	¾ Loss of Radio isotope	¾ Same as above	¾ Try to locate with the help of Survey Meter. ¾ Inform BARC/AERB(*) (*) Atomic Energy Regulatory Board (AERB), Bhabha Atomic Research Centre (BARC) Anushaktinagar, Mumbai - 400 094
	¾ Short circuiting	¾ Can cause Electrocution or Fire	¾ Use rubberized hand gloves and other PPE ¾ Don't lay wires under carpets, mats or door ways. ¾ Allow only licensed electricians to perform on electrical facilities ¾ Use one socket for one appliance ¾ Ensure usage of only fully insulated wires or cables ¾ Don't place bare wire ends in a socket

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			¾ Ensure earthing of machineries and equipments ¾ Do not use damaged cords and avoid temporary connections ¾ Use spark-proof/flame proof type field distribution boxes. ¾ Do not allow open/bare connections ¾ Provide all connections through ELCB ¾ Protect electrical cables / equipment's from water and naked flames ¾ Check all connections before energizing.
	¾ Overloading of Electrical System	¾ Bursting of system can occur which leads to fire	¾ Display voltage and current ratings prominently with 'Danger' signs. ¾ Ensure approved cable size, voltage grade and type. ¾ Switch off the electrical utilities when not in use. ¾ Do not allow unauthorized connections. ¾ Ensure proper grid wise distribution of Power.
	¾ Improper laying of overhead and underground transmission lines / cables	¾ Can cause electrocution and prove fatal	¾ Do not lay unarmored cable directly on ground, wall, roof of trees ¾ Maintain at least 3m distance from HT cables ¾ All temporary cables should be laid at least 750 mm below ground on 100 mm

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			fine sand overlying by brick soling ¾ Provide proper sleeves at crossings/ intersections ¾ Provide cable route markers indicating the type and depth of cables at intervals not exceeding 30m and at the diversions / termination.
	¾ Small fires can become big ones and may spread to the surrounding areas	¾ Cause burn injuries and may prove fatal.	¾ In case a fire breaks out, press fire alarm system and shout "Fire, Fire" ¾ Keep buckets full of sand & water/fire extinguishing equipment near hazardous locations ¾ Confine smoking to 'Smoking Zones' only ¾ Train people for using specific type of fire equipments under different classes of fire ¾ Keep fire doors/ shutters, passages and exit doors unobstructed ¾ Maintain good house keeping and first-aid boxes (for detail refer Annex-2) ¾ Don't obstruct assess to Fire extinguishers ¾ Do not use elevators for evacuation during fire ¾ Maintain lightening arrestors for elevated structures ¾ Stop all electrical motors with internal combustion. ¾ Move the vehicles from dangerous

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
	¾ Short circuiting of electrical system	¾ Same as above ¾ Can cause Electrocution	¾ Don't lay wires under carpets, mats or door ways ¾ Use one socket for one appliance ¾ Use only fully insulated wires or cables ¾ Do not allow open/bare connections ¾ Provide all connections through ELCB ¾ Ensure earthing of machineries and equipments
	¾ Crossing the Speed Limits (Rash driving)	¾ Personal injury	¾ Obey speed limits and traffic rules strictly ¾ Always expect the unexpected and be a defensive drive ¾ Use sat belts/helmets ¾ Blow horn at intersections and during overtaking operations. ¾ Maintain the vehicle in good condition ¾ Do not overtake on curves, bridges and slopes
	¾ Adverse weather condition	¾ Same as above	¾ Read the road ahead and ride to the left ¾ Keep the wind screen and lights clean ¾ Do not turn at speed ¾ Recognize the hazard, understand the defense and act correctly in time.
	¾ Consuming alcohol before and during he	¾ Same as above	¾ Alcohol and driving do not mix well. Either choose

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
	driving operation		alcohol or driving. ¾ If you have a choice between hitting a fixed object or an oncoming vehicle, hit the fixed object ¾ Quit the steering at once and become a passenger. Otherwise take sufficient rest and then drive. ¾ Do not force the driver to drive fast and round the clock ¾ Do not day dram while driving
	¾ Falling objects / Mechanical failure	¾ May prove fatal	¾ Ensure effective braking system, adequate visibility for the drives, reverse warning alarm. ¾ Proper maintenance of the vehicle as per manufacturer instructions
	¾ Bursting of piping ¾ Collapse of tanks ¾ Tanks flying off	¾ May cause injury and prove fatal	¾ Prepare test procedure & obtain CONSULTANT/ Owner's approval ¾ Provide separate gauge for pressurizing pump and piping/equipment ¾ Check the calibration status of all pressure gauges, dead weight testers and temperature recorders ¾ Take dial readings at suitable defined intervals and ensure most of them fall between 40-60% of the gauge scale range ¾ Provide safety relief valve (set at

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			pressure slightly higher than test pressure) while testing with air/nitrogen ¾ Ensure necessary precautions, stepwise increase in pressure, tightening of bolts/ nuts, grouting, etc. before and during testing ¾ Keep the vents open before opening any valve while draining out of water used for hydro testing of tanks ¾ Pneumatic testing involves the hazard of released energy shored in compressed gas. Specific care must therefore be taken to minimize the chance of brittle failure during a pneumatic leak test. Test temperature is important in this regard and must be considered when the designer chooses the material of construction ¾ A pressure relief device shall be provided, having a set pressure not higher than the test pressure plus the lesser of 345 KPa (50 psi) or 10% of he test pressure. The gas used as test fluid, if not air, shall be nonflammable and nontoxic.
	¾ Person can fall down	¾ May sustain severe injuries or	¾ Provide guard rails/barricade at the

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
		prove fatal	work place ¾ Use PPE like safety belts, full body harness, life line, helmets, safety shoes, etc. ¾ Obtain a permit before starting the work at height above 3 meters ¾ Fall arrest systems like safety nets, etc. must be installed ¾ Provide adequate working space (min. 0.6 m) ¾ Tie/weld working platform with fixed support ¾ Use roof top walk ladder while working on a slopping roofs ¾ Avoid movement on beams
		¾ May hit the scrap / material stacked at the ground or in between	¾ Keep the work place neat and clean ¾ Remove the scrap immediately
	¾ Material can fall down	¾ May hit the workers working at lower levels and prove fatal.	¾ Same as above plus ¾ Do not throw or drop material or equipment from height ¾ All tools to be carried in a toolkit bags or on working uniform ¾ Remove scrap from the planks ¾ Ensure wearing of helmet by the workers at low level
	¾ Suffocation / drowning	¾ Unconsciousness, death	¾ Use respiratory devices, if required ¾ Avoid over crowding inside a confined space ¾ Provide Exhaust Fans for ventilation ¾ Do not wear loose clothes, neck ties,

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			etc. ¾ Fulfill conditions of the permit. ¾ Check for presence of hydrocarbons, O_2 level ¾ Obtain work permit before entering a confined space ¾ 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
	¾ Presence of foul smell and toxic substances	¾ Inhalation can pose threat to life.	¾ Same as above plus ¾ Check for hydrocarbon and Aromatic compounds before entering a confined space ¾ Depute one person outside the confined space for continuous monitoring and for extending help in case of an emergency
	¾ Ignition / flame can cause fire	¾ Person may sustain burn injuries or explosion may occur	¾ Keep fire extinguishers at a hand distance ¾ Remove surplus material and scrap immediately ¾ Do not smoke inside a confined space ¾ Do not allow gas cylinders inside a confined space ¾ Use low voltage (24V) lamps for lighting ¾ Use tools with air motors or electric tools with max.

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			voltage of 24V ¾ Remove all equipments at the end of the day
	¾ Failure of load lifting and moving equipments	¾ Can cause accident and prove fatal	¾ Avoid standing under the lifted load and within the operating radius of cranes ¾ Check periodically oil, brakes, gears, horns and tyre pressure of all moving machinery ¾ Check quality, size and condition of all chain pulley blocks, slings, U-clamps, D-shackles, wire ropes, etc. ¾ Allow crane to move only on hard, firm and leveled ground ¾ Allow lifting slings as short as possible and check gunny packings at the friction points ¾ Do not allow crane to tilt its boom while moving ¾ Install Safe Load Indicator ¾ Ensure certification by applicable authority.
	¾ Overloading of lifting equipments	¾ Can cause electrocution and fire	¾ Safe lifting capacity of derricks and winches written on them shall be got verified. ¾ The max safe working load shall be marked on all lifting equipments ¾ Check the weight of columns and other heavy items painted on them and accordingly decide about the crane

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			capacity, boom and angle of erection ¾ Allow only trained operators and riggers during crane operation
	¾ Overhead electrical wires	¾ Can cause electrocution and fire	¾ Do not allow boom or other parts of crane to come within 3 m reach of overhead HT cables ¾ Hook and load being lifted shall preferably remain in full visibility of crane operator.
	¾ Person can fall down	¾ Person may sustain severe injuries and prove fatal	¾ Provide guard rails for working at height ¾ Face ladder while climbing and use both hands ¾ Ladders shall extend about 1m above landing for easy access and tying up purpose ¾ Do not place ladders against movable objects and maintain base at ¼ unit of the working length of the ladder ¾ Suspended scaffolds shall not be less than 500 mm wide and tied properly with ropes ¾ No loose planks shall be allowed ¾ Use PPE, like helmets, safety shoes, etc.
	¾ Failure of scaffolding material	¾ Same as above	¾ Inspect visually all scaffolding materials for stability and anchoring with permanent structures. ¾ Design scaffolding

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			for max. load carrying capacity ¾ Scaffolding planks shall not be less than 50x250 mm full thickness lumber or equivalent. These shall be cleared or secured and must extend over the end supports by at least 150mm and not more that 300 mm ¾ Don't overload the scaffolds ¾ Do not splice short ladders to make a longer one. Vertical ladders shall not exceed 6m.
	¾ Material can fall down	¾ Persons working at lower level gets injured.	¾ Remove excess material and scrap immediately ¾ Carry the tools in a tool-kit bag only ¾ Provide safety nets
	¾ Personal negligence and danger of fall	¾ Can cause injury or casualty	¾ Do not take rest inside rooms built for welding machines or electrical distribution system ¾ Avoid walking on beams at height ¾ Wear helmet with chin strap and safety belts when working at height ¾ Use hand gloves and goggles during grinding operations ¾ Cover or mark the sharp and projected edges ¾ Do not stand within the operating radius of cranes
	¾ Lifting / slipping of	¾ Same as above	¾ Do not stand under the lifted load

	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
	material		¾ Stack properly all the materials. Avoid slippage during handling ¾ Control longer pieces lifted up by cranes from both ends ¾ Remove loose materials from height ¾ Ensure tightening of all nuts and bolts
	¾ Erection / lowering failure	¾ Can cause injury	¾ Do not stand under the lifted Load ¾ Do not allow any person to come within the radii of the side boom handling pipes ¾ Check the load carrying capacity of the lifting tools and tackles ¾ Use safe Load Indicators ¾ Use appropriate PPEs
	¾ Other	¾ Same as above	¾ Wear gum boots in marshy areas ¾ Allow only one person to perform signaling operations while lowering of pipes ¾ Provide night caps on pipes ¾ Provide end covers on pipes for stoppage of pigs while testing/cleaning operations.

FORMAT NO. : HSE-1,
REV. 0

HSE CHECKLIST CUM COMPLIANCE REPORT (1/6)

Project: _____ Contractor : _____

Date: _____ Owner : _____

Inspection By: _____ Report No. : _____

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				

	ITEM	YES	NO	REMARKS	ACTION
	Toe boards in place				
	Adequate shoring				
	Adequate access				
	Others				
	LADDERS				
	Extension side rails 1m above				
	Top of landing				
	Properly secured				
	Angle + 70 from horizontal				
	Others				
	HOISTS, CRANES AND DERRICKS				
	Condition of cables and sheaves OK				
	Condition of slings, chains, hooks and eyes OK				
	Inspection and maintenance logs maintained				
	Outriggers used				
	Signs/barricades provided				
	Signals observed and understood				
	Qualified operators				
	Others				
	MACHINERY, TOOLS AND EQUIPMENT				
	Proper instruction				
	Safety devices				
	Proper cords				
	Inspection and maintenance				
	Others				
	VEHICLE AND TRAFFIC				
	Rules and regulations observed				
	Inspection and maintenance				
	Licensed drivers				
	Others				
	TEMPORARY FACILITIES				
	Emergency instructions posted				
	Fire extinguishers provided				
	Fire-aid equipment available				
	Secured against storm damage				
	General neatness				
	In accordance with electrical requirements				
	Others				
	FIRE PREVENTION				
	Personnel instructed				
	Fire extinguishers checked				
	No smoking in Prohibited Areas				

	ITEM	YES	NO	REMARKS	ACTION
	Others				
	ELECTRICAL				
	Use of 3-core armoured cables				
	Usage of 'All insulated' or 'double insulated' electrical tools				
	All electrical connection are routed through ELCB				
	Natural Earthing at the source of power (main DB)				
	Continuity and tightness of earth conductor				
	Covering of junction boxes, panels and other energized wiring places				
	Ground fault circuit interrupters provided				
	Prevention of tripping hazards				
	Others				
	HANDLING AND STORAGE OF MATERIALS				
	Properly stored or stacked				
	Passageways clear				
	Others				
	FLAMMABLE GASES AND LIQUIDS				
	Containers clearly identified				
	Proper storage				
	Fire extinguishers nearby				
	Others				
	WORKING AT HEIGHT				
	Erection plan and work permit obtained				
	Safety nets				
	Full body harness and lanyards; chute lines				
	Health Check record available for workers going up?				
	Others				
	CONFINED SPACE				
	Work permit obtained				
	Test for toxic gas and sufficient availability of oxygen conducted				
	At least one person outside the confined space for monitoring deputed				
	Availability of sufficient means of entry, exit and ventilation				
	Fire extinguishers and first-aid facility ensured				
	Lighting provision made by using 24V lamps				
	Proper usage of PPEs ensured				
	RADIOGRAPHY				
	Proper storage and handling of source as per BARC / AREB guidelines				
	Working permit obtained				
	Cordoning of the area done				

	ITEM	YES	NO	REMARKS	ACTION
	Use of appropriate PPE's ensured				
	Proper training to workers/supervisors imparted				
	Minimum occupancy of workplace ensured				
	HEALTH CHECKS				
	Workers medically examined and found to fit for working : i) At heights ii) In confined space.				
	Availability of First-aid facilities				
	Proper sanitation at site, office and labour camps				
	Arrangement of medical facilities				
	Measures for dealing with illness				
	Availability of Portable drinking water for workmen & staff				
	Provision of crèches for children				
	Stand by vehicle available for evacuation of injured.				
	ENVIRONMENT				
	Chemical and other effluents properly disposed				
	Cleaning liquid of pipes disposed off properly				
	Seawater used for hydro-testing disposed off as per agreed procedure				
	Lubricant Waste/Engine oils properly disposed				
	Waste from Canteen, offices, sanitation etc. disposed properly				
	Disposal of surplus earth, stripping materials, oily rags and combustible materials done properly				
	Green belt protection				

Signature of Resident
Engineer with Seal

FORMAT NO. : HSE-2, REV. 0

ACCIDENT / INCIDENT REPORT

(To be submitted by Contractor after every Accident / Incident within 24 hours)

Report No:_____
Date: _____

Name of Site:-_____
CONTRACTOR_____

Type of Accident / Incident : ☐ Fatal ☐ Other Lost Time ☐ Non Loss Time ☐ First-Aid case

NAME OF THE INJURED.....
AGE .....
FATHER'S NAME.....
SUB-CONTRACTOR M/S.....
DATE & TIME OF ACCIDENT.....
LOCATION .....

BRIEF DESCRIPTION OF ACCIDENT

CAUSE OF ACCIDENT

NATURE OF INJURY/DAMAGE

MEDICAL AID PROVIDED/ACTIONS TAKEN

INTIMATION TO LOCAL AUTHORITIES (IF APPLICABLE)

DATE: SIGNATURE OF CONTRACTOR WITH SEAL

To : OWNER..... 1 COPY
: RCM/SITE-IN-CHARGE, MECON 3 COPIES

Divisional Head (Constn.) through RCM
Project Manager MECON, through RCM

FORMAT NO. : HSE-3, REV. 0

SUPPLEMENTARY ACCIDENT / INCIDENT INVESTIGATION REPORT

Supplementary to Report No: _____(Copy enclosed)

Project:_____ Site:_____
Name of Work :_____ Date:_____
Contractor:_____ Work Order / LOI No. :_____

NAME OF THE INJURED .....
AGE : .....
SUB-CONTRACTOR M/S.....
DATE & TIME OF ACCIDENT / INCIDENT .....
LOCATION.....

BRIEF DESCRIPTION & CAUSE OF A ACCIDENT/ INCIDENT

NATURAL OF INJURY/DAMAGE

COMMENTS FROM MEDICAL PRACTITIONER WHO ATTENDED THE VICTIM/INJURED

SUGGESTED IMPROVEMENT IN THE WORKING CONDITION IF ANY

LOSS OF MANHOURS AND IMPACT ON SITE WORKS

ANY OTHER COMMENT BY SAFETY OFFICER.

DATE: SIGNATURE OF CONTRACTOR WITH SEAL

To : OWNER..... 1 COPY
: RCM/SITE-IN-CHARGE, MECON 3 COPIES

Divisional Head (Constn.) through RCM
Project Manager MECON, through RCM

FORMAT NO. : HSE-4, REV. 0

NEAR MISS INCIDENT - SUGGESTED PROFORMA

Report No: _____

Name of Site :_____ Date :_____

Name of Work :_____ Contractor :_____

INCIDENT REPORTED BY :

DATE & TIME OF INCIDENT :

LOCATION :

BRIEF DESCRIPTION OF INCIDENT

PROBABLE CAUSE OF INCIDENT

SUGGESTED CORRECTIVE ACTION

STEPS TAKEN TO AVOID RECURRENCE

YES ☐ NO

DATE:

SIGNATURE OF CONTRACTOR
WITH SEAL

To : OWNER.....

: RCM/SITE-IN-CHARGE, MECON

1 COPY

3 COPIES

Divisional Head (Constn.) through RCM
Project Manager MECON, through RCM

FORMAT NO. : HSE-5, REV. 0

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

Actual work start Date:_____ For the Month of:_____
Project:_____ Report No:_____
Name of the Contractor:_____ Status as on:_____
Name of Work:_____ Name of Safety officer:_____

ITEM			UPTO PREVIOUS MONTH	THIS MONTH	CUMU-LATIVE
a)	Average number of Staff & Workmen (average daily headcount, not man days)				
b)	Manhours Worked				
c)	Number of HSE meeting organized at site				
d)	Number of HSE awareness programmes conducted at site				
e)	Number of Lost Time Accidents (LTA)	Fatal			
		Other LTA			
f)	Number of Loss time Injuries (LTI)	Fatalities			
		Other LTI			
g)	Number of Loss Time Accidents				
h)	Number of First Aid Cases				
i)	Number of Near Miss Incidents				
j)	Man-days lost due to accidents				
k)	LTA Free Manhours i.e. Number of LTA free manhours from the Lst LTA				
l)	Compensation cases raised with Insurance				
m)	Compensation case resolved and paid to workmen				
n)	Whether workmen compensation policy taken		Y/N		
o)	Whether workmen compensation policy valid		Y/N		
p)	Whether workmen registered under ESI Act		Y/N		
Remark					

DATE:

Safety Officer /Resident Engineer
(Signature and Name)

To : OWNER
: RCM/, MECON (2 COPIES)

FORMAT NO. : HSE-6, REV. 0

PERMIT FOR WORKING AT HEIGHT (ABOVE 2 METER)

Project Site : ..... Sr. No.: .....
Name of the work: ..... Date: .....
Name of Contractor : ..... Nature of Work : .....
Total No.of Workers: ..... Exact location of work : .....
Duration of work: from ..... to .....

The following items have been checked and compliance shall be ensured during the currency of the permit:

Sl.	ITEM	DONE	NOT REQD.
1.	Equipment/Work Area inspected	☐	☐
2.	Considered hazard from other routine/non-routine operations and concerned person alerted	☐	☐
3.	ELCB provided	☐	☐
4.	Proper lighting provided	☐	☐
5.	Area cordoned off.	☐	☐
6.	Precautions against public traffic taken	☐	☐
7.	Sound Scaffolding provided	☐	☐
8.	Adequate protected Platform provided	☐	☐
9.	Acces and Exit to the area (Ladder properly fixed)	☐	☐
10.	Floor Openings covered		
11.	Safety Net provided		
12.	Heath check of personnel		

A. Following personal protective equipment are provided (mark) and used as relevant Safety helmet/Gloves/Goggles/Shoes/Face Shield/Life Line/Safety Belt/Safety Harness.

B. This permit shall be available at the work site at all times.

C. Permit shall be issued for maximum one week only (Monday to Sunday).

D. This permit shall be applicable in non-operational areas.

E. After completion of the work, used permits shall be preserved for record purposes.

F. Additional precautions, if any .....

Permission is granted to work (See overleaf) = Yes/No

Name of Contractor's Supervisor
(Initiator)

Name of Contractor's Safety Officer
(Issuing Authority)

GRANT OF PERMIT AND EXTENSIONS

Sl. No.	Validity Period From ..... To	Work time From .....Hrs. To .....Hrs.	Initiator (Supervisor of Contractor)	Issuing Authority (Safety Officer) of Contractor	Verification by CONSULTANT with date

Additional safety instructions, if any.

FORMAT NO. : HSE-7, REV. 0

CONFINED SPACE ENTRY PERMIT

Project Site : ..... Sr. No.: .....
Name of the work: ..... Date: .....
Name of Contractor : ..... Nature of Work : .....
Exact location of work : .....

Safety Requirements : POSITIVE ISOLATION OF THE VESSEL IS MANDATORY

(A) Has the equipment been ?

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

(B) Expected Residual Hazards

Y	NR		Y	NR		Y	NR	
		lack of O_2			combustible gas / liquid			H_2S / toxic gases
		corrosive chemicals			pyrophoric iron / scales			electricity / static
		Heat / stream / frost			high humidity			ionizing radiation

(C) Protective Measures

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

Authorization / Renewal (It is safe to enter the confirmed space)

Date	No. of Persons Allowed	Name of Persons allowed	Signature		Time		Signature
			Contractor's Supervisor	Contractor's Safety Officer	From	To	Workman

Permit Closure :

(A) Entry was closed stopped will continue on

(B) Site left in a safe condition
Housekeeping done

(C) Multi lock removed key transferred
Ensured all men have come out Manways barricaded

FORMAT NO. : HSE-8, REV. 0

RADIATION WORK PERMIT

Project : Sr. No.:

Name of the work : Date:

Name of Contractor : Job No. :

Location of work :

Source Strength :

Cordoned distance (m) :

Name of Radiographing agency : Approved by Owner / MECON ☐

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 :

Location details of dismantling / demolition with sketch : (Clearly indicate the area)

The following items have been checked & compliance shall be ensured during currency of the permit :

S. No.	Item Description	Done	Not Applicable
1.	Services like power, gas supply, water, etc. disconnected.	☐	☐
2.	Dismantling / Demolishing method reviewed & approved.	☐	☐
3.	Usage of appropriate PPEs ensured.	☐	☐
4.	Precautions taken for neighboring structures	☐	☐
5.	First-Aid arrangements made	☐	☐
6.	Fire fighting arrangements ensured	☐	☐
7.	Precautions taken for blasting	☐	☐

(Contractor's Supervisor) (Contractor's Safety Officer)

Permission is granted.

(Permit issuing authority)
Name :
Date :

Completion Report :

Dismantling / Demolishing is completed on _____ Date at _____ Hrs.

Materials / debris transported to identified location ☐

Tagging completed (as applicable) ☐

Services like power, gas supply, water, etc. restored ☐

(Permit issuing authority)