



**CENTRAL UP GAS LIMITED
(CITY GAS PROJECT IN KANPUR &
BAREILLY)**

TENDER FOR

**Engaging Contractors for CS Pipeline Laying
and Other associated works in Kanpur, Unnao,
Bareilly and Jhansi**

E-TENDER No. 55334

TENDER NO. CUGL/C&P/TEN2324/40

**TECHNICAL VOLUME
VOLUME II OF II – PART-1**

OPEN DOMESTIC COMPETITIVE BIDDING

BIDDING (THROUGH E-TENDERING MODE)

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CENTRAL U.P. GAS LIMITED (CUGL)

Engaging Contractors for CS Pipeline Laying and Other associated works in Kanpur, Unnao, Bareilly and Jhansi

PTS – CONSTRUCTION OF NATURAL GAS CARBON STEEL PIPELINE

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1.0 DEFINITIONS AND INTERPRETATION

- 1.1. Particular Technical Specification (PTS) shall be read in conjunction with the General Conditions of Contract (GCC), Special Conditions of Contract (SCC), General Technical Specifications (GTS) of work, drawings, Schedule of rates (SOR), Instruction to Bidders (ITB) and other documents forming part of the tender wherever the context so requires.
- 1.2. Where any portion of the GTS is repugnant or variance with any provisions of the PTS, unless a different intention appears, the provision(s) of PTS shall be deemed to govern the provision(s) of GTS of contract. If there is no variance or repugnance between GTS and PTS, both clauses shall be applicable.
- 1.3. In case of conflict between the requirements of this specification and that of the referred codes, standards and specifications, the requirements of this specification shall govern.
- 1.4. Definition of Terms

The terms used in the technical document must be understood as follows:

| | |
|-----------------------------------|---|
| GA | : Geographical Area Bareilly, Kanpur & Unnao and Jhansi GAs |
| “Additional Works” | : Works that are not part of the Agreement but that appear to be necessary during the execution of the Agreement. These works can only be executed at the demand of the Owner. |
| “Approval” | : Means written approval. |
| “Construction Site/Building Site” | : The area where the works are to be undertaken by the Contractor in accordance with the Agreement. |
| “Contractor” | : The natural person or legal entity with whom the Owner has concluded the Agreement. |
| “Days” | : They are the number of days stipulated in the Agreement. They are calendar days and not workdays, unless explicitly specified otherwise. |
| “Defective Joint” | : Each weld that has been declared unacceptable by the Owner or Owner’s representative and has to be repaired by welding. |
| “Equipment” | : Means all apparatus, tools and machineries of any kind whatsoever that are necessary for the construction, execution and maintenance of the Works specified in the Agreement. |
| “Goods and/or Services” | : Depending on the specific case, all or part of the Construction materials, equipment, constructions, appliances, tools, machines, works, etc. that are to be built, assembled, adapted or brought into operation by the Contractor pursuant to the Agreement, including all studies, performances, works and services specified within the Agreement. The terms Goods or Services can be used interchangeably according to the context. |
| “HDD” | Horizontal Directional Drilling |

| | |
|--------------------------------------|--|
| “Line Work” | : Is the delivery and execution of all Works for the construction of pipelines that do not form part of a Special Point or CNG/DRS that are executed in accordance with normal accepted laying methods. |
| “Material” | : Means the materials or any other supplies that are intended to be part of or integral to the Works. |
| “Owner” | : Is the principal requesting the works to which the Agreement relates, i.e. CENTRAL U.P. GAS LIMITED (CUGL). |
| “Owner’s Representative/ Consultant” | : Shall mean Owner’s CONSULTANT/EIC/Site Engineer |
| “Over-Depth” | : Is the difference between the actual depth of the upper generatrix of the pipeline or installation upon laying and the planned minimum depth as stipulated in the Agreement, if this difference is greater than 50 cm. |
| TPIA | : Third Part Inspection Agency (CUGL’s Approved TPIA). |
| “Works” | : Are either the execution or having executed together with the design of works that complies with the requirements specified by the Owner. The work is the result of all the construction activities intended to have an economic or a technical function as such. |
| NA | Not Applicable |
| LS | Lumpsum |
| Mechanical Completion (MC) | Shall mean completion of all pre-commissioning activities and associated requirements. It also includes completion of all work related to CP and civil activities deemed necessary for completion of pre-commissioning. |
| Pre-Commissioning | It includes mechanical resistance test, tightness/leak test, cleaning including magnetic cleaning, GED survey, dewatering, swabbing, pre-drying activity, Golden Tie-ins connecting the stations and final acceptance dossier (As built document) and all other related activities. It also includes completion of all works related to CP and civil activities. |
| Commissioning | It includes final drying, filling the Nitrogen (if required) and commissioning with gas, testing of golden tie-ins welds at GasMO, gas-in activity and final acceptance dossier. It also includes all works related to CP and civil activities. |

1.5. Laws –Codes –Rules & Standards

1.5.1. General

Basically, the following are applicable:

- Petroleum and Natural Gas Regulatory Board (PNGRB) Act 2006: GSR 808 I – “Technical Standards and Specifications including Safety Standards for Natural Gas Pipeline Regulations” – 2009.

- Basic Laws – Codes – Rules & Standards, mandatory by law in respective GAs and India.
- The complete set of Specifications and Standards which are part of the present technical volume.
- Particular Codes and Standards as per Section 1.5.2
- The “Rules of good Practice” commonly used by the worldwide gas industry.
- The “Rules of Art” and “Sound Practices” of the engineering.
- In general, the pipeline and stations have to be built in accordance with the best states of engineering practice.

In case of contradiction, the above shall prevail in descending order of precedence.

1.5.2. Particular Codes & Standards (Latest Editions)

| S. No. | Code No. | Description |
|--------|---------------|---|
| 1 | ASME B.31.8 | “Gas Transmission and Distribution Piping Systems” – Latest edition and all Codes it refers to. |
| 2 | API RP 1102 | “Steel pipelines Crossings Railroads and Highways” – Latest edition. |
| 3 | API 1104 | “Welding of pipelines and related facilities” – Latest edition. |
| 4 | AS/NZS 2885.5 | Pipelines – Gas and liquid petroleum – Field Pressure Testing |
| 5 | OISD 141 | “Design and construction requirements for cross-country hydrocarbon pipeline–” - latest edition. |
| 6 | OISD 226 | “Natural Gas Transmission Pipelines and City Gas Distribution Network” |
| 7 | DIN 30670 | “Polyethylene coating for steel pipes and fittings”. |
| 8 | DIN 30671 | “Thermoset plastic coating for buried steel pipes ” |
| 9 | DIN 30672 | “Tape and shrinkable materials for the corrosion protection of buried or underwater pipelines without Cathodic protection for use at operating temperatures up to 50°C.” |
| 10 | DIN 30673 | “Bitumen coatings and linings for steel pipes, fittings and vessels”. |
| 11 | DIN 30675-1 | “External corrosion protection of buried pipes & range of applications for steel pipes.” |
| 12 | DIN 30677 | “Protection of buried valves against corrosion coating (external) with duroplastics.” |
| 13 | EN 12062 | “Non destructive examination of welds – General rules for metallic materials”. |
| 14 | EN 12068 | “Cathodic Protection – External organic coatings for the corrosion protection of buried or immersed steel pipelines used in conjunction with cathodic protection – Tapes and Shrinkable materials.” |

| | | |
|--|-------------|---|
| 15 | IS 8062 | “Code of practice for Cathodic protection of steel structures” |
| 16 | IS 12944-5 | “Paints and Varnishes – Corrosion Protection of Steel Structures by protective paint system “ |
| 17 | ISO-8502-3 | “Preparation of steel substrates before application of paints and related products – Tests for the assessment of surface cleanliness”. |
| 18 | ISO 9305 | “Seamless steel tubes for pressure purposes full peripheral ultrasonic testing for the detection of transverse imperfections”. |
| 19 | ISO 10124 | “Seamless & welded (except submerged arc welded) steel tubes for pressure purposes. Ultrasonic testing for the detection of laminar imperfections”. |
| 20 | ISO 12094 | “Welded steel tubes for pressure purposes. Ultrasonic testing for the detection of laminar imperfections in strips/plates used in the manufacture of welded tubes”. |
| 21 | ISO 15741 | “Paints and varnishes – friction – reduction coatings for the interior of on – and offshore steel pipelines for non- corrosive gases.” |
| 22 | ISO 15590-1 | “Petroleum and Natural Gas Industries – Induction bends, fittings and flanges for pipeline transportation system – Part I : Induction Bends”. |
| 23 | ISO 21809-3 | Petroleum and natural gas industries – External coatings for buried or submerged pipelines used in pipeline transportation systems. |
| And all other relevant codes/standards, etc. | | |

2.0 SCOPE OF WORK

2.1 General

It broadly describes the scope of work to be executed by Laying Contractor pertaining to Mechanical, Civil, Temporary Cathodic Protection, HDD, Shallow HDD, Cased Crossing, testing, pre- commissioning & commissioning, final documentation etc. of pipeline system. It also describes the responsibility of the Contractor to interface all such works so as to make the total pipeline system operational as intended.

All such works which are not listed below but are otherwise required to complete the work in all respects in accordance with specifications, drawings, operation & maintenance and other requirements shall also form part of Contractor’s Scope of Work. All works described below shall be performed in accordance with Schedule of Rates, Particular Technical Specification, General Technical Specification, drawings and other requirements of Tender and shall be subject to review by the Owner/Owner’s Representative and their approval. Technical audit shall be done by Owner/Owner’s Representative during a sample production / Execution.

2.2 Project Planning, Control and Reporting

The scope of work of the Contractor includes but not limited to planning, scheduling, monitoring & interfacing of all activities for the entire project. The Contractor shall co-ordinate all activities from concept to successful commissioning, with his own sub-contractors, site workers, vendors, suppliers, Owner/Owner’s Representative, Owner and Government agencies for specific clearances. It is also the responsibility of the contractor to prepare & perform the Quality Control of all the activities and

expediting plan for all procured items at Vendor's factory. The Contractor shall expedite suppliers for timely deliveries and transportation.

The Contractor shall submit progress report as per tender requirement.

It is Contractor's responsibility to carry out proper documentation of inspection and quality assurance programs for all equipment, items and materials, duly approved/reviewed by Owner/Owner's Representative. The Contractor shall maintain an accurate and traceable listing of procurement records for the location, quality and character of all permanent materials in the Project.

The Contractor shall report to Owner/Owner's Representative of all changes which will affect material quality, recommendations and take necessary corrective actions, after obtaining Owner/Owner's Representative approval.

2.3 Work Description

Work tendered in this bid package consists of engineering and procurement, supply (as per scope of supply defined elsewhere in tender), installation of complete pipeline, testing, pre-commissioning, Preservation and commissioning of CGD gas pipeline for the GA, Future Tap-off, Sectionalizing valve station and all associated works i.e. mechanical, civil, structural and Temporary C.P works etc.

The location where the work is to be carried out under this tender are detailed below:

The contractor shall broadly carry out the following activities:

Laying of Under Ground Carbon Steel Pipeline complete with Associated Facilities in following sizes as per GAs specified in Scope of work i.e.

- ✓ NB 6"x 6.4 mm thk – API 5L X 42/52 (HFW / SMLS)
- ✓ NB 4"x 6.4 mm thk. - API 5L X 42/52 (HFW / SMLS)
- ✓ 125mm MDPE x PE100
- ✓ 90mm MDPE x PE100
- Construction of Valve Pits wherever required.
- Installation of pipeline at crossings of Rail, Road, Utilities, Underground Pipeline & water bodies (Drain, Stream, Canal & Nala etc.)

3.0 SCOPE OF SUPPLY

3.1 Materials to be supplied by Owner as Free Issue Material

Owner shall supply only the following materials as free issue from its designated storage point:

- Carbon Steel Material
 - ◆ 3 LPE Coated Line Pipe of API 5L X 42/52 (HFW / SAW / SMLS) with externally corrosion coated (three-layer polyethylene coating) of size and wall thickness - specified NB 6" x 6.4 mm thk, & 4" x 6.4 mm thk.
 - ◆ MDPE Valves and Fittings
 - ◆ MDPE Pipes

Free Issue Material shall be issued to the Contractor from the designated store(s) of Owner. Contractor shall be responsible for lifting the free issue material from Owner's storage point(s) and transporting the same to work site(s) at his own cost. Contractor shall also return balance material after completion of work to owner's designated stores at above mentioned location (s) as directed by owner / owner's representative.

3.2 Material to be supplied by Contractor

The procurement and supply, in sequence and at the appropriate time of all materials and consumable required for completion of the WORK as defined in the contract except the material specifically listed under clause 3.1, shall be entirely the Contractor's responsibility and item rates quoted for the execution of the contract shall be inclusive of supply of all these materials. The materials are, but not limited to, as follows applicable for carbon steel pipeline/piping:

- Valves of all types, sizes and ratings.
- 3D Bends of all required sizes.
- Pipe fittings like elbows, tees, reducers, weldolets, sockolets, nipples, flanges, blind flanges, spectacle blinds etc. Sizes (All sizes)
- Insulating Joint wherever required.
- 1.0 mm thick, 300 mm wide PE warning mat.
- All consumable for welding such as oxygen, acetylene, inert gases and all types of electrodes, filler wire, solder wire, brazing rods, flux etc. for welding/cutting and soldering purposes.
- All materials for all types of pipeline markers including paints conforming to normal corrosive environment as per specification & tender document, cement, sand, reinforcement steel etc.
- All equipment and consumables required for hydrostatic testing like filling pumps, flow meter, compressor, pressure gauge (Approved Make) and temperature gauges, thermocouples, corrosion inhibitor for water used for hydrostatic testing, including water for testing etc.
- All materials required for continuous concrete coating for providing negative buoyancy, to the pipeline wherever required.
- All materials and consumable required for external field weld joint coating and protective coating of bends, tee as per specifications including supply of coating materials. Raychem's "Dirax", Denso, Rigil or Canusa make (or any other approved vendor) field weld joint coating material for carrier pipes.
- All material and consumable items required for external coating to the buried piping, flanges, valves, etc.,
- All materials required for repair of damaged corrosion coating of line pipe.

- Bare Casing pipe (All required sizes) of material IS3589 FE 410 / API 5L Gr. B or equivalent shall be procured by contractor for the crossing. Thickness Calculation of the same shall be submitted by the contractor for approval as per applicable codes & statutory requirement.
- Casing insulators and end seals are to be required for steel casing pipe.
- All materials required for sand/soft soil padding around pipeline and select approved quality backfill, bank stabilization of water crossings, etc.
- All materials required for repair/restoration of pavements, roads, bunds other structures affected/damaged by Contractor's construction activities. Materials shall be equivalent/superior to those used for original construction of the facility.
- All materials/compressed air/pigs as required for cleaning, gauging, filling. Dewatering, swabbing for CS pipeline etc.
- All temporary materials required for filling, pressurizing and dewatering in connection with hydrostatic testing including pipes, flanges, blind flanges, fittings, temporary gaskets, nuts, bolts, clamps, strainers etc. required for fabrication of test headers and all consumables.
- All types of bolts, studs, nuts and gaskets of all sizes and ratings, thickness as required for the permanent installation in piping system in accordance with the relevant material specification. All fittings like elbows, tees, reducers, weldolets, nipples, flanges, blind flanges, spectacle blind flanges, valves, pipes pressure gauge (with calibration certificates) of sizes 2" NB & below and of all ratings.
- Contractor shall submit the MTC and all inspection reports for the bought-out items.
- All types of coating and painting materials including primers, paints, solvents, sand blasting materials, cleaning agents, compressed air etc. shall be suitable for normal corrosive environment.
- All steel materials such as structural steels, reinforcement steels and steel for all types of supports, foundations, ladders, platforms, etc.
- All materials and equipment required for all types of tests such as radiography/ultrasonic testing, magnetic particle and dye penetrate examination.
- Shims, wedges, fire blankets and packing plates (machined wherever required).
- All materials for civil and structural works, grouting etc., including casing end seals required in pit.
- All safety tools/tackles/devices/apparatus/equipment, etc. including ladders and scaffolding as required.
- All materials for corrosion protection of buried piping, pipe fittings, valves etc.
- All materials, equipment, labour for required pre-commissioning / commissioning works including supply of required quantity of Nitrogen.
- Pressure Gauges:
 - Pressure gauge dial shall be white, nonrusting plastic with black figures. Pointers shall have external micrometer adjustment for gauge zero adjustment.
 - Pressure gauges shall be weatherproof with dial size of 150 mm and shall have features like screwed bezels, externally adjustable zero, over range protection and blowout discs. Pressure gauge sensing element shall be SS 316 and movement material shall be SS 304, as a minimum. The design of pressure gauges shall conform to IS 3624 Pressure gauges shall have an accuracy of $\pm 1\%$ of UR V as a minimum.
 - Over range protector and pulsation dampener, whenever used, shall be of SS 304, as a minimum. Pulsation dampeners shall be used for all pulsating services. These shall be floating pin type, externally mounted and externally adjustable.
 - Connection shall normally be 1/2" NPTM bottom.

- Cases shall normally be cast aluminium alloy or black phenol and weatherproof to IP-55 as per IEC-529/IS-2147. Blow-out discs shall be provided for all gauges.
- Ranges shall be so specified that the gauge normally operates in the middle third of the scale and shall conform to IS 3624 standard dials wherever possible.
- Shatter proof glass shall be provided for pressure gauges.
- All pipe & pipe fitting including bends, flanges etc of size 2” NB & below.
- Field jointing coating material (Heat shrink sleeve).
- Cold applied tape.
- All other materials not specifically listed herein but required for the successful execution of the work. & satisfaction of the owner/ owner’s representative.
- **Rock Shield:** Supply and installation of rock shield is in contractor scope. Rock shield shall provide external pipe protection from backfill rock damage and/or abrasion damage during pipe operation of the exterior coating.

Basic parameter for the Rock-shield shall be as per below requirement but Contractor shall have to purchase the material once the QAP, Specification and other requirements as approved by the Owner/EPMC beforehand.

- Minimum thickness of 6mm, flexible Polyethylene, strand extruded rock shield mesh. The rock shield shall be extruded from an elastomeric plastic material of which the basic resin is prime virgin polyethylene. The PE compound shall not contain any scrapped, reclaimed or recycled material whatsoever. Minimum weight of rock shield should be 0.825 lbs/square foot. It should sufficiently protect the pipe regardless which side of the rock shield faces the pipe. The color of the rock shield shall be yellow to provide higher visibility to third party excavators.

- Performance Requirements as follows:

Property Test Method Required Limits-Impact Resistance ASTM G-13/G-14 (Modified), Protection integrity < 6” rock drop

Tensile and Elongation properties shall be as per ISO:10319

Compression strength shall be as per ASTM D 1621

Must be constructed from PE plastic ASTM D-2240 Durometer 78 (+ / - 3)

Cathodic Protection Shielding Flange method on free film Matrix must allow passage of CP current

Impact resistance: ASTM G-13 testing consists of the following parameters:

35 lbs of stones, 3/4” in diameter

Dropped from a height of 6 ft. through a funneling chute onto the test surface

This test is repeated 10 times or until a holiday (defect / damage) is discovered. If no holiday is present after 10 repetitions, the product is said to have passed. Provide non-metallic banding or durable filament tape to affix rock shield securely to the pipe.

- INSTALLATION

A. Rock shield shall be affixed to pipe utilizing non-metallic bands of filament tape.

B. Spacing of non-metallic banding shall not exceed 80 cm on center.

C. Rock shield shall completely encircle the pipe with a minimum overlap of 10 cm. Overlap shall be located at the bottom radius (6 o’clock position).

D. Back-fill should be “shaded” into the trench during back-fill procedure. Back fill shall not be dumped directly on protected pipe.

E. Manufacturer's (Rock Shield) recommendations shall be followed.

4.0 CONSTRUCTION

The Contractor's scope of work shall consist, but not limited to the following. However, all such works, which are not listed below but are otherwise required to complete the work in all respects shall form part of the Contractor's scope of work.

4.1 General

In order for the tender to be valid, the bidder must forward to the Owner/Owner's Representative, at least the following documents correctly, completely filled in and clearly legible:

- A detailed methodology of the works drawn up on the basis of the start and end dates for the works as stipulated in SCC. The various phases of the work must be included in this program in so far as they are applicable to the works.
- The Bidder must provide a detailed organization chart (including key personnel like Project Manager, Construction Manager, QA/QC In-charge and HSE Officer's qualification) indicating the organization or personnel and equipment for each phase of the Works and for each work site.
- An explanatory note must be attached describing the organization of the Construction Site as well as the methods and phases of execution, the complete inspection plan that the Bidder intends to follow, the qualitative and quantitative description of the means of execution, the installations, the equipment, the material, the tools and the personnel that Bidder shall employ in each phase in order to complete the Works within the planned schedule.
- The Contractor must draw up working methodologies including equipment, manpower and material needed for all phases of the construction of the pipeline.
- All job procedures must get approved by the Owner/Owner's Representative before start of work.
- Only approved job procedures will be implemented at site during all construction stages.
- The Contractor shall deploy all equipment and material required to achieve the work as per his detailed methodology and agreed schedule.
- Contractor shall mobilize resources simultaneously for Pipe Laying, all crossings etc in order to achieve commissioning activities in due time as specified in the SCC.
- If deemed necessary as per the job procedure and/or at the request of the Owner, Contractor must deploy extra equipment without being entitled to raise any compensation.
- This description is only binding upon the Contractor. He must provide, at his own expense, all the necessary equipment, machinery and personnel even in addition to those indicated in the offer.
- The Contractor shall locate and expose manually all underground facilities if any during trenching. Safety barriers shall be erected along the trench to prevent any damages or accident. On locations where pipeline is laid under the existing facilities and near the approaches of 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 Owner to open cut paved road crossing, or where the 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 Owner. After laying the pipeline, backfilling shall be immediately performed, and all the areas affected connected with the excavation 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 the satisfaction of concerned authorities, resident and Owner.

4.2 STATUTORY PERMISSIONS:

Owner shall apply for permission for laying of pipeline however obtaining the permission from the statutory authorities, obtaining work permits/ NOC from various statutory authorities having jurisdiction before execution of the works and complying with all stipulations / conditions / recommendations of the said authorities and necessary day to day clearances, approvals from all concerned authorities in respect of pipeline and all related work shall be responsibility of contractor and cost of same shall be deemed to have included in quoted prices. On behalf of the Owner, Contractor shall co-ordinate with the relevant authorities along with the copy of required pipeline route drawings / certificates complete in all respect shall be prepared and submitted by the Contractor well ahead of time so that the actual construction of the work is not delayed for want of the approval / inspection / permission by concerned authorities. The inspection of work by authorities shall be arranged by Contractor and necessary co-ordination and liaison work in this respect shall be the responsibility of the Contractor. However, statutory fees / restoration charges, if any, shall be paid by Owner on production of documentary evidence.

4.3 Main Activities

4.2.1 Main Pipeline (Carbon steel pipeline)

Contractor's scope of work defined in this heading shall consist but not limited to following:

- Topographic Survey
- The contractor shall be deemed to have familiarized themselves with route prior to quoting and take care of all the eventualities. No extra cost shall be admissible in any form at a later date. Route survey and their details required for pipeline. Laying and construction of entire pipeline including survey of route/detoured portions and pipeline section/ section of pipeline, shall be within the scope of contractor and governed by SOR of tender without any additional cost implication. Contractor shall be deemed to have considered such eventualities while formulating his bid.
- To carry out pre-construction surveys, detailed construction method statement and calculations for the approval of Owner/Owner's Representative.
- To carry out Soil resistivity survey for TCP design. Soil Resistivity Survey shall be carried out by DES party and same shall be used for design of TCP.
- To carry out all construction works as per drawings, approved procedures, specifications and applicable codes and standards. Any changes at site shall also need prior approval from the Owner/Owner's Representative and revision of drawings.
- To prepare and establish safety procedures for laying of the pipeline and personnel associated with the project.
- To co-ordinate and supervise the work of all suppliers/ sub-contractor(s), if any.
- To verify the underground utilities before execution of work at site.
- To mobilize and provide all equipment, manpower (skilled and unskilled), tools and tackles, consumables and other resources etc. as required for the execution of the complete job defined and discussed herein and thereafter demobilizing the same upon completion of work.
- To provide all safety tools/tackles/devices/apparatus/ equipment, etc. including ladders and scaffolding as required.
- To provide camp facilities for personnel of pipeline construction.

- To transport the materials to work site, To Prepare and execute adequate Material Control Procedure at Work Site.
- Location and directions of the pipeline and dimensions of trench within the ROU shall get approved before execution of the work. No extra claim shall be entertained in this regard.
- Site preparation, arranging required land for setting up of string fabrication yard and obtaining necessary permissions from concerned authorities.
- During ROU clearing, the vegetation shall be cut off at ground level leaving the roots intact. Only stumps and roots directly over the trench shall be removed for pipeline installation.
- Welding of all tie-in joints including testing of joints on either side of major/ minor crossings / with adjoining pipeline including cutting of test header, re-beveling, WPS/PQR and other related operations etc.
- Staking, clearing, grading, trenching to all depths in all types of soils, transportation of coated pipes to ROU along the route, stringing, aligning, welding, NDT including radiographic inspection, field weld joint coating including supply of all materials corrosion protective coating of bends including supply of materials as per specifications, sand padding, laying and lowering of the pipeline, back filling, carrying out rail, road, canal, utility and submerged minor water course crossings including installation of carrier pipe by open cut method/HDD/rock drilling/moling, crossing of canal by conventional methods on approved drawings and as directed by Owner/Owner's Representative, installation of supports wherever required, supply of select backfill material as required, clean-up, pigging, flushing, gauging, hydrostatic testing, de-watering, swabbing, drying, pre-commissioning and commissioning of complete pipeline system, including all associated works as per relevant specifications, standards and approved drawings.
- Taking of DGPS coordinate of all Field Joints, Reference points with landmarks & inform to owner in the approved format. Coordinate shall be taken as per instrument approved by Owner. Contractor shall submit the survey or CV for approval.
- Preparation of pipeline:- Launch way, repair of damages to corrosion, string preparation, field welding, NDT including radiography, pre-test of completed strings wherever required, corrosion coating of field joints, trenching, laying at approved depth, back filling including supply of select backfill material (where required), post installation hydrotest, capping, supply and installation of markers, etc.
- Sectionalizing valve station at every 3 KM (manual Operated valve station) shall be installed in the Valve Pit or as per Latest PNGRB guidelines.
- Valve pit/ Chamber

The construction of the valve pit/ chamber provided on the pipeline shall be constructed in accordance with the standard drawing (enclosed in the tender). The construction of valve chamber shall be taken immediately after installation of valve.

The excavation work shall be done at a location given by Owner/ Owner's representative. All care shall be taken not to damage existing facilities and surface of construction shall be restored to its original state.

Valve pit for MDPE pipeline shall also be constructed along with supply of MDPE Valve as per spacing between valve chambers as per PNGRB and Tender Specifications. For Mainline, approximate MDPE valve Chamber spacing shall be approximate 1km
- To lay Warning tape as per typical drawings.
- Bare Casing pipe (Size – 4", 6", 8", 10", 12", 14", 18" & 24" NB) of material IS3589 FE 410 / API 5L Gr. B or equivalent shall be procured by contractor for the crossing. The bentonite shall be filled after installation of carrier pipe in between carrier and casing pipe as per the direction of EIC.
- To install all field joint coating by heat shrink sleeves.

- Cold tapes/ R 95 shall be applied at specific location (wherever required) with prior approval.
- To carry out all Civil / Structural works TCP system, Pre-commissioning and commissioning works in accordance with relevant specifications and requirements enclosed elsewhere in the Tender.
- To fabricate and install of all piping, structural components etc. as per drawings.
- To lay the carbon steel pipe (minimum cover of 1.20 m). Wherever, Steel and MDPE Pipeline shall be laid in same trench, Steel Pipeline cover shall be 1.2m and orientation and cover of MDPE pipeline shall be as per the drawing attached in Tender.
- To put in practice approved (by Owner/Owner's representative) Welding procedure specification (WPS) / PQR by approved qualified welders in accordance with API – 1104 (latest edition). Even if contractor is having qualified WPS but it shall be once again reviewed and approved by the third-party inspection agency /Authorized Inspection Agency /Owner representative at site and at manufacturer's premises.
- To perform impact test as specified in the PTS.
- Fabrication, testing, painting etc. of above ground piping in the CNG/ RO station up to compressor flange or DRS /MRS inlet flange as per instruction of EIC
- To provide, operate and maintain all temporary facilities required for the construction related works and remove after completion of work.
- To perform all works related to testing, dewatering, swabbing, drying, pre-commissioning and commissioning of pipeline system.
- All expenses and cost for attending Tests/Inspections related to construction, bought out items etc. at laboratory or at vendors' place for Owner/Owner's Representative/TPIA shall be borne by the Contractor.
- To prepare as built drawings, pipe books, documents, photographs, video shots and project records as per specification and instructions of the Owner/Owner's Representative including furnishing of all Test Certificates / Inspection reports for all materials used for permanent installation.
- All balance works are required to be performed in an operating/gas charged environment. It shall be Contractor's responsibility to obtain hot work permit and comply with all necessary instructions, restrictions and conditions imposed by the Owner.
- As far as possible, the Shallow HDD method shall be carried out to avoid the cased crossing, wherever it is not mandatory to provide the casing.
- Clean-up and restoration of ROU and other conveniences like road, rail, canals etc. to original condition as per specification and drawings to the entire satisfaction of Owner and/or Authorities having jurisdiction over the same, including disposal of surplus construction materials to a location identified by the Contractor/Owner/Owner's Representative approved by local authority without causing any disturbance to environment, locals and to the entire satisfaction of Owner/Owner's Representative.
- No compensation will be made to the Contractor for temporary supports, if required for piping erection job.

All incidental/associated works and any other works not specifically listed herein but are required to be carried out to complete entire works related to pipelines and the associated facilities.

4.4 Reconciliation of Owner Supplied Materials

4.3.1 The Contractor shall submit an account for all materials issued by Owner, consumption and physical verification report of remaining materials in the Performa prescribed by the Engineer-in-charge on quarterly basis. On completion of the work, the contractor shall submit "Material Appropriation Statement / Reconciliation statement" for all materials issued by the Owner in the Pro-forma prescribed by the Engineer-in-charge.

All coated line pipes as per line pipe specifications enclosed elsewhere in the bidding document, shall be issued on linear measurement basis. All other piping materials shall be issued on numbers basis. All cut pieces pipes in length measuring 2 m to 9 m when returned to Owner's storage points after beveling, shall be considered as serviceable material. All cut pieces of pipes measuring less than 2 m will be treated as wastage/ scrap. All pipes above 9 m will be considered as good pipe. Bevel protector shall also be returned to owner.

a) For 3 LPE Coated Carbon Steel Line Pipes:

For the purpose of accounting of coated line pipes following maximum allowances shall be permitted,

- | | |
|--|-------|
| i) Unaccountable wastage | 0.1% |
| ii) Scrap (all cut pieces of pipes measuring less than 2m) | 0.25% |

Unaccountable wastage/ scrap shall be at actual as per site assessment subject to maximum as stated above.

b) For MDPE pipe and Valves & Fittings

For the purpose of accounting of MDPE pipes following maximum allowances shall be permitted for both 125mm and 90mm Pipe,

- i) Unaccountable wastage - 2%
- ii) Scrap – 2% (below 2 mtr length)
- iii) Usable return length (2 mtr and above)
- iv) MDPE Valves and Fittings Unaccountable wastage – 0
- v) MDPE Valves and Fittings Scrap – 0

4.3.2 All unused, scrap materials and salvageable materials shall be the property of the Owner and shall be returned by the Contractor category-wise at his cost to the Owner's designated store yard (s). In case the Contractor fails to do so or exceeds the limits of allowances specified above for scrap/ serviceable materials, then recovery for such quantities not returned as well as returned in excess of permitted limit by the Contractor will be done at the penal rate i.e. 200% of landed cost at the time of final bill/ closing of contract by Engineer-in-charge shall be effected from the Contractor's bill (s) or from any other dues of the Contractor to the Owner. Contractor shall be responsible for the adjustment and measurement of the surplus materials to be returned to the store. Contractor shall also be responsible for suitable segregation of returned materials into separate stacks of serviceable and scrap materials. Wherever certain material is covered under Contractor's scope of supply whether part or in full for any item of work covered under SOR, no allowance towards wastage/ scrap etc. shall be accounted for during execution stage.

4.5 Other Activities

The contractor's scope of work shall consist but not limited to the following:

Soil Investigation : The soil investigation includes boring, collection of disturbed samples from bore holes and visual engineering classification of soil along the pipeline route and submission of detailed report to Company. Visual classification of soil shall be in accordance with IS-1498; IS Classification and Identification of Soils for General

Engineering Purposes” Geotechnical investigation of soil shall be carried out as per relevant clauses of IS 1892 and other applicable IS standards.

Bore Holes

- : Boreholes shall be made at locations as direct by Engineer-in-charge along the pipeline route to find out the presence of rock strata.

Boring shall be carried out in accordance with the provision of IS: 1892. Minimum diameter of boring shall be 150 mm. Auger boring shall be resorted to above water table, whereas below water table the boreholes shall be advanced by rotary drilling with mud circulation through all kinds of soil other than rock. While boring above water table, no water shall be introduced in boreholes. Casing shall be used to support the sides of boreholes in soft to firm soil.

Except for crossing location as defined below, the boring shall be carried out up to 10 m depth below NGL or 01 m. below the rock bed, if rock is encountered at a depth of less than 10 m.

In case of boring at Highways (National/State), River and Railways crossings, the boring shall either terminated at a depth of 15 m below NGL or 01 m. below the rock bed on top of bed rock, if rock is encountered at a depth less than 15 m.

Presentation of Survey Data

- : Results of soil investigation survey shall be submitted in the form of report covering minimum the followings,

Visual engineering classification of soils encountered along the pipeline route in bore log form. Depth of Ground Water Table (GWT) below NGL shall also be mentioned if encountered.

Soil profiles along the pipeline route shall also be prepared and attached with the report.

Regions along the pipeline route where hard rock is present and special excavation techniques like blasting, etc. needs to be adopted for excavation of pipeline trench shall be clearly indicated in the report.

Test shall be carried out at approved laboratory.

Summary of results obtained from tests and their interpretation to evaluate soil parameters.

Visual engineering classification of soils obtained from bore holes shall be shown in Alignment sheets also whenever preparation of Alignment sheets are in SURVEYOR’S scope of work.”

Construction

- : Stringing, aligning, field welding, NDT including radiography, joint coating, protective coating for bends and underground fittings, valves etc. as per specifications, padding, lowering, execution of roads, canals, nala, rivers, railway, utility crossings backfilling, etc

| | |
|-------------------------------------|---|
| Attending repairs | : To carry out repairs of line pipe and pipe coating (including supply of all materials) including defects/damages occurring during transportation and/or handling in co-ordination with Owner/Owner's Representative. |
| Tie-in | : Welding of all tie-in joints, NDT and other testing. |
| Golden Joints | : To carry out NDT (manual UT with X-ray / Gamma rays), if required. |
| Cathodic Protection | : Conducting soil resistivity survey, design, engineering supply of all materials, installation, testing and commissioning of temporary cathodic protection. |
| Documents | : To give updated approved documents in A3 / A4 (Periodically) to Owner / Owner's Representative for reference at site. |
| Permits | : To obtain all necessary approvals and work permits, as applicable for performing the work. |
| Preservation of Pipeline | : For preservation of pipeline during Idle time, if required, by filling the pipeline system with nitrogen at a positive pressure of 2 barg. |
| Restoration | : Clean-up and restoration of Right-of-Way as per specifications and other utilities like road, railway, canal, river, etc. to original condition, obtaining certification from concerned parties and to the entire satisfaction of Owner and/or concerned authorities having jurisdiction. Supply and installation of all types of pipeline markers including all associated civil works as per specifications and instructions of Owner/Owner's Representative. Restoration work for crossing to the satisfaction of authorities. |
| Testing | : Backfilling including supply of select backfill material wherever required, cleaning, gauging, pigging, hydrostatic testing, dewatering, swabbing, drying and commissioning of completed pipeline system as per specifications and direction of Owner / Owner's Representative. |
| Constructions (carbon steel) | Carbon steel pipe shall be laid as defined above. Cleaning, flushing, testing, purging with nitrogen and commissioning of pipeline as per specification and approved procedures providing all tools & tackles, nitrogen, instruments, manpower and related accessories as directed by owner /Owner's representative. |

5.0 STATUTORY PERMISSIONS

Guidelines:

Prior to start of construction activity, Contractor shall prepare the route survey AutoCAD drawing, mark proposed gas pipeline and submit to Owner/Consultant for approval.

Bidders shall also be responsible for liaisoning of all permissions from respective statutory authorities i.e. PWD, NHAI, Railway, Nagar Nigam, Local authorities, Forest/ central forest etc. Liaisoning for Permission from Statutory Authorities comprises carry out detail survey and preparing the drawing as per the requirement of statutory authority, applying for permissions, regular follow ups and obtaining the permission. CUGL is responsible only for preparing the letter towards application for permission and submission of demand note raised by statutory authorities. In case, bidder fails in getting permission from statutory authority within a stipulated time, CUGL may appoint another agency & complete the work at bidder's risk and cost. On behalf of the Owner, Contractor shall co-ordinate with the relevant authorities along with the copy of required pipeline route drawings / certificates complete in all respect shall be prepared and submitted by the Contractor well ahead of time so that the actual construction of the work is not delayed for want of the approval / inspection / permission by concerned authorities. The inspection of work by authorities shall be arranged by Contractor and necessary co-ordination and liaison work in this respect shall be the responsibility of the Contractor.

Any change / addition required to be made to meet the requirements of the statutory authorities shall be carried out by the Contractor without any extra cost to Owner. The inspection and acceptance of the work by statutory authorities shall however, not absolve the Contractor from any of his responsibilities under this contract.

5.1 Priorities

Owner may, at its sole option, assign priority of construction to any section of total pipeline length or to any part/segment of the WORK. Contractor shall comply with such priority of execution without any time and cost implication to the Owner.

5.2 Audits

Owner/ Owner's Representatives shall carry out audit of all Contractors' works/ site Offices/ Project Offices at regular intervals (Minimum two nos. of audits). Contractor/ Contractor's personnel have to extend full co-operation to Owner's audit team, including but not limited to providing access to all Project data/ information/ records, facilities etc. Contractor hereby agrees to immediately act upon and rectify/ correct/ make good any findings/ observations of these audits.

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AMENDMENTS TO GENERAL TECHNICAL SPECIFICATIONS 740/GTS/0502

THE NUMBERING OF THE PARTS IN THE BELOW CORRESPONDS TO GENERAL TECHNICAL SPECIFICATIONS 70000/740/GTS/0502

The present specification (PTS) can confirm, complete, modify or delete certain sections/paragraphs of those clause numbers of 740/GTS/0502 appearing below.

Contractor shall note that relevant clauses pertaining to item rate contract in GTS are not applicable. The payment shall be made ONLY on the basis of Schedule of Rates (SOR) forming the part of bid document.

The qualifying statements and conditions against GTS clauses are detailed as below.

PART 1 – SITE OCCUPATION

1.1 OCCUPATION OF THE SITE

Add:

Contractor will store excavated earth/soil at suitable locations after Owner's approval so that the adequate area is available for equipment movement.

The topsoil/arable soil removed during grading shall be stored and preserved separately from sub-surface excavated material.

1.2 MARKING OUT AND PROVISIONAL FENCING:

Fencing of the terrain shall be at the discretion of Contractor. However, area where work is being carried out above man height or below 1' ground depth must be barricaded. Wherever traffic congestion or heavily populated area encountered, Contractor shall use hard barricading as per instruction of Engineer-In-Charge. Other than above areas, Contractor may use soft barricading with approval of Engineer-In-Charge. Contractor shall be fully responsible for any damage, accidents etc. arising during construction work along the route and any compensation thereof and shall suitably indemnify Owner/ Engineer for any such damage and accidents.

1.4 CLEARING OF THE SITE INSTALLATION

All the clauses of this section are applicable for pipe laying contractor (s) site installation.

PART-4 DELIVERY AND HANDLING OF THE MATERIAL

4. DELIVERY AND HANDLING OF THE MATERIAL

4.1. General

The materials to be supplied by Owner as mentioned in present PTS Clause No. 3.1

Technical description of all the material supplied by Owner shall be given in due line after award of contract.

Storage

All free issue items to be supplied by Owner shall be stored in contractor's warehouse located along the line pipe route. Contractor has to collect free issue material from Owner designated stores.

Cost of Transportation, loading, unloading shall be borne by Contractor.

4.2. Method of Delivery

All materials shall be supplied by the contractor except that indicated in para 3.1 of present PTS.

During loading/unloading, lifting hooks shall be equipped with a plate curved to fit the curvature of the pipe and contact points with pipe shall be provided with soft material like rubber, Teflon or equivalent. Coated pipes shall be handled by means of slings and belts of proper width (min. 60 mm) made non-metallic, non-adhesive materials. During handling, suitable handling equipment with proper length of booms like fork lifts shall be used.

The weld bead of the pipes shall be positioned in such a manner so as not to touch the adjacent pipes.

Contractor store points / stock yards shall be located within the vicinity of pipeline route and the location shall be approved by Owner. Plot acquisition for the store points / stock yards and maintenance of the same shall be as per instructions of the Owner/Owner's Representative at Contractor's cost.

4.6. Storage and Handling of Materials

Contractor must provide suitable covered, waterproof storage facilities for storage of supply material. Proper store management including receipt, inspection, storage, preserving the material in good condition and issuing material to construction site at appropriate time including arranging temporary land for storage of material shall be the responsibility of contractor.

PART- 6 WELDING

6. WELDING

6.1. Qualification of Welders

- Welders shall be qualified in accordance with the API 1104, PNGRB T4S and other applicable specifications and as per approved WPS qualified by the contractor at his expense.
- The butt weld test pieces of the qualification test shall also meet the requirements of visual inspection and radiographic test requirements specified in GTS.
- A Welder who fails to complete successfully the qualification test session may be given a second opportunity to qualify after mutual agreement between Owner/Contractor as per section 6.7 of API 1104 code. Contractor shall submit the welder qualification test reports to Owner's representative for approval.
- Welders shall always have in their possession the identification card (certified by Owner's Representative). No welder shall be permitted to work without the possession of valid identity card.
- For pipeline welding one welder shall be engaged on each joint.

6.2. Welding procedure qualifications

- The welding procedure qualification test shall be carried out and qualified on the same line in accordance with requirements of API 1104 (latest edition) and other applicable specifications by the Contractor at his expenses.
- The test pieces for welding procedure qualification shall also meet the requirements of visual inspection and radiographic test requirements specified in GTS.
- In addition to the mechanical tests mentioned in API-1104, other tests like macro/micro examination, hardness tests, dye penetration tests, Charpy V-notch (Impact test) etc. shall be carried out on test specimens as per GTS and present PTS. All the above tests shall be carried out in accordance with specifications.
- Essential variables for WPS of pipeline shall be in accordance with API 1104.
- Size of Electrode for mainline welding shall be used as 2.5mm for Root weld and 3.3mm for hot and subsequent passes. Same shall be mentioned and approved during WPS/PQT before starting of construction.

- The welding electrodes/filler wires supplied by the Contractor shall conform to the class specified in the qualified welding specification. The SMYS of electrodes / filler wires shall be equal to or more than the parent material to be welded.
- Physical properties of the welds produced by electrodes recommended for the welding of a particular base metal shall not be lower than the minimum values specified for the base metal. The choice of electrode shall be the sole prerogative of the Owner/Owner's Representative.
- The Contractor shall submit batch test certificates from the electrode manufacturer giving details of physical and chemical tests carried out for each batch of electrodes to be used.
- For each batch, electrode qualification test report shall be submitted as per Annexure – A to the Owner/ Owner's Representative for approval.
- All electrodes shall be preserved in good condition as recommended by manufacturer. Low- hydrogen electrodes shall be kept in oven. The baking period shall be strictly as per manufacturer's recommendations. The electrodes used shall be free from rust, oil, grease, earth and other foreign materials which affect the quality of welding.
- All other consumables (like shielding gas) equipment and accessories shall be strictly as per applicable standards, codes and instruction of Owner/Owner's Representative.
- The welding process for pipeline shall be shielded metal arc welding (SMAW).
- Acceptance of welding process is in prerogative of Owner/Owner's Representative.
- Shielding Gas - The composition and purity of shielding gas when required by the welding processes other than shielded metal arc welding, when permitted by the Company shall bear the approval of the Owner/Owner's Representative.
- Preheating temperature shall be maintained over the whole length of the joint during welding. Temperature indicating crayons of other indicating devices shall be provided by the Contractor as per instruction of Owner's Representative.
- Post weld heat treatment, wherever required for joints between pipes and fittings, pipe body and supports shall be carried out by the Contractor at his own expense as per relevant specifications, applicable standards and the instructions of the Owner/Owner's Representative.

6.2.4. Qualification Tests

6.2.4.1. Introduction

The pipes for qualification test shall be provided by Owner to Contractor on chargeable basis.

6.2.4.3. Non-Destructive Tests

In addition to the API 1104 requirements, the welds containing the following repairs are not acceptable.

- Cracks including crater cracks regardless of size or location are unacceptable.
- Any length of inadequate penetration (LP/IP) of the root bead as defined by API 1104 is not acceptable except root concavity is allowed as per API 1104.
- Any amount of incomplete fusion (LF) at the root of the joint as per API 1104 is not acceptable.
- Un-repaired burns through areas are not acceptable.

6.2.4.4. Destructive Tests

Impact test:

Specimens shall be prepared in accordance with ISO R 148 and ASTM A370. Three test specimens shall be taken from each sample (given below) and they shall be cut and prepared so that their length is transversal and perpendicular to the roller surface. Four type of samples are taken out.

- a. At Weld Metal
- b. At Fusion Line
- c. 2 mm from Fusion Line
- d. 5mm from Fusion Line

The test shall be carried out as per ISO R 148 “Beam impact test V – notch”

Test pieces shall be immersed in a thermostatic booth and maintained at the test temperature (0°C) for at least 15 minutes.

Bend Testing: Bend test specimens shall be made and tested as per requirements of API 1104 (latest edition). Acceptance criteria for bend tests shall be in accordance with API 1104 (latest edition).

Additional Test Welds

Two specimens shall be taken from top and bottom of the weld for micro/macro examination. The specimens shall be prepared in accordance with ASTM E2 and E3. The width of the macro section has to be at least three times the width of the weld. Specimen shall be carefully examined under the microscope, with a magnification of at least 25:1. Owner may ask 5:1 magnification macrographs for records. However, test shall be carried out on the specimens used for macroscopic examination.

Same two specimens shall be used for hardness test. Vickers method with 10 kg. load indentations are to be made along transverse each approximately 1mm below the surface at both sides of the weld. In the weld metal a minimum of 6 indentations equally spaced along the traverses are to be made. The HAZ indentations are to be made along the traverse for approximately 0.5 mm each into unaffected material and starting as close to the fusion line as possible.

One indentation at each side of the weld along each transverse has to be made on parent metal. The indentations are to be made in the adjacent region as well as on the opposite side of the micro section along the specified transverse.

The test shall be carried out in accordance with recommendation ISO R81, Vickers hardness, using a diamond pyramid penetrator set at 2.37 rad (136°) with a load of 10 kg.

6.2.5 Qualification of Welding Procedure for Repairs

A separate welding procedure specification shall be qualified for the following two types of repairs:

- i) Full through thickness repair
- ii) Partial thickness repair

Procedure for weld repair shall be qualified as below

In addition to API 1104, including the special requirements of the specifications and shall also be subjected to radiography, visual inspection and destructive testing.

Maximum length and type of repairs shall be accepted as per API 1104 latest Edition.

In addition to API 1104, following mechanical tests shall also be carried out:

- i) Macro/Micro examination
- ii) Hardness test and
- iii) Impact Test

Acceptance criteria for the above tests shall be as per specifications mentioned above and following:

- i) Single pass repair deposit shall not be allowed.
- ii) Only one attempt at root portion shall be allowed. Repairs are limited to a maximum of 30% of circumferential weld length. For repairs, which open the weld root, only 20% of the weld length may be repaired. The minimum length of a repaired area shall be 100mm as measured over the recapped length.

6.3. Welding of Pipeline Elements

6.3.1. Welding Conditions

Welding tent / houses or suitable protection shall be provided for the field welding.

6.3.2. Preparation of the welding work

6.3.2.4. Alignment

- The longitudinal welds shall be staggered in the top 90° of the pipeline except in case of sag and over bends and successive horizontal bends.
- The use of internal line-up clamp is recommended for pipeline welding. However, in some cases like tie-in welds, flanges, fittings, etc. where it is impossible to use internal clamps, an external line-up clamp may be used as per separate approved WPS.
- Every effort shall be made to reduce misalignment by the use of the clamp and rotation of the pipes to the best fit. However, suitable jacking and hammering as per approved procedure may be allowed to match both ends.
- The internal clamp shall not be released before the entire first pass has been completed. External clamp shall be released after at least 60% of the first pass shall be welded. Weld segments thus welded shall be equally spaced around the circumference of the pipe.
- The vertical up method of welding shall be used for the root pass of the tie-ins, special crossings, special parts, fillet welds, repairs and when an external line-up clamp is used.
- Root pass of butt joints shall be properly executed so as to achieve full penetration with complete fusion of the root edges. Weld penetration inside the pipe shall not exceed 2.5 mm wherever not specified by the applicable Codes.
- Normally, the time lapse between first and second pass shall not be more than 4 minutes and between second and third pass shall not be more than 5 minutes. However, time lapse shall be maintained as stated in the procedure specification.
- The number of Welders and the allowable welding sequence shall be as per stipulations laid down in the qualified welding procedure.
- Electrodes starting and finishing points shall be staggered from pass to pass.

PART - 7 INSPECTIONS AND TESTING OF PRODUCTION WELDS

7. INSPECTION AND TESTING OF PRODUCTION WELDS

7.1. Generalities

The following specifications shall apply in conjunction with the following (all latest editions) codes and standards:

- i) API 1104
- ii) ASME B31.8
- iii) ASTM E94
- iv) ASTM E 142

- v) ASNT, recommended practice no. SNT-TC-IA supplement A.
- vi) ISO R 148
- vii) ASTM A370
- viii) ASME Sec. V

7.2. Testing of Welded Joints and Acceptance Criteria

7.2.1. Non-destructive testing

7.2.1.1 Visual Inspection

No negative tolerance allowed on thickness.

7.2.1.2. Radiographic testing

Every field joint shall be Radiographed.

All Radiographic films (100%) shall be submitted to Owner/Owner’s Representative for review and further acceptance.

Contractor has to submit procedure for repair of Arc ignition points to Owner for approval. After ground wall thickness of the pipe shall be within the tolerance specified in line pipe specifications.

Radiographic examination procedure to be demonstrated by Contractor and shall be submitted to Owner’s Representative for approval. The procedure of radiographic examination to be followed as below:

- Lead foil intensifying screens, at the rear of the film shall be used for all exposures.
- Type 2 and 3 films as per ASTM E-94 shall be used.
- Densitometry shall be used to determine the film density. The transmitted film density shall be 1.8 to 3.5 throughout the weld. The unexposed base density of the film shall not exceed 0.3.
- All parameters recorded during procedure qualification like SFD/ (Source to Film Distance), exposure time, capacity of Radiography machine, type of film used, Image quality indicator, sensitivity and density achieved etc.
- The radiography procedure shall be established for different techniques (like, SWSI DWSI, DWDI, etc.).
- When a complete weld is radiographed in a single exposure using a source inside the pipe, four penetrameters approximately, equally spaced around the circumference shall be used. For radiographs made with the source on the outside, a penetrameter shall be placed on each side of the film with smaller one of the penetrameter tuned towards the end of the film itself.
- Radiographic examinations shall be carried out using X-radiations only. Radiographic examination by Gamma Ray may be allowed, at the discretion of the Owner’s Representative in case of inaccessible joints.
- Whenever possible, pipeline welds shall be radiographed by panoramic exposure (360°) method. If it is impossible to place the radiation source inside the pipe, the weld will be inspected with the source on the outside. An overlap of at least 40 mm at the ends of each film shall be required.
- The weld joints shall be re-radiographed in case of unsatisfactory quality of the radiography, at the expense of the Contractor.
- All the repaired joints shall be re-radiographed at no extra cost to the Owner. Repair welds shall be indicated with ‘R’ to indicate repair. Total repaired joints shall be radiographed to compare with original film in order to ensure the repair is correctly attended.
- The final disposition of all unacceptable welds shall be decided by the Owner’s Representative.

- Contractor shall be responsible for the protection and personnel monitoring of every man with or near radiation sources. In view of visual hazards in the handling of radioactive source of material, Contractor shall be solely responsible for complying with all rules and regulations set forth by Atomic Energy Commission or any other Government Agency (ies) of India. All safety equipment, manpower, safety displays etc. shall be arranged by Contractor at his own cost.
- All pipeline radiographers shall be qualified in accordance with the requirements of API 1104 and to the satisfaction of Owner/Owner's Representative. All documentary proof related to qualification of all the radiographers shall be submitted to Owner/Owner's Representative for approval. The Contractor shall provide all the necessary facilities at site, such as a dark room with controlled temperature, film viewer etc. to enable the Owner to examine the radiographs.

7.2.1.3. Ultrasonic Testing

This clause is not relevant for this particular project

7.2.3 Destructive Tests

When laying a new pipeline the contractor shall cutout at least one production weld test as per instructions of owner/ owner's representative to satisfaction of jobs.

5 test specimens of impact test shall be carried out for production weld. One highest and one lowest energy value out of 5 test specimens to be discarded. Finally 3 test specimens of impact test shall be considered. In case of production weld failure, two (2) more additional joints has to be conducted for same days, same welders and same thickness for which production joint failed.

The destructive test must be carried out in accordance with section 5.6 of API 1104. All tests will be carried out in laboratory approved by the Owner/Owner's PMC.

PART - 9 COATING

9.1 General

9.1.1. Purpose of the coating

Maximum operating temperature to be considered is 60°C. Hence the design temperature for Field Joint coating shall be considered as 60°C.

All the girth weld joint coating material for buried pipeline section shall confirm to EN 12068 C HT 60UV for C 60 Class as per EN 12068.

Application procedures must take into account the extreme weather condition i.e. high relative humidity, burial temperature above 40°C.

Add DIN EN 10289 for Thermosetting Plastic coating in place of DIN 30673.

All coating material shall be DIN – DVGW certified.

9.1.2. Material to be coated

Line pipe shall be supplied with external coating as per clause 3.1 of present PTS.

External Coating shall be as per Standard ISO 21809-1, DIN 30670 and relevant GTS/PTS.

The coating cut back for pipes is min. 150 mm [(+) 25 mm (-) 0 mm].

9.1.3. Obligation of the bidder

Add DIN EN 10289 for Thermoset Plastic coating in place of DIN 30673.

EN 12068 for tape and shrinkable material

Functional Properties of Joint Coating System (As applied)

As applied field joint coating system shall comply with the requirements of DIN EN 12068 Table 2 corresponding to designation DIN EN 12062.C-50 for C-50 class certified material.

9.1.5 Overview of the coating systems to be accepted by the Owner/Owner's Representative.

Polypropylene, bitumen (asphalt), 2 component- coal-tar epoxy and bituminous tapes reinforced with fibre glass are deleted.

Thermosetting plastic coating is included.

9.1.6 Definition of the type of coating according to application

Contractor shall provide with his Bid document a complete description of the joint coating material (in line with the tender requirements), he intends to use for the entire work for Owner/Owner's Representative approval. In any case contractor must successfully demonstrate at least 10 Nos. joint coatings as per approved procedure, testing/quality control requirements. If the material proposed by Contractor is not approved by Owner/Owner's Representative, even after demonstration, then Contractor must revise the proposal and get Owner/Owner's Representative approval without any cost implication.

The coatings mentioned below are for undergrounds installations.

For Joint Coating RAYCHEM/DIRAX or Denso (or any other brand as per approved vendor list) shall be used. Directional drilling kit, multilayer sleeve system or equivalent to be approved by Owner/ Engineer.

Only coating material certified C HT 60 Class as per EN 12068 and DVGW (heat shrinkable material) will be accepted for all material to be coated.

For the buried valve station (moulded piece, valves, elbows etc) Thermoset plastic coatings may be used. It shall be of Type 3 DIN EN 10289.

Underground bare valves if any will be coated with above material.

At the point of transition from the aboveground pipe to underground pipe special coating material FIBAROLL or equivalent to be used over the coated part of U.G. pipe and painted part of A.G. Pipe end overlapping shall be at least 500 mm inside the ground and 500 mm on painted AG line. Minimum thickness shall be 1.5 mm. The application of the material will be as per supplier's specification.

Wherever Thrust Boring (Jacking) method is carried out, for mechanical protection of coating of carrier pipe extra layer of hard cold applied tapes C-60 Class as per DIN 30675-1 or Solvent free PUR (1000 microns) as per DIN 30677/2 EP-60 types (also refer the requirements of GTS & present PTS) shall be applied. Surface preparation (sand blasting) of PE layer shall be appropriate as per applicator's recommendations. The type & thickness of coating must get approved by Owner/Owner's Representative prior to coating.

Field Joint Coating of 3LPE Coated Pipelines using Viscoelastic Corrosion Prevention Coating System

It shall be used to coat pipe joints wherever surface preparation with abrasive blasting is not possible in city limits. Minimum requirements for primer-less viscoelastic wrap coating materials to be used for the corrosion prevention of field joint coating of steel pipe network for city gas distribution network conforming to the requirements of ISO 21809 Part 3 and operating temperature 60°C. The field joint Coating system shall comprise of primer less viscoelastic tape for corrosion protection of power tool or hand brush cleaned steel girth weld surface followed by a Butyl Rubber based low pre-heat shrink sleeve for mechanical protection and sealing the overlap area of 3LPE Coating.

9.2 Preparation of the surfaces to be coated

Surface cleaning shall be as per SA 2½ (ISO 8502-3) for base items and will be achieved by shot or sand blasting. Minimum roughness range to be between 50 and 100 µm.

9.3 Identification of all Buried Joints

This clause is not relevant for this particular project.

9.5 Application of the Coating

9.5.1 Coating with plastic wrapping tape

9.5.1.1 Composition of the coating

Contractor shall provide methodology for application of coating only, to be approved by Owner/Owner's Representative before commencement of coating.

Only approved heat shrinkable wraparound sleeve (Raychem or Denso or any other brand as per approved vendor list) material shall be acceptable. The material shall consist of radiation cross linked, thermally stabilized, ultra violet resistant, semi-rigid polyolefin dimpled backing with uniform thickness of high shear strength thermoplastic/copolymer, hot adhesive.

Contractor to provide coating application procedure as per supplier application recommendation to be approved by Owner/Owner's Representative before starting coating work.

Only 3 layers system (with primer) will be accepted for the proposed joint coating system. The heat shrinkable sleeves will be of radiation cross link polymer backing type.

The heat shrinkable sleeves should be suitable for application using gas torches. Heat shrinkable sleeves shall be applied over wet epoxy layer. The steel will be pre heated to 50°C prior to blasting to remove any moisture to prevent flash rusting. After blasting, the steel shall be preheated as per manufacturer's recommendation.

Min thickness for joint coating system shall be: "2.0 mm for Body and 1.6mm on Weld Seam for upto 10" size & 2.2mm on Body and 1.8mm on Weld Seam for 12" and upto 16" Size. The min. thickness of the 1st layer (epoxy) shall be 200 microns." Thickness of adhesive and backing material to be approved by Owner/Owner's representative. The minimum overlap with 3LPE Coating shall be 100 mm (50mm on each side).

For repair it would be as per manufacturer's recommendations, which have to be approved by Owner/Owner's Representative.

9.5.1.2 Applying the coating

Cold applied tape shall be used for coating purpose on irregular surfaces i.e. elbow & fittings etc. Holiday test shall be carried out at 25 KV.

9.6 Repairing of the Coating

9.6.1 Repairing PE Coating

9.6.1.2 Repairing PE coating with plastic repair patch

The repair materials to be used for repair of 3LPE / joint coating shall be certified to stress class C-80 as per EN12068.

9.8 Quality Control of the Corrosion Protection

Owner reserves the right to remove and test one out of 50 joint coating or one joint coating out of everyday's production whichever is stringent.

From each test piece, one or more stripes of size 25 mm x 200 mm shall be cut perpendicular to the pipe axis and slowly peels off.

Peel strength shall meet the code requirements and removal of strip the bulk of adhesive shall remain adhered to the pipe showing no bare metal, otherwise, test shall be considered fail.

The adhesive layer that remains on the pipe surface shall be free of voids resulting from air or gas inclusion.

If the sleeve taken away for test doesn't met the requirements of tender, the adjacent two sleeves shall also be removed and inspected. If the adjacent two sleeves are acceptable the test rate shall be increased to one sleeve per every twenty-five until Onwer's Representative is satisfied. If either or both of the adjacent two sleeves do not met the requirement of specifications, the field coating shall be stopped and further investigation shall be carried out.

Thickness shall be measured from 10 different location on weld and body. The minimum thickness on joint shall be 1.6 mm. Average thickness on joint shall be minimum 2 mm. Thickness shall be checked with calibrated coat / elcho metre.

Coating thickness shall be checked by non-destructive methods for each field joint.

The entire surface of the joint section shall be inspected by means of a full circle holiday detector approved by Owner.

Inspection of the sleeves shall be conducted only after the joint has cooled below 50°C.

9.8.1 Systematic Inspection

Specification of the test current for the inspection with the Holiday detector shall be 25 KV for all the coating thickness.

PART 10 EARTHWORKS FOR LAYING PIPELINE

10. EARTHWORKS

10.1. Excavation

10.1.2. Underground Obstacles

Replace the second last para as below:

“Unless otherwise stated in particular cross section drawings, the clear spacing between the gas pipeline and other petroleum pipeline will be between min 0.50 m and other utilities shall be 300mm at crossing point and min. 3.0 m when the pipeline is running parallel to the utilities (PNGRB T4S). Wherever it is possible the minimum distance must be increased.” Detail drawing is attached with Tender document.

10.1.4. Trenches depth

10.1.4.1. Minimum depth

The trench shall be excavated to a minimum width so as to provide, on both sides of the installed pipeline, a clearance as indicated in the job standards/drawings and to a depth sufficient to provide the minimum cover as indicated below. The dimensions in the table below shall govern except as noted herein or as shown on the job standards or detailed construction drawings or as required by authorities having jurisdiction, whichever is greatest. Minimum depth of cover shall be measured from the top of pipe corrosion/concrete surface/casing of the pipe with respect to top of graded working strip or top of road or top of hill whichever is lower. Fill material in working strip shall not be considered to add to the depth of cover. However, surface of fill material placed to fill hollows may be used to determine the depth of cover subject to prior approval by Owner.

Wherever, Steel and MDPE pipeline shall be laid in same trench, Orientation and Cover of both pipelines shall be as per the drawing attached with Tender. However, Steel pipeline cover be no less than 1.2m anywhere in the stretch.

| S. No | Location | Minimum Cover In Meters |
|-------|--|-------------------------|
| 1 | Normal surface i.e. Road & Residential Areas | 1.2 |

| | | |
|---|--------------------------------|---|
| 2 | Minor Water Crossings/Canals | 1.5 |
| 3 | Drainage ditches at road | 1.5 |
| 4 | Rocky area | 1.0 |
| 5 | Uncased/Cased Road Crossings | 1.5 |
| 6 | Rail Road Crossings | 1.8 (as per approved railway guideline/drawing) |
| 7 | Other Areas | 1.2 |
| 8 | Major Water Crossings / Canals | 5 (below scour depth) |
| 9 | HDD/Micro-tunneling | 2.5 (below scour depth) |

Trenching to all depth in all types of soil including soft & hard rock etc. In any circumstances contractor is not entitled to claim extra payments for excavation of increased depth due to site conditions / crossings / utilities and ground level differences etc. however in certain special cases with prior written approval of owner / owner's representative extra excavation may be paid.

At points where the contour of the earth may require extra depth to fit the minimum radius of the bend as specified in the specification or to eliminate unnecessary bending of the pipe according to customary good pipeline practice, or where a deep trench is required at the approaches to crossings of roadways, railroads, rivers, streams, drainage ditches, etc. Contractor shall excavate such additional depths without any cost/time implication.

A minimum separation of three meter should be maintained between the steel pipeline and footing of transmission tower.

In case of rivers/water bodies which are prone to scour and erosion, adequate safe cover (minimum 2.5 metre) shall be provided below the predicted scour profile expected during the lifetime of the pipeline.

The depth of cover shall be determined as per latest edition of OISD 141.

10.1.5. Trench Width

Typical sketches of cross sections for trench are enclosed under approved Job standards. This is indicative only. As per site conditions and instructions of Owner, trench width may have to be increased at no extra cost and time impact to the Owner.

10.1.8. Appearance of the Trench Bottom and Trench Walls

The trench shall be cut to a grade that will provide a firm, uniform and continuous support for the pipe. Bends shall be made in the pipe at significant changes in grade of the trench. Owner reserves the right to set the grade of the trench and locate the bends if so desired, in which case CONTRACTOR shall excavate, at no extra cost, the trench and bend the pipe to such a grade. Owner desires to reduce to a minimum the required number of bends to lay the pipe to conform to the general contour of the ground and maintain a normal cover. This can be accomplished by cutting the trench slightly deeper at the crest of ridges and by gradually deepening the trench in approaches to crossings. Such trenching work shall be done by CONTRACTOR at no extra cost to the Owner.

CONTRACTOR shall keep the trench in good condition until the pipe is laid, and no claim is to be made to the Owner by reason of its caving either before or after pipe is laid. All lumber, sheet-piling

jacks or other materials that may be necessary to shore the trench, in order to prevent caving are to be furnished and removed by CONTRACTOR.

CONTRACTOR shall dewater, if necessary, using well point system or other suitable systems, shore or do what else might be required to excavate the trench, install the pipe in it and backfill the trench as per instruction of Owner's Representative.

CONTRACTOR shall excavate and maintain the pipeline trench on the staked centre line of the pipeline taking into account the curves of the pipeline. CONTRACTOR shall, by any method approved by Owner, dig the pipeline trench on the cleared and graded Right-of-Way. In steep slope areas or on the hillside, before commencing the works, proper barriers or other protection shall be provided to prevent the removed materials from rolling downhill. In certain sloppy sections, before the trench cuts through the water table, proper drainage shall be ensured both near the ditch and the Right-of Way in order to guarantee soil stability.

10.1.9. Water Run-Off Drainage of the Trench and Work Pits

Wherever up-floating of the pipeline after backfilling shall be reckoned with, anti-buoyancy measures shall be provided by CONTRACTOR as may be encountered during construction as per instructions of Owner/Owner's Representative.

10.2. Backfilling the Trench

10.2.1. General

Backfilling shall be done after ensuring that pipe have the proper fit and the pipe is following the trench 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. Before backfilling, it shall be the responsibility of contractor to first get the approval of Owner/Owner's Representative. If any backfilling is done without Owner's approval, Owner will have the right to require removal of the backfill for examination, and the cost of such uncovering and refilling shall be borne by CONTRACTOR. Backfilling of trench in water courses shall be carried out as per the relevant specifications.

Trench shall be back filled by 300 mm soft soil or sand from top of pipe first then by excavated material, if soft soil is not available in excavated material contractor has to arrange the same at no extra cost to Owner.

Backfilling shall be carried out immediately after the pipeline has been laid in the trench, inspected and approved by the Owner, thus avoiding long exposure of coating to high temperature, damaging actions of adverse weather conditions, sliding down of trench sides and pipe movement in the trench. If immediate back filling is not possible, a covering of at least 300mm of earth, free of rock and hard lumps shall be placed over and around the pipe and coating. On no account the top soil from the ROW be used for this purpose. In general, the trench shall be dry during the backfilling. Deviations thereof must have prior approval of the Owner. After the initial backfill has been placed into the trench to a level slightly above the surrounding ground, CONTRACTOR shall compact the backfill material. The surplus material shall be neatly crowned directly over the trench to such a height which will, in Owner's opinion, provide adequately for future settlement of the trench backfill during the maintenance period and thereafter. The crown shall be high enough to prevent the formation of a depression in the soil when backfill has settled into its permanent position. Should depression occur after backfill, CONTRACTOR shall be responsible for remedial work at no extra cost to Owner. Surplus material, including rock, left from this operation shall be disposed of to the satisfaction of land Owner or authority having jurisdiction at no extra cost to the Owner.

10.2.3. Working Method for Backfilling

The trench in irrigated and paddy fields shall be backfilled to within 300 mm of the top, then rammed and further backfilled until the trench is completely backfilled.

At the end of each day's work, backfilling shall not be more than 500 meters behind the end of lowered-in pipe, which has been padded and approved for backfill. The backfill shall be maintained by CONTRACTOR against washouts etc., until the completion and final acceptance of the work by Owner/Owner's Representative.

CONTRACTOR shall furnish materials and install breakers in the trench in steep areas (slope generally 10% and more) for the purpose of preventing erosion of the backfill. The type of breakers installed shall be as per the drawings provided in specifications. Breakers shall be constructed of grout bags filled with a mixture of 4:1 (Sand: Portland cement) at Owner's direction. CONTRACTOR may propose other methods such as foam dams etc. which shall be subject to approval by Owner. Such works shall be at no extra cost to Owner. CONTRACTOR shall pay attention to the direction of backfilling in such steep areas.

Backfilling shall be laid immediately after obtaining approval from Owner's representative. It is not possible immediately at least a covering or 300 mm of earth, free of rock and hard lumps shall be placed over the pipe. For this purpose top soil (arable) shall not be used. Surplus material shall be neatly crowned directly over the trench as per instructions of Owner's Representative. Arable soil shall be replaced at its own position. Crown shall be high enough to prevent the formation of a depression in the soil when backfill has settled into its permanent position. Depression occurs after approval of backfill by Owner, Contractor shall be responsible for remedial work at no extra cost to Owner.

During execution of the road crossings or any other utility crossing the backfill material shall be thoroughly compacted by special compaction methods, such as moistening or ramming of the backfill in layers upto satisfaction of Owner/concerned authority. In these cases the surface of the backfill be gravelled with crushed rock or some other purchased materials and the road shall be reinstated at no extra cost to Owner.

10.2.3.3. Top Soil Layer (arable soil)

Protection of the arable soil and sub-soil.

In the cultivated land and other areas specifically designated by the Owner, top 300mm of the arable soil on the pipeline trench top with plus 500 mm on either side, shall be excavated and stored separately to be replaced in original position after backfilling and compacting rest of the trench as per instructions of Owner/Owner's Representative.

In the course of natural or artificial deposits of loose soil, sand, heaps of earth or other fill materials, these shall be removed till stable natural ground level is reached so as to ensure the construction of the pipeline ditch in stable ground.

Contractor shall confine all its operations within limits of the Right-of-Use. Any damage to property outside ROU shall be restored or settled to the Contractor's account. Contractor shall promptly settle all off Right-of-Use damage claims. Contractor fails to do so, Owner will give written notice to Contractor and if Contractor does not settle such claims within seven days after such notice, Owner shall have the authority to settle claims from the account of Contractor.

10.2.4. Works during Backfilling

10.2.4.1. Reinforced Concrete Slabs as mechanical Protection for the Pipe

Concrete slabs shall be at utility crossings and overhead power lines as per job standards enclosed in the tender, site conditions and instructions of Owner/Owner's Representative:

10.2.4.2. Warning Signs

10.2.4.2.1. Netting

This is not applicable for the present project.

10.2.4.2.2. Warning Tape

A warning tape made of 1.0 mm thick and 300 mm wide PE material (Yellow Colour) shall be laid as per standard drawing. Warning mat shall be supplied by the contractor.

PART 11 LOWERING AND BALLASTING

11. LOWERING –IN AND BALLASTING

11.1. Lowering-In

11.1.2. Conditions before Laying

Contractor shall submit pipe book upto Joint coating part to Owner's Representative. After certification of the pipe book only lowering in can be started. Prior to lowering in; a complete check by a full circle holiday detector for pipe coating and field joint coating in presence of Owner's Representative shall be carried out and all damages noted shall be repaired at Contractor's cost.

Before pipeline lowering & pipe string, Holiday test shall be carried out at 25 KV.

The pipeline shall be lifted and laid with all necessary suitable equipments of non-abrasive material having adequate width for the fragility of the coating.

The pipeline must be laid without interruption for the whole or the length of the section available. If water is present, no laying shall be carried out.

11.1.3. Precautions to be taken during lowering-in

A comprehensive report/method statement on the laying operation to be used shall be submitted to the Owner for approval. The report shall include, but not limited to the following:

- i) Method of installation by lifting.
- ii) Pulling method and related calculation wherever lifting method cannot be used.
- iii) Pulling device and its characteristics.
- iv) Characteristics of the pulling rope.
- v) Braking device, if any.

PART 14 TESTING, CLEANING AND DRYING

14. TESTING, CLEANING AND DRYNG

14.1. General

Preamble

The pre-commissioning activities shall include all activities which are not under commissioning scope. It will include mechanical resistance test, tightness/ leak test, cleaning including Swabbing, drying

activity and the final acceptance dossier and all related activities. The pre-drying includes runs of high-density foam pigs till water content is acceptable by Owner/ Engineer.

The commissioning activities which concern complete pipeline system shall include the final drying, filling the nitrogen and commissioning with gas and all related activities. The nitrogen and all material for commissioning activity will be supplied by contractor. The drawing up of the Emergency Management Plan and safety measures, the testing of Golden Tie-in welds at Gas MOP (maximum operating pressure) the Gas-in activities and the final acceptance record shall be carried out by the contractor.

For Pre-commissioning and Commissioning:

Contractor shall identify and arrange for supply of manpower, spares, tools, tackles and consumables as required for pre-commissioning and commissioning activities.

The Contractor shall draw up the complete pre-commissioning and commissioning methodology in sequential order including equipment material, manpower to deploy, safety measures etc. methodology. Criteria of acceptance, final report etc. shall be drawn up as per International Code like AS/NZS 2285.5 latest edition or other recognized International code, and good engineering practice. Only approved by Owner/Owner's Representative, methodology will be implemented.

Contractor shall follow the safety practices during execution of pre-commissioning and commissioning works as detailed in the scope of work. Contractor shall also maintain and follow all safety practices equivalent or better than those being practiced by the industry during pre-commissioning and commissioning activities. The rate for pre-commissioning & commissioning are included in SOR.

Filling of nitrogen for gas-in:

The nitrogen shall be injected in the pipeline before filling the pipeline with gas (gas-in) to prevent direct mixing of gas with air.

Nitrogen needed for Inertisation of the pipeline shall be provided by the contractor. The maximum allowable Oxygen content inside the pipeline shall be less than 1% by volume.

After completion of an entire pipeline system, the Contractor must proceed with final drying and commissioning with Gas filling activity as per approved methodology. If deemed necessary by Owner/engineer shall be kept idle under 1barg of nitrogen as per approved methodology before gas in operation. Supply & Filling of nitrogen will be covered under item for SOR.

The pipeline will be tested, cleaned and dried, section after section.

In any case contractor shall draw up the entire job procedure to be approved by the Owner/Owner's Representative before commencing any commissioning activity.

The connection with the pipeline (golden tie-in welds) will be made only after completion of the testing, cleaning and drying of the pipeline. The Contractor must submit his job procedure for Owner/Owner's Representative's approval.

The pipeline to be constructed has to meet the requirements of statutory bodies such as Chief Controller of Explosives (CCOE) / local concerned authority / Railways / Road department / River and Canal authorities etc.

Testing shall be performed on the entire length of the pipeline. Test shall be performed in accordance with approved Test Diagrams for each test section. The Contractor to detail the sections for testing and get approval from Owner/Owner's Representative.

Test shall commence only after mechanical and civil works completion, i.e., all welds have been accepted and the pipeline has been laid and backfilled according to the specifications. Contractor shall perform all works required for testing after obtaining prior written approval from the Owner.

Reference Codes, Standards and Specifications

Reference has been made in this specification to the latest edition/revision of the following codes, standards and specifications.

- a) ANSI B 31.8 Gas Transmission and Distribution Piping systems.
- b) API RP 1110 Pressure Testing of Liquid Petroleum Pipelines.
- c) ASME Sec. VIII Div. 1 Boiler & Pressure Vessels Code.

In case of conflict between the requirements of this specification and that of the above referred codes, standards, and specifications, the requirements of this specification shall govern.

I. Contractor shall submit for Owner's approval a test procedure. The procedure shall strictly comply with the requirements of this specification and shall be submitted to Owner for approval well in advance. The procedure manual shall include all temporary materials and equipment, but not be limited to the following items:

- a) Cleaning of pipeline : Before starting the pigging activity, initial weight of the pig shall be measured at the Launching Station and after receiving the pig at the Receiving Station, the final weight of the pig shall also be measured. The difference between the initial and final weights of the Pig shall not exceed more than 20% of the initial weight of the pig.
- b) Pre-Hydrostatic test Pressure and Final Hydrostatic Test Pressure shall be done at 1.5 times of design pressure. It should be confirmed that the hoop stress should not increase by 95% of SMYS. (The detailed design calculations shall be submitted by the contractor and for approval by owner/owner representative, prior to the execution of hydrostatic tests)
- c) A diagram indicating all fittings, vents, valves, test headers, temporary connections, relevant elevations and ratings. The diagram shall also indicate injection location and intake and discharge lines.
- d) Cleaning, gauging, filling and flushing procedures, including a complete description of all proposed equipment and instruments (including spares), their location and set-up.
- e) Estimated amount of test water, water sources, results of test sample, including required concentration of corrosion inhibitors and additives, procedure for inhibitor injection and control of concentration.
- f) Air cleaning must be done by oil free compressors only.
- g) P-V Graph shall be used for calculating air volume for air cleaning
- h) Pressure testing procedure including a complete description of all proposed equipment and instruments (including spares), their location and set-up, and proposed system for observation and recording of data during the pressure test.
- i) 24 hours strength test and tightness test shall be carried out.
- j) Procedures for leveling and stabilization after filling and for pressurization and to allow for temperature stabilization.
- k) Procedure for detection and location of leaks.
- l) Procedure for dewatering the pipeline section after testing, including a complete description of all proposed equipment and instruments (including spares), their location and set-up, the type and sequence of pigs along with the pig specifications.
- m) Forms for recording the test data.

14.3. Mechanical Resistance Test

14.3.2. Hydraulic Resistance Test

Duration of test shall be minimum 24 hours after stabilization and the test pressure shall be as indicated in the specification.

Equipment and Instrumentation

The Contractor shall furnish all necessary equipment for performing the work as stated in cleaning, flushing, filling, leveling, stabilizing, testing and dewatering procedures.

This shall include, but not be limited to, the following equipment and instruments:

1) Pigs for filling:

- Cleaning pigs with foam.

The Contractor shall provide a sufficient number of pigs, including spares.

2) Fill pumps: The Contractor shall determine the type and number of fill pumps in order to guarantee the following:

- Differential head 20% greater than the maximum required.
- Flow rate: Minimum 200 m³/h

Maximum 400 m³/h

If a single pump is used, a standby unit must be available.

- 3) Variable speed positive displacement pumps equipped with a stroke counter to pressurize the line with a known stroke and capable of exceeding the maximum test pressure by at least 20 bar.
- 4) Two positive displacement meters to measure the volume of water used for filling the line. These meters shall be provided with a calibration certificate not older than one month.
- 5) Pressure gauges of suitable pressure range (1.5 x pressure to be measured) and accuracy.
- 6) Pressure recording charts range shall be 1.5 x pressure to be measured.
- 7) Dead weight testers with an accuracy of ± 0.05 % of actual ratings with a calibration certificate not older than three month.
- 8) Two temperature recorders for fill water.
- 9) Thermocouples for measuring the pipe wall temperature.
- 10) Two laboratory thermometers 0°C to 60°C range, accuracy ± 0.5 degrees of graduation to be used in thermowells.
- 11) Water tanks during water filling.
- 12) Portable tanks of sufficient size to provide a continuous supply of water to the pump during pressurizing.
- 13) Means to measure the volume of water necessary to drop the line pressure by 0.5 bar (container on scales or graduated cylinder).
- 14) Injection facilities to inject additive for anti-corrosion into the test medium in the required proportions.
- 15) The temporary scraper traps shall be installed according to the testing sections fixed in the test procedure manual. Proper piping and valve arrangements shall be available to allow launching and receiving of each pig independently.
- 16) Communication equipment suitable for a continuous connection between the beginning and the end of the test section and with the inspection team along the line, in accordance with the requirements of Local Authorities.

17) Thermocouples for measuring the temperature of the pipe wall shall be installed on the pipeline to be tested:

- 1 thermocouple at about 250m distance from the pumping head.
- 1 thermocouple every 500 m of the pipe.
- 1 thermocouple at about 250 m distance from the terminal head.

In addition to above, Owner's Representative may demand to install more thermocouples as per site conditions.

Thermocouples shall be attached on the external surface of the pipe after removal of external coating and shall be adequately protected and Owner's coating instruction shall be followed.

Procedures

If the difference of minimum and maximum atmospheric temperature should cause thermal instability on the pipe section directly exposed to atmospheric condition, the temporary scraper traps and above ground pipeline shall be properly protected.

The test medium shall be tested to confirm soft non-aggressive water. The water to be used shall be filtered, shall not be contaminated, and free from sand or silt. Contractor shall submit laboratory test reports of water used for testing. The Contractor shall furnish and install all temporary piping which may be necessary to connect from source of water to its pumps and manifolds/tankages.

Before filling operation the Contractor shall clean the pipeline by air driven pigs to remove all mill scale rust/sand from the internal of pipe sections. The finishing touch shall be executed with pigs provided with air jet holes or nozzles to keep the internal dust in turbulence ahead of the pigs. The number of pig runs is depending upon the cleaning results and shall be determined by the Owner at site.

Thermal Stabilization

After a check has been made to confirm if the pressure has attained at least 1 bar (g) on the highest section, the thermal stabilization can be started.

Thermal equilibrium between the pipeline and environment shall be checked through the thermocouples installed on the pipeline.

Temperature readings shall be made at 1 hours-intervals. Thermal stabilization shall be considered to have been achieved when a difference not higher than 1°C is attained between the average values of the last two readings. Thermal stabilization completion shall be approved by Owner's Representative.

The pressurization rate shall not be more than 2 bar/min.. Pressure shall be recorded in dead weight tester and confirmation can be done with pressure gauge on the same header. Volume shall also be recorded with respect to pressure.

- Each 5 bar increments up to 80% of test pressure as recorded by the dead weight tester;
- Each 2 bar increment between 80% to 90% of the test pressure full test pressure as recorded by the dead weight tester.

Air Volume Ratio shall be calculated as per following:-

- i) Pressurize to 50% of test pressure, hold pressure for 1 hour, collect water for air volume calculations.
- ii) Drop pressure to static head of test section at test head.

- iii) Pressurize 75% of test pressure, hold pressure for 1 hour, collect water for air volume calculation.
- iv) Drop pressure to static head of test section at the test head.
- v) Pressurize to test pressure.

During the pressurization to each test pressure, two tests shall be carried out for the calculation of air volume in the pipeline under test.

Air volume Calculation

In order to check the presence of air in the pipeline, two separate consecutive pressure lowerings of 0.5 bar shall be carried out.

For calculation of air in the pipeline the second pressure lowering shall be used, and the relevant drained water shall be accurately measured (V1). This amount measured shall be compared to the theoretical amount (V2) corresponding to the pressure lowering that has been carried out, by using the procedure outlined in the specification.

If no air is present in the length under test:

$$V1/V2 = 1$$

In order that the above ratio is acceptable, it shall not differ from 1 by more than 6% (i.e. 1.06).

If ratio is within limits, pressurization can continue. If not, water refilling shall be carried out by passing of another pig.

Testing

After the section has been pressurized and the air volume test has given acceptable results the test pressure shall be held for a minimum of 24 hours after stabilization. After temperature and pressure has stabilized, the injection pump shall be disconnected and all connections at the test heads shall be checked for leakage. The pressure recorders shall then be started with the charts in a real time orientation for continuous recording throughout the test.

During testing all ball valves in position shall be in partially OPEN condition.

During the testing period the following measurements shall be recorded/reported:

- Every one hour pressure measurements from dead weight testers.
- Every two hours the ambient temperature and the pipe temperature at the thermocouples.

All data shall be recorded on appropriate forms attached to the hydrostatic test procedure manual. Care shall be taken that the maximum test pressures are not exceeded.

Bleed-off water shall be accurately measured and recorded.

14.5. Cleaning and Drying

14.5.2. Station Construction

14.5.2.3.. Drying

Pipeline shall be dried upto dew point of -8° C. Drying procedure shall be submitted by Contractor to Owner's Representative for approval.

14.8. Acceptance

The hydrostatic test shall be considered as positive if pressure has kept a constant value throughout the test duration, except for change due to temperature effects. Such changes shall be evaluated as described below.

The pressure change value as a function of temperature change shall be algebraically added to the pressure value as read on the meters. The pressure value thus adjusted shall be compared with the initial value and the test shall be considered as acceptable if the difference is less than or equal to 0.3 bar. In case of doubt the testing period shall be extended by 24 hours.

If test section doesn't meet the above requirement, Contractor shall determine by search the location of leakage or failure. All leaks and failures within the pipe wall or weld seam shall be repaired by replacement of entire joint or joints in which leakage or failure occurs. In those cases where leaks occur in circumferential welds the method of repair shall be determined by the Owner. Contractor shall comply with instructions of the Owner's Representative whether to replace a section of the line pipe that includes the line leak or whether to repair the circumferential weld. The repair shall be carried out as per specifications. Where failures occur in pipeline field bends, bends shall be replaced with same degree of bends. After completion of repairs, the hydrostatic test shall be repeated in full, as per this specification.

The cost of repairs or replacements, followed by refilling and repressurizing the line, due to poor workmanship, shall be borne by the Contractor. In the event of leaks or failures resulting from faulty Owner furnished materials as per Schedule of Rates (SOR). Contractor shall be entitled for time extension as per the provisions of the Contract.

Termination

After the positive results of testing and all the data have been gathered, the test shall be terminated upon written approval given by Owner.

The pipeline shall be slowly depressurized at a moderate and constant rate as instructed by Owner.

Details of the instruments:

Water Amount Measurement

The water volume added to the section to be tested shall be measured during the filling stage through a positive displacement meter (a turbine meter may also be used).

In the calculation, use shall be made of the geometrical volume of the section in question. The water amount that has been let into the section shall be measured during the pressurization stages through positive displacement meters or turbine meters.

Pressure Measurement

Pressure shall be measured with a dead weight tester. (least count of the pressure gauge should be 0.05 bar (g)) Pressure recorder and gauge shall be installed on line.

Pressure instrument shall have the following accuracy:

Accuracy : $\pm 0.1\%$ of the full-scale value for analysis gauge.

The recording pressure gauge shall be checked by means of dead weight test at the beginning, during and at the end of the hydrostatic test.

The thermocouples sensitivity shall enable temperature readings with accuracy of $\pm 0.2^\circ\text{C}$.

Thermocouples/Readout units shall be calibrated with thermometer which should have NPL calibration certificate.

The recording thermometer shall feature the following characteristics:

Accuracy : ± 1% of the scale range

Scale : - 10° to + 40°C

Environmental temperature shall be recorded by thermometer which shall have:

Accuracy : ± 1% of the scale range

Scale : 0° to + 60°C

Calculations

The theoretical water amount that is necessary for filling the section to be tested shall be obtained from the geometrical volume of the section considering the pipe tolerances.

The theoretical water amount that is necessary for pressurizing the section shall be calculated by means of the following formula:

$$V_p = (0.884 r_i / t + A) \times 10^{-6} \times V_t \times \Delta P \times K$$

Where:

V_p = computed water amount required to raise by P the pressure in the section to be tested (m³).

V_t = geometrical volume of the section (m³).

ΔP = pressure rise (bar)

r_i = nominal inner radius of the pipe (mm).

t = nominal pipe thickness (mm).

A = isothermal compressibility value for water at the pressurization temperature in the P range (bar⁻¹) x 10⁶.

(Refer water compressibility factor vs. pressure and temperature chart).

K = a dimensionless coefficient that is equal to a value of 1.02 for longitudinally welded pipe.

The pressure change due to a water temperature change shall be calculated through the following formula:

$$\Delta P = \frac{B \Delta T}{0.884 * \frac{r_i}{t} + A}$$

Where,

| | | |
|------------|---|--|
| ΔP | = | Pressure change resulting from a temperature change (bar). |
| ΔT | = | Algebraical difference between water temperature at the beginning of the test and water temperature as measured at the end of the test ($^{\circ}\text{C}$). |
| B | = | Value of the difference between the thermal expansion of water at the pressure and temperature as measured at the end of the test and that of steel ($^{\circ}\text{C}-1$) $\times 10^6$. |
| | | (Refer Table in Annex G) |
| A | = | Isothermal compressibility value of water as estimated at the pressure and temperature values obtained at the end of test (bar-1) $\times 10^6$ (Refer Figure in Annex G). |
| r_i | = | nominal inner radius of the pipe (mm) |
| t | = | nominal pipe thickness (mm). |

PART 15 SITE RESTORATION AND MARKING OUT

15.4. Aerial Beacons

Not Applicable for this Project.

15.5. Marking Out of the Pipeline

Reference Codes

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

API RP 1109: Recommended Practice for Marking Liquid Petroleum Pipeline Facilities.

The pipeline markers shall be fabricated and installed in accordance with the standard drawings included herein. Permanent marker & warning sign shall be powder coated type. Before starts of fabrication of the markers, Contractor shall prepare and submit for Owner's approval the detailed scheme for the marker plates as applicable for the project.

15.5.1 Concrete Marker Posts

Route Marker

Route Marker shall be constructed as per enclosed standard drawing in tender.

Route Marker will be installed at every 50m interval and as directed by the Owner/Owner's Representative.

15.5.2 Cast iron marker tiles

Pipeline Warning Sign

Pipeline Warning Sign shall in general be installed at:-

- National and State Highway crossings (2 Nos.)
- Other Road crossings (2 Nos.)
- Minor Water crossings (2 Nos.)

- Major Water crossings (2 Nos.)
- Any other locations as shown in the approved drawings and as directed by the Owner/Owner's Representative.

Pipeline Warning Sign shall identify the existence of the pipeline and display the name of the Owner/Owner's Representation, with an emergency telephone number, as show in Standard Drawing and directions of Owner/Owner's Representative.

Painting and Coloring:

- For underground Steel Structure (except that embedded in concrete) coal tar epoxy of min. 300 micron thickness shall be applied.
- For over ground steel structure one coat of primer and two coats of specified yellow paint.
- Letters, except Warning (which shall be in red) shall be painted in black.
- Colour scheme for company monogram shall be as directed by company.
- Posts shall be painted with golden yellow colour.

Owner name plate shall face the crossing.

Location of the Warning Markers shall be decided by the Owner at site.

The foundation shall be made of concrete M20.

The dimensions of the post may be varied to suit field requirements.

PART 16 PARTICULAR CONSTRUCTIONAL TECHNIQUES

16. PARTICULAR CONSTRUCTION TECHNIQUES

Contractor shall take a note that any crossing, which is neither identified in the crossing list nor appearing in the alignment sheet; however made known to the contractor during detailed route survey or during pipeline construction , shall be executed by him at no additional cost to owner. Such additional crossing may include any unidentified UG utilities or any new facility (road/canal) constructed after the preliminary survey by owner. Contractor based on his detailed design/engineering shall submit the proposed methodology for owner/owner's representative approval and also carry out necessary liaison/follow-up for obtaining the permission of concerned authority.

16.1. General

Method of execution of crossing (open cut, boring etc.) shall be submitted by Contractor for approval to Owner/concerned authority. Contractor shall carry out works as per approved method/instructions of concerned authority/Owner at no extra cost and time to Owner.

16.2. Trenchless Crossings

16.2.1. Boring

16.2.1.1. Geo-technical Survey Report

Contractor shall carry out the soil survey in different depths for relevant Crossings, If required and submit to Owner for their approval.

16.2.1.2. Working pits and shoring works

Location of the Anti buoyancy measures to be considered (continuous concrete coating), if required.

However, contractor has to submit to Owner detailed survey indicating locations where anti buoyancy measure to be taken with calculations for approval. Contractor shall qualify procedure for design mix of concrete coating proposed to be used.

16.2.1.3. Casings

The casing element to be supplied & installed by the contractor as per SOR item details,

16.2.1.5. Spacer Collars

Not Applicable for this project.

16.2.4. Horizontal Directional Drillings

Refer to 70000/GTS/740/501, present PTS & PTS- HDD (P.013553 G 11077 M602)

16.3.1.1. Materials

Refer clause no. 16.2.1.3

PART 18 – PAINT WORK

18.1 General :

The paintwork system has to be taken as a strict guideline. Contractor may propose equivalent or better paint product for Owner/Engineer’s approval.

Underground piping shall be painted/coated as illustrated in Part 9_Coating of Present PTS. Contractor shall obtain approval from Owner/Engineer before commencement of painting/coating.

For station work (mechanical) all above ground pipes, valves, accessories, supports, etc. will be painted strictly in compliance with approved paint system.

The recommended painting system should be of Category C5 – I Very high (Industrial) as specified in the Standard ISO 12944 Part 1 to 8. The proposed Painting system shall conform to Table A 5 of ISO 12944 – 5 Standard.

The colour codes for final layer of Station Pipe Work & Metering Shed shall be as under:

| S. No. | DESCRIPTION | FINAL LAYER COLOUR SHADE | RAL CODE |
|--------|--------------------|--------------------------|----------|
| 1 | Pipe Work | Yellow | RAL 1004 |
| 2 | Piping Support | Grey | RAL 7043 |
| 3 | Hand Rail | Grey | RAL 7043 |
| 4 | Gas O/L Actuator | Blue | RAL 5015 |
| 5 | Valve Handle/Wheel | Black | RAL 9005 |
| 6 | All Valves | Grey | RAL 7038 |
| 7 | IJ | Grey | RAL 7038 |
| 8 | Filter | Grey | RAL 7038 |
| 10 | Bolts & Nuts | Grey | RAL 7038 |

| | | | |
|------|-----------------------|----------------|----------|
| 11 | Grating | Hot Galvanized | |
| 12 | Metering Station Shed | | |
| 12.1 | Steel Frame | Beige | RAL 1018 |
| 12.2 | Roof / Vertical Shed | Grey | RAL 7030 |
| 12.3 | Control Panel | Grey | RAL 7032 |

18.1.1.1 Products chosen by the Owner :

The paint system proposed under clause 18.8 has to be taken as information only.

Only approved by Owner/Engineer, paint system will be applicable.

Contractor must propose a system of coating equivalent or better in quality for Owner/Engineer approval.

List of recommended Manufacturers

1. Asian Paints (I) Ltd.
2. Berger Paints Ltd.
3. Goodlass Nerolac Paints Ltd.
4. Shalimar Paints Ltd.
5. Coromandel Paints & chemicals Ltd.
6. Bombay Paints Ltd.
and others subject to approval of Owner/Engineer.

GTS 70000/740/0501 HORIZONTAL DIRECTION DRILLING: (in addition to clause 16.2.4)

1. GLOSSARY

Refer to definition of terms of the present PTS.

GENERAL

Contractor shall Cross the road/ canal etc by the HDD at locations as directed by Owner/ Owner's Representative as per crossing survey drawings prepared by the contractor and approved by Owner. Before start of HDD, the contractor shall ascertain by pre construction survey all under ground obstacles namely electrical, telecommunication cables, foreign pipelines, waterlines, drain/ sewerage lines etc and prepared crossing profile drawings showing all elevations and levels. The contractor shall also ascertain the type of soil and their terrain whether rocky or normal by way of trail pit etc. before start of job. The contractor shall submit procedure, profile drawing with complete design calculations of HDD as per requirement of applicable Codes & Standards.

4. GEOLOGICAL DATA

Contractor shall perform Hydrological & Geological Surveys, if required. and final report of same shall be approved by Owner/ Owner's Representative prior to start of HDD.

5. RIGHT OF WAY AND WORK SPACE

Availability of ROW and work space for HDD and other pipeline activity shall be sole responsibility of contractor. Contractor shall co-ordinate and takes necessary permission from concerned authorities.

Contractor shall carry out construction work in the width as made available to him with no time and cost implication to the Owner. It shall be Contractor's sole responsibility to make arrangement for any additional land requirement for execution of HDD, if required.

6. DRILLING PROFILE

The Contractor shall be responsible for preparation of final profile drawing, the constraints and particularities of the obstacle to be crossed and same shall be approved by Owner/ Owner's representative.

9. DOCUMENTS TO BE SUPPLIED BY THE CONTRACTOR BEFORE AND DURING THE EXECUTION OF THE HDD AND AFTER ITS COMPLETION.

9.2 After the HDD execution
All alignment sheet, length profile, coordinates, welds numbers etc. will be recorded and integrated as per other pipeline work under the general scope of the contractor.

10 CONTROLS

10.2 Weld examination
All welds (for HDD string) shall be tested non-destructivity
100% X-ray

10.3 COATING

Only approved field joint coating system will be accepted for HDD string. Refer to GTS 740/502 and relevant clauses in the present PTS.

The contractor shall call-up the CP contractor to perform the Coating integrity test (Methodology of the same shall be submitted by the contractor for approval from Owner/Owner Representative before commencing the HDD) and the acceptance criteria shall be as mentioned in Clause no. 10.3 of GTS 740/501. Cost will be borne by the laying contractor.

10.5 Testing

10.5.1 General

After completion of HDD tests and cleaning operations the HDD section will be integrated in the pipeline and final testing and cleaning will be undertaken by contractor during testing and cleaning of the entire pipeline section.

Pre-testing shall be performed prior to pull-back operation at 1.5 times of design pressure duration of 4 hrs.

11. Reinstatement

Refer to GTS 740/502 and relevant clauses in the present PTS.

12. Acceptance

Refer to GTS 740/502 and relevant clauses in the present PTS.

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ANNEXURE – A: ELECTRODE QUALIFICATION TEST RECORD

A Tested at _____ Date: _____

Manufacturer’s Name :

Brand Name :

Batch Number & Size tested :

Classification & Code :

Intended for Welding in positions :

In combination with :

(if any)

Code of Reference :

(used for testing)

Special requirements :

(if any)

B All-weld Tensile Test

Base Material used :

Pre-heat temp. :

Post weld Heat :

Treatment details

Visual examination :

Radiographic :

examination results

Tensile test results :

| Identification No. | U.T.S. | Yield Point | Elongation Remarks |
|--------------------|--------|-------------|--------------------|
|--------------------|--------|-------------|--------------------|

- 1.
- 2.

C Impact Test Results

Test Temperature : Notch in :
 Type of Specimens : Size of
 (Charpy) Specimens :

| Specimen No. | Impact Value | Average |
|--------------|--------------|---------|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |

D Chemical Analysis Result

Electrode Size used :

Batch No. :

| % | %S | %P | %SI | %Mn | %Cr | %Ni | %Mo | Other |
|---|----|----|-----|-----|-----|-----|-----|-------|
| | | | | | | | | |

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ANNEXURE – B : STRESS RELIEF HEAT TREATMENT PROCEDURE SPECIFICATION

Name of the Heat-Treater :

Name of the Project :

Specification Reference No. :

1. General Details

Name of the Equipment :

Name of the Assembly/Part :

Assembly / Part Drawing No. :

Material :

2. Furnace Details

Type of Heating : Gas/Oil/Elec.Res./Induction

Type of Heating : (Tick Mark)

Capacity (Size) :

Maximum Temp. (°C) :

Method of Temp. Measurement :

Atmosphere Control :

3. Heat Treatment Cycle Details

Changing Temp. °C :

Rate of Heating, °C/Hr. :

Soaking Temp. °C :

Soaking Time, Hrs. :

Rate of Cooling, °C/Hr.

Mode of Cooling :

4. Other Details, if any

Notes:

The following documents shall be furnished alongwith the specifications:

- i. Material Test Certificates
- ii. Assembly Part Drawing

ANNEXURE – C: WELDING PROCEDURE QUALIFICATION TEST RECORD

Example of record form for welding procedure approval test:

| | | | |
|--------------------------------|----------------------------|---------------------|-------|
| Project/ Contract | | Contractor | |
| Pipe and Coating Material | | | |
| Process | | | |
| Outside Diameter | | | |
| Pipe Thickness | | | |
| Joint Design (Sketch Attached) | | | |
| Make and type of filler metal | Diameter | Current | Volts |
| Root | | | |
| Second Run | | | |
| Other Run | | | |
| Other Electrical | A.C./D.C | Electrode + ve /-ve | |
| Characteristics | | | |
| Shielding Gas : | | | |
| Type or mixture | | | |
| Flow | | | |
| Shielding Flux | | | |
| Position | | | |
| Direction of Welding : | Vertical up/ Vertical down | | |
| Root : | Vertical up/ Vertical down | | |
| Second Run : | Vertical up/ Vertical down | | |
| Other Runs : | Vertical up/ Vertical down | | |
| Number of Welders : | | | |
| Root | | | |
| Second Run | | | |
| Other Runs | | | |

Time lapse between commencement of root and commencement of second run

Time lapse between commencement of Second run and commencement of other run

Minimum number of runs before joint allowed to cool

Maximum time between commencement and completion or weld

Type of line-up clamp

Removal of clamp after run :

Lowering off after run :
Cleaning
Preheating

Minimum temperature °C
Type of heater to be used

Ambient temperature °C

Interpass temperature

Minimum °C

Maximum °C

Post weld heat treatment

Speed of travel

Test results

State acceptable non-acceptable (with reasons) or give numerical results

Non-destructive test:-

Visual
Radiograph

| | | | | |
|-------------------------------|----|----|----|----|
| Destructive Test | 1. | 2. | 3. | 4. |
| Transverse tensile | | | | |
| Tensile strength (with units) | | | | |

Fracture location
Test temperature
Macro-examination
Fillet weld fracture

Hardness Survey:-

| | | |
|------|------|---|
| Type | Load | Location of hardness measurement (Sketch) |
|------|------|---|

Hardness range:

Parental metal

Heat affected zone

Weld

Charpy

V- notch impact tests

Specimen location and size

Notch location

Test temperature

Results (with units)

Additional test and tests and results e.g. chemical analysis, micro-examination, CTOD tests, bend tests etc.

The statements in this record are correct. The test joints were prepared, welded and tested in accordance with the requirements of this specification.

Inspector

Date: -

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ANNEXURE – D: EXAMPLE OF RECORD FORM FOR WELDER APPROVAL TEST

| | | | |
|-------------------------|---------------------------------------|--|--|
| Welder test certificate | | Test No. | |
| Project / Contract | | Date | |
| Contractor | | Inspector | |
| Welder's Name | | | |
| Address | | | |
| Pipe Material | | | |
| Pipe Thickness | | | |
| Pipe Outside Diameter | | | |
| Welding Process | Root | Fill and Cap | |
| Electrode / Wire | | | |
| Root | Current | Voltage | |
| Second Run | Current | Voltage | |
| Full and cap | Current | Voltage | |
| Director of travel | Root: Vertical Up/vertical Down | Fill and cap: Vertical up/ Vertical down | |
| Reason for failure | | | |
| Visual | | | |
| Non-destructive testing | | | |
| Butt Joint | | | |
| Fillet weld | | | |
| Number of attempts | | | |
| Comments | | | |

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ANNEXURE – E: WELDERS IDENTIFICATION CARD

Name :
Identification : Photograph
Date of Testing :
Valid Until :
Approval of Welding :
Welding Position :
Material :
Diameter :
Wall Thickness :
Type of Welding :
Consumables :
Approved by : Employer's signature with seal

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ANNEXURE – F: RADIOGRAPHIC PROCEDURE FOR PIPE WELDING

1. Location
2. Date of Testing
3. name of Supervised Contractor
4. Material
5. Dia. & Thickness
6. Type of Weld Joint
7. Radiation Source
8. Type of equipment (External/Internal)
9. Intensifying Screens and Material
10. Filter Type and placement mask, diaphragm lead screen etc. adjacent to Radiation Source or Specimen
11. Geometric Relationship (Source local spot size, max and min source strength, object to film distance, radiation angle with respect to weld and film)
12. Limit of film coverage
13. Film type and make
14. exposure Time
15. Processing (time temperature for development, stop bath or rinse, fixation, washing, drying etc.)
16. Density
17. Sensitivity
18. Type of penetrameter

Approval of the COMPANY

Signature of CONTRACTOR with Seal

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ANNEXURE – G: DIFFERENCE BETWEEN THE WATER THERMAL EXPANSION FACTOR AND THE STEEL THERMAL EXPANSION FACTOR (OC-1) X10-6

| °C | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|------|--------|--------|--------|--------|--------|--------|--------|--------|
| bar | | | | | | | | |
| .981 | -98.62 | -79.89 | -61.81 | -44.34 | -27.47 | -11.14 | +4.66 | +19.98 |
| 10 | -95.55 | -76.94 | -58.99 | -41.65 | -24.89 | -8.67 | +7.02 | +22.23 |
| 20 | -92.15 | -73.68 | -55.86 | -38.64 | -22.01 | -5.92 | +9.65 | +24.74 |
| 30 | -88.74 | -70.40 | -52.72 | -35.63 | -19.14 | -3.16 | +12.29 | +27.26 |
| 40 | -85.32 | -67.12 | -49.58 | -32.62 | -16.24 | -0.41 | +14.93 | +29.78 |
| 50 | -81.90 | -63.84 | -46.43 | -29.60 | -13.36 | +2.36 | +17.57 | +32.31 |
| 60 | -78.47 | -60.55 | -43.27 | -26.58 | -10.46 | +5.15 | +20.23 | +34.85 |
| 70 | -75.30 | -57.25 | -40.10 | -23.54 | -7.56 | +7.92 | +22.89 | +37.39 |
| 80 | -71.60 | -53.96 | -36.94 | -20.51 | -4.65 | +10.70 | +25.55 | +39.94 |
| 90 | -68.16 | -50.66 | -33.77 | -17.47 | -1.73 | +13.50 | +28.23 | +42.50 |
| 100 | -64.72 | -47.35 | -30.60 | -14.43 | +1.18 | +16.29 | +30.90 | +45.05 |
| 110 | -61.28 | -44.05 | -27.43 | -11.38 | +4.10 | +19.08 | +33.58 | +47.61 |
| 120 | -57.84 | -40.74 | -24.26 | -8.34 | +7.02 | +21.88 | +36.26 | +50.18 |
| 130 | -54.40 | -37.44 | -21.08 | -5.29 | +9.95 | +24.68 | +38.94 | +52.75 |
| 140 | -50.96 | -34.13 | -17.90 | -2.25 | +12.87 | +27.49 | +41.63 | +55.32 |
| 150 | -47.53 | -30.83 | -14.73 | +0.80 | +15.79 | +30.29 | +44.31 | +57.89 |
| 160 | -44.10 | -27.53 | -11.56 | +3.85 | +18.72 | +33.10 | +47.00 | +60.46 |
| 170 | -40.67 | -24.23 | -8.40 | +6.89 | +21.64 | +35.90 | +49.69 | +63.04 |
| 180 | -37.24 | -20.94 | -5.23 | +9.94 | +24.56 | +38.70 | +52.37 | +65.62 |
| 190 | -33.83 | -17.65 | -2.06 | +12.98 | +27.48 | +41.51 | +55.06 | +68.19 |
| 200 | -30.42 | -14.37 | +1.09 | +16.01 | +30.40 | +44.30 | +57.75 | +70.77 |
| 210 | -27.02 | -11.09 | +4.25 | +19.04 | +33.31 | +47.10 | +60.43 | +73.34 |

| | | | | | | | | |
|-----|--------|--------|--------|--------|--------|--------|--------|--------|
| 220 | -23.63 | -7.82 | +7.40 | +22.06 | +36.22 | +49.90 | +63.12 | +75.90 |
| 230 | -20.24 | -4.56 | +10.54 | +25.08 | +39.13 | +52.69 | +65.80 | +78.48 |
| 240 | -16.87 | -1.30 | +13.67 | +28.10 | +42.03 | +55.48 | +68.48 | +81.05 |
| 250 | -13.50 | +1.94 | +16.79 | +31.11 | +44.92 | +58.26 | +71.15 | +83.61 |
| 260 | -10.14 | +5.17 | +19.90 | +34.12 | +47.81 | +61.04 | +73.81 | +86.81 |
| 270 | -6.80 | +8.39 | +23.00 | +37.11 | +50.69 | +63.80 | +76.48 | +88.73 |
| 280 | -3.48 | +11.60 | +26.11 | +40.09 | +53.56 | +66.57 | +79.41 | +91.29 |
| 290 | -0.17 | +14.80 | +29.19 | +43.07 | +56.43 | +69.33 | +81.78 | +93.83 |
| 300 | +3.13 | +17.98 | +32.27 | +46.03 | +59.29 | +72.08 | +84.83 | +96.38 |

| °C | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|------|--------|--------|--------|---------|---------|---------|---------|
| bar | | | | | | | |
| .981 | +34.82 | +49.22 | +63.20 | +76.78 | +89.99 | +102.83 | +115.34 |
| 10 | +36.97 | +51.26 | +65.15 | +78.64 | +91.75 | +104.51 | +116.93 |
| 20 | +39.36 | +53.55 | +67.33 | +80.71 | +93.72 | +106.39 | +118.71 |
| 30 | +41.76 | +55.84 | +69.51 | +82.79 | +95.70 | +108.26 | +120.49 |
| 40 | +44.18 | +58.14 | +71.70 | +84.87 | +97.68 | _110.14 | +122.28 |
| 50 | +46.60 | +60.45 | +73.90 | +86.96 | +99.68 | +112.04 | +124.07 |
| 60 | +49.02 | +62.76 | +76.10 | +89.07 | +102.67 | +113.93 | +125.88 |
| 70 | +51.44 | +65.08 | +78.32 | +91.17 | +103.68 | +115.84 | +127.69 |
| 80 | +53.88 | +67.40 | +80.53 | +93.29 | +105.69 | 117.76 | +129.50 |
| 90 | +56.32 | +69.73 | +82.75 | +95.41 | +107.70 | +119.67 | +131.32 |
| 100 | +58.77 | +72.07 | +84.98 | +97.53 | +109.73 | +121.59 | +133.15 |
| 110 | +61.21 | +74.41 | +87.22 | +99.66 | 111.75 | +123.52 | +134.98 |
| 120 | +63.67 | +76.74 | +89.45 | +101.79 | +113.79 | +125.46 | +136.82 |
| 130 | +66.12 | +79.09 | +91.69 | +103.93 | +115.83 | +127.39 | +138.67 |

| | | | | | | | |
|-----|---------|---------|---------|---------|---------|---------|---------|
| 140 | +68.58 | +81.45 | +93.93 | +106.07 | +117.87 | +129.34 | +140.51 |
| 150 | +71.05 | +83.80 | +96.18 | +108.21 | +119.90 | +131.20 | +142.37 |
| 160 | +73.51 | +86.15 | +18.43 | +110.36 | +121.96 | +133.74 | +144.22 |
| 170 | +75.97 | +88.51 | +100.68 | +112.51 | +124.01 | +135.19 | +146.08 |
| 180 | +78.44 | +90.87 | +102.94 | +114.66 | +126.06 | +137.15 | +147.94 |
| 190 | +80.91 | +93.23 | +105.19 | +116.82 | +128.12 | +139.11 | +149.81 |
| 200 | +83.37 | +95.59 | +107.45 | +118.97 | +130.17 | +141.07 | +151.68 |
| 210 | +85.84 | +97.95 | +109.71 | +121.13 | +132.24 | +143.03 | +153.55 |
| 220 | +88.30 | +100.31 | +111.97 | +123.29 | +134.29 | +144.99 | +155.42 |
| 230 | +90.67 | +102.67 | +114.23 | +125.45 | +136.36 | +146.96 | +157.30 |
| 240 | +93.22 | +105.03 | +116.48 | +127.60 | +138.42 | +148.93 | +159.18 |
| 250 | +95.69 | +107.39 | +118.74 | +129.76 | +140.48 | +150.90 | +161.05 |
| 260 | +98.14 | +109.74 | +121.00 | +131.92 | +142.54 | +152.87 | +162.93 |
| 270 | +100.60 | 112.10 | +123.25 | +134.08 | +144.61 | +154.84 | +164.81 |
| 280 | +103.05 | +114.44 | +125.75 | +136.24 | +146.67 | +156.84 | +166.69 |
| 290 | +105.50 | +116.79 | +127.75 | +138.39 | +148.73 | +158.78 | +168.57 |
| 300 | +107.4 | +119.13 | +130.00 | +140.54 | +150.79 | +160.75 | +170.45 |

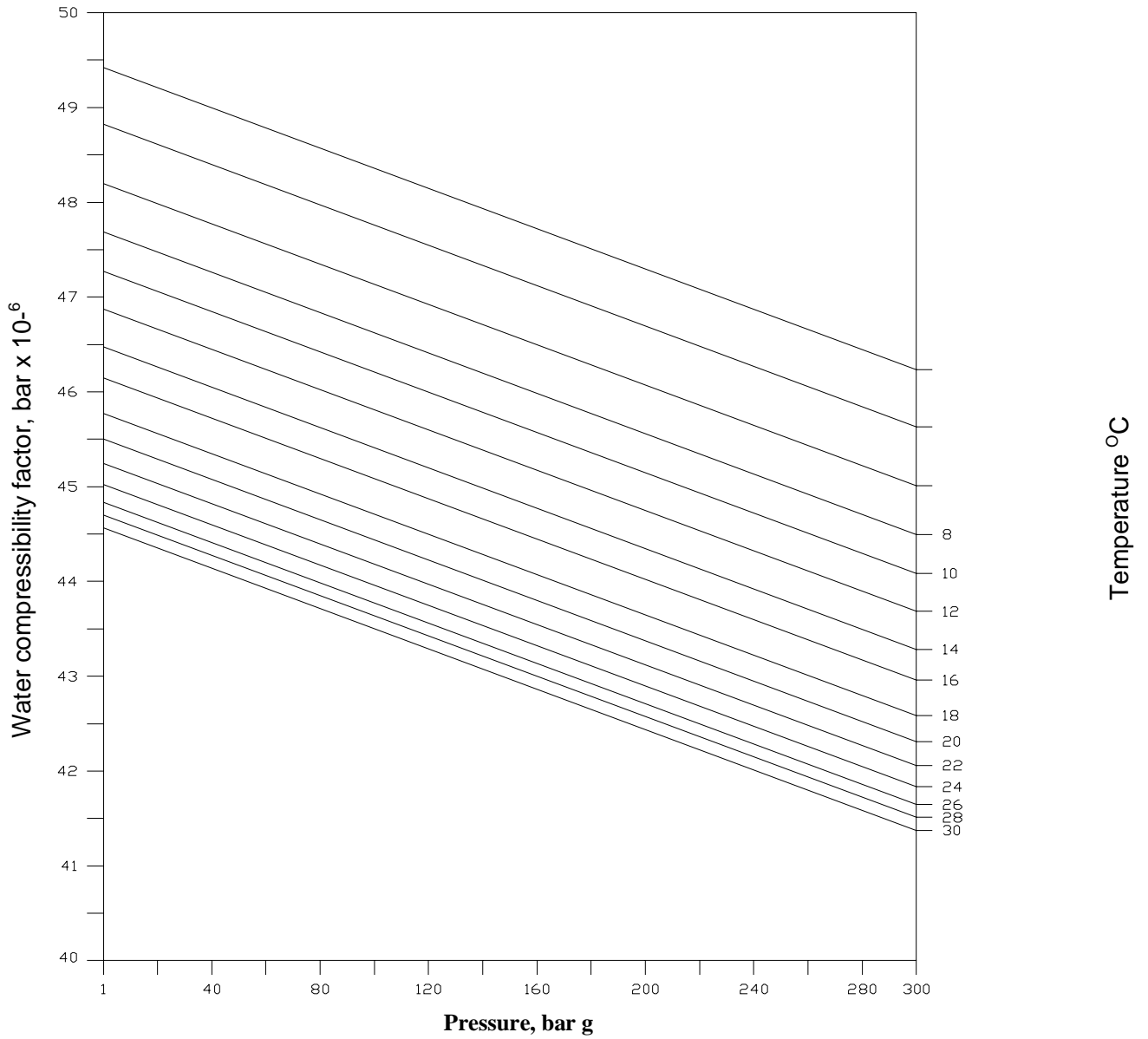
| °C bar | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|-----------|---------|---------|---------|---------|---------|---------|---------|---------|
| .981 | +127.52 | +139.41 | +151.00 | 162.31 | +173.37 | +184.18 | +194.75 | +205.08 |
| 10 | +129.02 | +140.83 | +152.36 | +163.58 | +174.56 | +185.30 | +195.79 | +206.07 |
| 20 | +130.71 | +142.42 | +153.85 | +165.00 | +175.90 | +186.55 | +196.96 | +207.07 |
| 30 | +132.40 | +144.02 | +155.35 | +166.42 | +177.23 | +187.80 | +198.14 | +208.26 |
| 40 | +134.10 | +145.62 | +156.87 | +167.85 | +178.58 | +189.07 | +199.33 | +209.37 |
| 50 | +135.80 | +147.24 | +158.39 | +169.29 | +179.93 | +190.34 | +200.52 | +210.49 |

| | | | | | | | | |
|-----|---------|---------|---------|---------|---------|---------|---------|---------|
| 60 | +137.51 | +148.86 | +159.92 | +170.73 | +181.29 | +191.62 | +201.72 | +211.61 |
| 70 | +139.22 | +150.49 | +161.46 | +172.64 | +182.66 | +192.91 | +202.93 | +212.74 |
| 80 | +140.95 | +152.11 | +163.00 | +173.64 | +184.03 | +194.20 | +204.14 | +213.88 |
| 90 | +142.67 | +153.75 | +164.56 | +175.10 | +185.41 | +195.50 | +205.36 | +215.03 |
| 100 | +144.42 | +155.40 | +166.11 | +176.58 | +186.80 | +196.80 | +206.59 | +216.17 |
| 110 | +146.15 | +157.04 | +167.66 | +178.05 | +188.20 | +198.12 | +207.82 | +217.33 |
| 120 | +147.90 | +158.70 | +169.24 | +179.54 | +189.59 | +199.44 | +209.06 | +218.49 |
| 130 | +149.65 | +160.36 | +170.81 | +181.02 | +191.00 | +200.75 | +210.31 | +219.66 |
| 140 | +151.40 | +162.03 | +172.39 | +182.51 | +192.41 | +202.09 | +211.56 | +220.84 |
| 150 | +153.16 | +163.70 | +173.98 | +184.00 | +193.82 | +203.42 | +212.81 | +222.02 |
| 160 | +154.93 | +165.37 | +175.56 | +185.51 | 195.24 | +204.76 | +214.08 | +223.20 |
| 170 | +156.69 | +167.05 | +177.15 | +187.02 | +196.66 | +206.10 | +215.34 | +224.39 |
| 180 | +158.47 | +168.73 | +178.75 | +188.53 | +198.09 | +207.45 | +216.61 | +225.58 |
| 190 | +160.24 | 170.42 | +180.35 | 190.05 | +199.52 | +208.80 | +217.89 | +226.79 |
| 200 | +162.01 | 172.10 | +181.95 | +191.57 | +200.97 | +210.16 | +219.17 | +227.99 |
| 210 | +163.80 | 173.80 | +183.55 | +193.09 | +202.40 | +211.53 | 220.46 | 229.20 |
| 220 | +165.58 | +175.49 | +185.16 | +194.62 | +203.85 | +212.89 | +221.74 | +230.41 |
| 230 | +167.36 | +177.19 | +186.78 | +196.14 | +205.30 | +214.26 | +223.04 | +231.63 |
| 240 | +169.16 | +178.89 | +188.39 | +197.68 | +206.75 | +215.63 | +224.33 | +232.85 |
| 250 | +170.94 | +180.59 | +190.01 | +199.21 | +208.20 | +217.00 | +225.63 | +234.08 |
| 260 | +172.73 | +182.30 | +191.63 | +200.75 | +209.66 | +218.40 | +226.93 | +235.31 |
| 270 | +174.53 | +184.00 | +193.25 | +202.29 | +211.12 | +219.77 | +228.24 | +236.54 |
| 280 | +176.32 | +185.70 | +194.88 | +203.83 | +212.59 | +221.16 | +229.55 | +237.77 |
| 290 | +178.11 | +187.42 | +196.50 | +205.37 | +214.05 | +222.54 | +230.89 | +239.01 |
| 300 | +179.90 | +189.13 | +198.13 | +206.92 | +215.51 | +223.93 | +223.18 | +240.26 |

| °C bar | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|-----------|---------|---------|---------|---------|---------|---------|---------|
| .981 | +215.22 | +215.14 | +234.88 | +244.41 | +253.79 | +263.00 | +272.03 |
| 10 | +216.13 | +225.99 | +235.66 | +245.13 | +254.44 | +264.59 | +272.57 |
| 20 | +217.15 | +226.94 | +236.53 | +246.75 | +255.18 | +264.27 | +273.18 |
| 30 | +218.18 | +227.88 | +237.41 | +246.75 | +255.69 | +264.95 | +273.80 |
| 40 | +219.21 | +228.85 | +238.30 | +247.58 | +256.69 | +265.64 | 274.42 |
| 50 | +220.25 | +229.82 | +239.20 | +248.40 | +257.45 | +266.33 | +275.07 |
| 60 | +221.30 | +230.79 | +240.11 | +249.24 | +258.22 | +267.04 | +275.70 |
| 70 | +222.35 | +231.78 | +241.02 | +250.08 | +258.99 | +267.75 | +276.35 |
| 80 | +223.43 | +232.77 | +241.94 | +250.93 | +259.78 | +268.47 | +277.01 |
| 90 | +224.48 | +233.77 | +242.87 | +251.79 | +260.57 | +269.19 | +277.66 |
| 100 | +225.56 | +234.76 | +243.79 | +252.66 | +261.36 | +269.92 | +278.33 |
| 110 | +226.64 | +235.78 | +244.73 | +253.53 | +262.17 | +270.77 | +279.01 |
| 120 | +227.73 | +236.79 | +245.68 | +254.40 | +262.98 | +271.41 | +279.69 |
| 130 | +228.82 | +237.81 | +246.63 | +255.28 | +263.62 | +272.16 | +280.38 |
| 140 | +229.92 | +238.84 | +247.59 | +256.18 | +264.62 | +272.92 | +281.08 |
| 150 | +231.03 | +239.87 | +248.55 | +257.07 | +265.44 | +273.69 | +281.78 |
| 160 | +232.14 | +240.91 | +249.52 | +257.97 | +266.28 | +274.46 | +282.49 |
| 170 | +233.26 | +241.96 | +250.49 | +258.88 | +267.12 | +275.23 | +283.20 |
| 180 | +234.38 | +243.01 | +251.47 | +259.79 | +267.97 | +276.01 | +283.20 |
| 190 | +235.51 | +244.06 | +252.46 | +260.71 | +268.82 | +276.80 | +284.64 |
| 200 | +236.64 | +245.12 | +253.45 | +261.63 | +269.67 | +277.59 | +285.37 |
| 210 | +237.77 | +246.18 | +254.45 | +262.50 | +270.54 | +278.39 | +286.11 |
| 220 | +238.91 | +247.26 | +255.45 | +263.49 | +271.40 | +279.19 | +286.85 |
| 230 | +240.06 | +248.33 | +256.46 | +264.43 | +272.28 | +280.00 | +287.59 |

| | | | | | | | |
|-----|---------|---------|---------|---------|---------|---------|---------|
| 240 | +241.21 | +249.41 | +257.46 | +265.37 | +273.16 | +280.82 | +288.35 |
| 250 | +242.36 | +250.49 | +258.48 | +266.31 | +274.04 | +281.63 | +289.11 |
| 260 | +243.52 | +251.58 | +259.49 | +267.27 | +274.92 | +282.46 | +289.86 |
| 270 | +244.68 | +252.66 | +260.52 | +268.23 | +275.82 | +283.29 | +290.64 |
| 280 | +245.84 | +253.76 | +261.54 | +269.18 | +276.71 | +284.12 | +291.40 |
| 290 | +247.01 | +254.86 | +262.57 | +270.15 | +277.61 | +284.95 | +292.18 |
| 300 | +248.18 | +255.96 | +263.60 | +271.11 | +278.51 | +285.79 | +292.95 |

WATER COMPRESSIBILITY FACTOR VS. PRESSURE AND TEMPERATURE



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CENTRAL U.P. GAS LIMITED (CUGL)

**LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN
BAREILLY, KANPUR & UNNAO AND JHANSI GAS**

PTS - HORIZONTAL DIRECTIONAL DRILLING

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1.0 DEFINITIONS AND INTERPRETATION

1.1 PTS shall be read in conjunction with the General and Special Conditions of Contract, General Technical Specifications (GTS) of work, drawings, SOR and other document forming part of the contract wherever the context so requires.

1.2 Where any portion of the General Technical Specifications is repugnant or variance with any provisions of the particular technical specifications, unless a different intention appears, the provision (s) of particular technical specification shall be deemed to govern the provision(s) of General Technical Specifications of contract. If there is no variance or repugnance between General Technical and Particular Technical Specifications both clauses shall be applicable.

1.3 In case of conflict between the requirements of this specification and that of the above referred codes, standards, and specifications, the requirements of this specification shall govern.

1.4 Definition of Terms

The terms used in the technical document must be understood as follows

- “Additional Works” : are works that are not part of the Agreement but that appear to be necessary during the execution of the Agreement. These works can only be executed at the demand of the Owner
- “Approval” : means written approval.
- “Approved Supervisory Body” or “Recognised Inspection Organisation” or “Third Party Inspection Agency” : is the Supervisory Body appointed by Project Management Consultant (PMC) which is qualified to enforce the safety and security measures to be taken when establishing and operating installations for the transport of gas by pipeline. Hereinafter referred to as the Supervisory Body or Recognised Inspection Organisation or Third-Party Inspection Agency.
- “Construction Site/Building Site” : is the area where the works are to be undertaken by the Contractor in accordance with the Agreement.
- “Contract Boundary”, abbreviated as C.B. : is the geographical definition of the area where the activity boundaries of two undertakings in relation to each other are situated. This is the point where the connection work takes place in order for the installation to form a single unit if its execution is entrusted to two or more Contractors.
- “Consultant” : The engineer company (PMC) appointed by the Owner for the project.
- “Contractor” : the natural person or legal entity with whom the Owner has concluded the Agreement.
- “Days” : They are the number of days stipulated in the Agreement. They are calendar days and not workdays, unless explicitly specified otherwise.
- “Defective Joint” : is each weld that has been declared by the Approved Supervisory Body to be unacceptable and has to be repaired by welding.
- “Equipment” : means all apparatus, tools and appliances of any kind whatsoever that are necessary for the construction, execution and maintenance of the Works specified in the Agreement.
- “Engineer” : designate the individual or legal entity to which the Owner has entrusted various tasks in relations with the carrying out of his

- project.
- “Lump Sum” : is an overall fixed price that considers all foreseeable visible and latent obstacles, even if not reported by the Owner, whereby the Contractor will act as a responsible professional in accordance with the codes of good practice, including but not restricted to domestic connections for gas, water, effluent, electricity and telephone, street drainage points, anchor walls, etc.
 - “Goods and/or Services” : are, depending on the specific case, all or part of the Construction materials, materials, equipment, constructions, appliances, tools, machines, works, etc. that are to be built, assembled, adapted or brought into operation by the Contractor pursuant to the Agreement, including all studies, performances, works and services specified within the Agreement. The terms Goods or Services can be used interchangeably according to the context.
 - “HDD” : Horizontal Directional Drilling
 - “Material” : Means the materials or any other supplies that are intended to be part of or integral to the Works.
 - “Over-Depth” : is the difference between the actual depth of the upper generatrix of the pipeline or installation upon laying and the planned minimum depth as stipulated in the Agreement, if this difference is greater than 50 cm.
 - “Owner” : is the principal requesting the works to which the Agreement relates. The representatives of the Owner, who act on behalf of the latter vis-à-vis the Contractor, are declared in the organisational chart of the Works.
- 1) “Pre-Commissioning” : It includes mechanical resistance test, tightness/leak test, cleaning, pre-drying activity and final acceptance dossier and all other related activities.
- “Unit Price” : is the Fixed Price per unit
 - “Works” : are either the execution or having executed together with the design of works that complies with the requirements specified by the Owner. The work is the result of all the construction activities intended to have an economic or a technical function as such.

2.0 PROJECT DESCRIPTION

Central U.P. Gas Limited (CUGL) is planning to lay the main pipeline of 6” and 4” to connect various Tap-off to CNG/RO/DRS Stations. Details are described in SOR

The present work envisages Construction of pipeline through HDD method across major crossings and others crossing which come in light at the time of laying. All other related works in conjunction with SOR, scope of work, GTS, drawings/documents etc required to complete the project in stipulated time frame.

3.0 PROJECT GENERAL

PREAMBLE: -

While analysing the cost of the SOR (as per tender documents), the Contractor should take into consideration the following: -

The width, depth, nature of crossings/obstacles may differ from the one reported on alignment sheet and/or crossing drawings.

Based on the above, the Contractor shall determine the exact number, characteristics, depth, width, nature of crossing/obstacles, etc. based on site visit or any other evidences or materials he may have.

At time of formulating his bid, the Contractor should take into account all such variations and must include it in the relevant price schedule. He will not be entitled for any compensation or raise extra cost for discrepancies between what has been reported in PTS.

3.1 Work Description

Pipeline shall be laid through HDD method for crossings as instructed by owner / owner's representative.

4.0 SURVEY OF TRENCHLESS LOCATIONS

4.1 CONTRACTOR shall carry out survey of trenchless location which comprises of topographical/bathymetric, hydrological surveys, geotechnical investigations like bore log details at his owncost for execution of works if required.

4.2 OWNER does not assume any responsibility with regard to the correctness of the data furnished in the Bid Document. It shall be the responsibility of the CONTRACTOR to verify/establish the correctness and utility of this data to the extent required by him. Also, it shall be the responsibility of the CONTRACTOR to collect/generate any/all data required by him.

5.0 DESIGN & OPERATING CONDITIONS

The Design and Operating conditions for the Pipeline crossings are as below:

| | |
|----------------------------|--------------------------|
| Maximum Operation Pressure | 35 Barg |
| Design Pressure | 49 Barg |
| Design Temperature | 60 ⁰ C (Max.) |
| | 0 ⁰ C (Min.) |

6.0 RIGHT OF USE (ROU)

6.1 The ROU will be arranged by the contractor. Contractor shall carry out all necessary survey work as per requirements of site conditions. It will be the responsibility of the Contractor to maintain the ROU until completion of the work

6.2 In case of encroachment on the ROU or extra land needed during construction, it will be the sole responsibility of the Contractor to relocate all issues (including any compensation) with the relevant land Owner, tenant or authorities. All related cost will be borne by the Contractor.

7.0 STATUTORY PERMISSIONS

Owner shall apply for permission for laying of pipeline however obtaining the permission from the statutory authorities, obtaining work permits/ NOC from various statutory authorities having jurisdiction before execution of the works and complying with all stipulations / conditions / recommendations of the said authorities and necessary day to day clearances, approvals from all concerned authorities in respect of pipeline and all related work shall be responsibility of contractor and cost of same shall be deemed to have included in quoted prices. On behalf of the Owner, Contractor shall co-ordinate with the relevant authorities along with the copy of required pipeline route drawings / certificates complete in all respect shall be prepared and submitted by the Contractor well ahead of time so that the actual construction of the work is not delayed for want of the approval / inspection / permission by concerned authorities. The inspection of work by authorities shall be arranged by Contractor and necessary co-ordination and liaison work in this respect shall be the responsibility of the Contractor. However, statutory fees / restoration charges, if any, shall be paid by Owner on production of documentary evidence.

Any change / addition required to be made to meet the requirements of the statutory authorities shall be carried out by the Contractor without any extra cost to OWNER. The inspection and acceptance of the work by statutory authorities shall however, not absolve the Contractor from any of his responsibilities under this contract.

8.0 PRIORITIES

8.1 Owner may, at its sole option, assign priority of construction to any section or to any part/segment of the WORK. Contractor shall comply with such priority of execution without any time and cost implication to the Owner. Design and drawings of every HDD location shall be checked and approved by EIC and Consultant well before commencement of the Work.

9.0 PROTECTION OF UNDERGROUND UTILITIES AND SPECIAL METHODS

CONTRACTOR shall obtain plans and full details of all existing and planned underground services from the relevant local authorities and be responsible for location and protection of the same. The CONTRACTOR shall fully co-ordinate with all local and related statutory bodies for clearances and permissions.

Where the pipeline crosses other underground utilities/structures, CONTRACTOR shall first give a written intimation to concern utility agencies on behalf of Owner and there after manual excavation to a desired depth to locate the utilities/structures.

The CONTRACTOR, at his own cost shall design and provide any temporary supports such as under pinning or any other type and other protective devices as necessary to keep the interfering structure intact.

In case, any damage to structure/utility etc. occur despite all precautions, CONTRACTOR shall inform to Owner/ Authority/Utility agency regarding the damage and repair shall forthwith be carried out by the CONTRACTOR at his expense under the direction and to the satisfaction of OWNER and the concerned Authority/Utility agency. If CONTRACTOR fails to repair in reasonable time, Owner reserves the right to have the repair executed at the cost of the CONTRACTOR. Any demand against the damaged utility from the authority/ Utility agency to Owner shall be recovered from the contractor.

In case the pipeline crosses other utilities, viz., other pipelines, sewers, drain pipes, water mains, telephone conduits and other underground structures, the pipeline shall be installed with at least 50 cm free clearance from the obstacle or as specified in the drawings or such greater minimum distances as may be required by authorities having jurisdiction. Also, in all cases, the minimum covers shall be maintained as specified in the technical specification.

Whenever any utility/facility, etc. is encountered within the length of the pipeline to be installed by drilling, such utility/facility crossing shall be executed as part of the HDD crossing works at no extra cost/time to OWNER. Qualified length of HDD shall be specified for Payment purpose and approved by EIC/Consultant.

10.0 OWNER'S OBLIGATION

General permission for laying of pipeline through HDD method.

11.0 OBLIGATIONS OF CONTRACTOR

Prior to quoting prices, Bidder shall be deemed to have satisfied himself regarding the feasibility of the method of construction for crossings. Any problems encountered at the time of construction due to any reason whatsoever shall be to CONTRACTOR's account, and CONTRACTOR shall not be entitled for any compensation or extension of time for this reason.

CONTRACTOR shall be paid as per the schedule of rates set forth in the bid document for completed crossing only.

12.0 FREE ISSUE SUPPLY BY OWNER

OWNER will supply only that material which is specified in Cl. 3.1 of PTS – Construction Gas Pipeline (P.014714 G 11077 M001) to Contractor as free Issue except for line pipe Unloading, Receipt, handling, storage, erection and Commissioning of such ‘Free Issue’ material are in the Contractor’s Scope of Work. Contactor shall be responsible for any demurrage payable to the transporters for any delay in unloading and any damage during storage and handling.

13.0 INSURANCE

As per GCC and SCC of Commercial Volume – IA of II.

Unless specifically excluded in the Bidding Documents all insurance cover required during the construction, pre-commissioning and testing period shall be on account of the Bidder. The insurance shall cover all material in transit for construction, all work in progress, and completion of project, third-party liability, workmen compensation, and all statutory insurance covers. The Owner shall be the beneficiary of insurance Policies and nominated as Loss Payee.

14.0 PROJECT COMPLETION SCHEDULE

The Contractor shall ensure that the entire work shall be completed within a period that is specified in commercial volume IA of II or purchaser’s order letter of Intent, unless such schedule has been revised in accordance with the provisions of the Contract. In addition to this, contractor shall close out the project as defined below: -

The Contractor shall submit a detailed Project Plan within the time-frame specified in the Letter of Intent.

15.0 DISCLAIMER

As such it is an item rate contract, but the length of the pipeline / quantities of various items mentioned in the SOR are indicative only. Contractor / Bidder has to verify and confirm the same on its own based on SOR specification, Drawing, sheets and actual site conditions. No extra claim with regard to quantity variation to any extent in pipe laying shall be entertained by Owner. For station works, the indicative quantity shall be given. These must be verified and confirmed before quoting.

16.0 SCOPE OF SERVICES OF THE PMC

OWNER appointed PMC shall be responsible for the followings,

- Basic Engineering
- RFP preparations
- PMC services
- Construction supervision.

17.0 EXECUTION

17.1 Minimum pipeline cover outside the river bed within the river limits shall be minimum 1.5 Mt.

17.2 OWNER has established the minimum scour depth profile for the river crossings, and the same is indicated in the reference drawings included in the bid package. Cover to top of pipe and cable conduit shall be minimum 2.5 metres below the scour level at any point within the bed of the river crossings.

BIDDER shall note that to achieve this minimum requirement of cover, CONTRACTOR may have to actually install the pipe and cable conduit by drilling at greater depths at some locations below the river bed and banks. CONTRACTOR shall be deemed to have taken cognizance of such deeper drilling as may be necessary while formulating his bid and no extra compensation shall be admissible on this account.

17.3 Depending upon width of crossing, minimum requirements of cover, and limitations of CONTRACTOR’s equipment, CONTRACTOR may have to actually drill a larger length of pipeline for the crossings than shown in the Reference Drawings. CONTRACTOR shall be deemed to have taken cognizance of all such

additional drilling lengths as may be necessary while formulating his bid, and the lump sum price quoted by him for crossings shall remain valid irrespective of the actual length of pipeline installed.

17.4 CONTRACTOR shall ensure that his construction activities shall not cause inconvenience to public nor shall there be any undue interference with the normal use of the land and watercourses. Minimum necessary trees on the ROU to be felled shall be identified, recorded and records handed over to OWNER. No additional trees shall be allowed to be cut by CONTRACTOR or his sub-contractors for whom CONTRACTOR shall be solely responsible.

17.5 CONTRACTOR shall make all arrangements for access to his work site at his own cost and responsibility.

17.6 For crossing, the entire drilled crossing shall be accomplished in a single drilling operation.

18.0 BENDING

18.1 After pulling the pipeline across the drilled crossing, CONTRACTOR shall cut the extended portion of the pipeline at the entry and exit points. Thereafter, the drilled portion of the pipeline shall be cut at suitable location/depth and extended on either bank by installing a cold field bend with minimum bend radius of 40 times the pipe O.D. and a straight pipe of sufficient length, such that at the ends the top of the pipeline is minimum 1.2 m below the natural ground level.

19.0 OPTICAL FIBRE CABLE

Two HDPE duct for OFC cable (one spare) shall be placed during laying of HDPE duct for OFC cable by HDD method and one nos. HDPE duct for OFC cable shall be placed during laying of HDPE duct for OFC cable by moling method. [General characteristics of the HDPE pipe are enclosed]. Contractor shall be responsible for damage free pulling of the HDPE duct. If required, contractor may also provide steel casing for safe pulling of the HDPE duct without any cost.

Wherever HDPE duct shall be inserted into MS Conduit, either separate HDD for MS conduit or Bundle pulling shall be done according to BOQ.

20.0 PRIOR TO CONSTRUCTION

Prior to construction, CONTRACTOR shall submit a detailed methodology statement for OWNER's approval for installation of pipeline and cable conduit including, but not limited to the following:

- Suggested diameter of reamed holes to facilitate smooth pulling operation.
- Methodology for bundling pipeline and cable conduit together. (If proposed).
- Minimum distance between entry points for pipeline and cable conduit and suggested methodology to ensure that clear distance between pipeline and cable conduit in as installed condition is 5.0 m.
- Method of pulling pipeline and cable conduit together in a bundle or separately, as applicable.
- Method of preventing the pipeline from rotating during pull-in, to ensure that cable conduit is not damaged during pulling operation, when CONTRACTOR proposes to install pipeline and cable conduit together.
- Method of inspection of cable conduit after installation.
- Method of blowing optical fibre cable.

Installation shall be carried out strictly in accordance with approved procedures.

21.0 SCOPE OF WORK

GENERAL

The Contractor's Scope of Work shall consist, but not limited to the following. However, all such works, which are not indicated here below but are otherwise required to complete the WORK in all respects shall form part of Contractor's Scope of Work. Further, the scope indicated below shall be read in conjunction with the schedule of rates, specifications. Contractor shall determine the exact number, characteristics,

depth, width, nature of crossing/obstacles, etc. based on site visit or any other evidences or materials he may have etc. It is understood that for the below mentioned Scope of Work all the relevant equipment / machineries, testing instruments of work and manpower shall be supplied by contractor, except otherwise specified.

In order for the tender to be valid, the bidder must forward to Owner at least the following documents, correctly, completely filled in and clearly legible:

- 21.1** Site survey and the finalization of exact length of pipeline / quantities of various items, location of exit entry point, depth etc.
- 21.2** A detailed methodology of the works drawn up on the basis of the start and end dates for the works as stipulated in the special condition of contract (SCC). The various phases of the work must be included in this programme in so far as they are applicable to the works also Preparation of detailed project schedule in MS project or equivalent.
- 21.3** Expediting and Monitoring of all procurement and construction activities with approved vendors / sub-contractors.
- 21.4** An explanatory note must be attached describing the organisation of the Construction Site as well as the methods and phases of execution, the complete inspection plan that the Bidder intends to follow, the qualitative and quantitative description of the means of execution, the installations, the equipment, the material, the tools and the personnel that he has to employ in each phase in order to complete the Works within the planned schedule.
- 21.5** The Contractor must draw up working methodologies including equipment, manpower and material needed for all phases of the construction of the pipeline through HDD method.
- 21.6** All working methodology must get approved by the Owner/Owner representative before starting work.
- 21.7** Only approved working methodology will be implemented at site during all construction stages.
- 21.8** The Contractor shall deploy all equipment and material required to achieve the work as per his detailed methodology and agreed schedule.
- 21.9** If deemed necessary as per the working methodology and/or at the request of Owner, Contractor must deploy extra equipment without being entitled to raise any compensation.
- 21.10** The Bidder must provide a detailed organisational chart (including key personnel qualification) indicating the organisation or personnel and equipment for each phase of the Works along with their responsibilities.

The site organisation shall include following managers:

| Sl. No. | Position | Nature of Experience | Years of Experience | No. of personnel (minimum) |
|---------|----------------------|---|---------------------|----------------------------|
| 1 | Construction Manager | Construction of Cross country pipeline (hydro-carbon pipeline) including HDD for the same | 15 | 1 |
| 2 | SHE Manager | Safety Management in construction of cross country pipeline (hydro-carbon pipeline) including HDD for the same | 5 | 1 |
| 3 | QA | Quality / NDT Management in construction of cross country pipeline (hydro-carbon pipeline) including HDD for the same | 5 | 1 |

- 21.11** Radiography & Manual UT at welding joints are in HDD contractor scope of work. It shall be done through another agency. However, HDD contractor shall coordinate / assist to the agency to perform radiography & manual UT test.

22.0 MAIN ACTIVITIES

The Contractor's Scope of Work shall consist, but not limited to the following. However, all such works, which are not indicated here below but are otherwise required to complete the WORK in all respects shall form part of Contractor's Scope of Work. Further, the scope indicated below shall be read in conjunction with the schedule of rates, specifications. Contractor shall determine the exact number, characteristics, depth, width, nature of crossing/obstacles, etc. based on site visit or any other evidences or materials he may have etc. It is understood that for the below mentioned Scope of Work all the relevant equipment / machineries, testing instruments of work and manpower shall be supplied by contractor, except otherwise specified.

- 22.1 Construction & maintenance and dismantling of the site camp, site offices for Contractor's workshops etc.
- 22.2 To develop access from nearest road to entry exit location for mobilization of machinery, manpower, tools, tackles consumables etc.
- 22.3 Marking out and clearing out of the ROU.
- 22.4 During ROU clearing, the vegetation shall be cut off at ground level leaving the roots intact. Only stumps and roots directly over the trench shall be removed for pipeline installation.
- 22.5 Contractor shall carry out all necessary survey work as per requirements of site conditions. It will be the responsibility of the Contractor to maintain the ROU until completion of the work.
- 22.6 In case of encroachment on the ROU or extra land needed during construction, it will be the sole responsibility of the Contractor to relocate all issues (including any compensation) with the relevant land Owner, tenant or authorities. All related cost will be borne by the Contractor.
- 22.7 Hydrographical survey of river bed shall be carried out up to 100 m on either side of pipeline at 25 m centre to centre. The dry bed shall be surveyed up to 200 m away from existing bank and 200 m on either side of pipeline at 25 m centre to centre. For geotechnical survey at least 2 boreholes shall be carried out in river bed where bank width is less than 100 m, where bank width is wider than 100 m boreholes at 100 m centre to centre distance shall be carried out. On river bank at least 2 boreholes shall be carried out 1 on either side. Boreholes shall at least be carried out 5 m below the level where pipeline is proposed to be laid.
- 22.8 All works for HDD crossing related to material handling, stringing of pipes, trenching, welding, inspection of welds, coating, earthworks, lowering-in and ballasting, site restoration, etc.
- 22.9 The Contractor shall also carry out the testing, cleaning, swabbing, pigging, gauging, hydrostatic testing, dewatering and pre-drying of the pipeline (Pre-commissioning activities).
- 22.10 Assistance to other Contractor during Commissioning.
- 22.11 To install all field joint coating by heat shrinkable sleeves (Dirax) & laying of HDPE duct along the pipeline & blowing of OFC cable.
- 22.12 The Contractor shall lay, test, clean and dry the pipeline laid through HDD method before connecting to the main pipeline. Tie – in for HDD shall be done by the Contractor.
- 22.13 All activities related to liaison, co-ordination etc. with authorities needed to achieve the work as per schedule will be under Contractor's scope.
- 22.14 The Contractor will assure the interface and the coordination of his approved sub-Contractors and also other Contractors who may be working on different packages like TCP/PCP works, SCADA work, Telecom work, etc.
- 22.15 The Contractor will also submit as built documents/drawings, material reconciliation, pipe-books, project records and photographs as per specifications and instructions of OWNER/OWNER's REPRESENTATIVE
- 22.16 Carrying out all engineering design calculations (such as, but not limited to, HDD profile calculation, stress calculations, string preparation details with roller spacings, RIG pulling capacity requirement, Mud engineering details etc) and preparation of all construction drawings and engineering for construction, as per requirements of CONTRACT document for carrying out crossings of pipeline and OFC by horizontal directional drilling (HDD) method. Obtaining approvals from the Owner/Owner's representative of the above drawings and design packages before execution.

- 22.17 Supply including procurement, inspection, expediting, port clearance, transportation to site of all equipment/machines, materials and consumables to be supplied by CONTRACTOR as per “Scope of Supply”, and of all construction, testing, survey and communication equipment etc. required for the installation of the crossings.
- 22.18 Preparation of procedures/work instructions/ execution methodology/ tracking method/ quality records and obtaining approval of the same from the Owner.
- 22.19 All additional topographic surveys, geo-tech/hydrological and any other soil surveys required for execution and as indicated in the drawings including preparation of plan and profile drawings as directed by OWNER’s REPRESENTATIVE.
- 22.20 **Construction:** Stringing, aligning, bending, field welding, NDT including radiography, joint coating, protective coating and installation of insulating joints with extension pipe pieces on both sides of the crossing.
- 22.21 **Restoration:** Backfilling, clean-up and restoration of right-of-way and obtaining certification from concerned parties as per specifications and instructions of Owner/Owner’s Representative.
- 22.22 Making pipeline and optical fibre cable conduit bundle as per design approved by OWNER (if applicable).
- 22.23 Installation and testing of pipeline and cable conduit (together in a single drilled hole or separately by two independent drilling operations as per approved design packages).
- 22.24 Port testing of the crossing section.
- 22.25 Temporary Cathodic protection works on the buried crossing section.
- 22.26 CONTRACTOR shall dispose all surplus soil and bentonite slurry at locations duly approved by authorities having jurisdiction and/or as instructed by OWNER and prices quoted by CONTRACTOR shall be inclusive of all such works.
- 22.27 Any other work not specifically listed herein but required for the supply, installation and completion of the pipeline work crossings as per the requirements of this CONTRACT Document.

23.0 OTHER ACTIVITIES

- 23.1 Tie-in for HDD shall be done by HDD Contractor or laying Contractor whoever finishes work at the respective point later.

24.0 SCOPE OF SUPPLY

24.1 Materials to be supplied by Contractor

The procurement and supply, in sequence and at the appropriate time, of all materials and consumables required for completion of the WORK as defined in this contract shall be entirely the Contractor’s responsibility and rates quoted for the execution of the contract shall be inclusive of supply of all these materials.

- o Procurement and supply of components, consumables etc required for temporary and permanent installation and for completion of pipeline system.
- o Vendor’s Purchase Order, Purchase Specification, Design, Drawing and Data Sheets for review and approval of Owner / Owner’s representative.
- o Supply of all material for completion of work as per scope of work except free issue supply by Owner.
- o Ensuring adequate quality assurance and control including stage wise inspection, testing and certification.
- o Documentation and traceability of shop inspection and Acceptance Certificate by Third Party against supply items.

The materials to be supplied are, but not limited to the following:

- i) All materials, equipment, trailers for transportation, loading, unloading, stringing etc.
- ii) All welding machines, lifting equipment, instruments, transporting vehicles and consumables for welding such as oxygen, acetylene, inert gases and all types of electrodes, filler wire, solder wire, brazing rods, flux etc. for welding/cutting and soldering purpose.
- iii) All materials, equipment and instruments required for all types of tests such as radiography, ultrasonic testing, magnetic particle and dye penetrant examination.
- iv) All materials, equipment, instruments and consumables including primer calibrated pump required for external corrosion coating and concrete coating (where required) of field weld joints. All joint coating sleeves, other accessories related to field joint coating.
- v) All materials, equipment, instruments and consumables required for repair of damaged corrosion coating of line pipe.
- vi) All materials, consumables and equipment related to blasting of rock for excavating trench or grading the Right-Of-Way if applicable.
- vii) All equipment for excavation.
- viii) Corrosion inhibitor for water used for hydrostatic testing, including water for testing.
- ix) All pigs for cleaning, gauging, filling, dewatering and swabbing of the pipeline.
- x) All equipment, pumps, instruments, pipes, fittings and equipment, metallic blinds, temporary gaskets as required for filling, pressurizing and dewatering for hydrostatic testing, including pipe headers for air pigging and hydrotesting etc.
- xi) All materials, equipment, instruments for lowering and back filling of pipeline sections including supply of warning mats and nets.
- xii) All equipment for restoration.
- xiii) All material for fencing.
- xiv) All safety tools/tackles/devices/apparatus/ equipment, etc. including ladders and scaffolding as required.
- xv) All materials for corrosion protection of buried IJ (if installed).
- xvi) All jointing materials / consumables for the above.
- xvii) All equipment, materials and consumables for HDD.
- xviii) All other materials not specifically listed herein but required for the execution of the WORK.
- xix) Lightening Arrestors.
- xx) Line Pipe coating for HDD portion shall be 3 Layer polypropylene.
- xxi) Any other material not mentioned above specifically bur required to complete the work in all aspects to complete HDD work.

25.0 PARTICULAR INSTRUCTIONS

- 25.1** For access route to the working strip the Contractor will be responsible to negotiate with the relevant Owner, tenant or authorities. Any deemed compensation will be borne by the Contractor.
- 25.2** Contractor proponent shall have to take prior approval of concerned Government agencies while carrying out blasting wherever required.
- 25.3** Contractor proponent shall have to preserve topsoil dug and shall be restored to original condition on completion of the work.

- 25.4** Contractor proponent shall have to obtain clearance from the Forest Department for the portion of pipeline passing through reserve forest or any other type of Forest or wildlife sanctuary, national park or other prohibited areas.
- 25.5** For the waste generated from the pigging and any other operation Contractor proponent shall have to provide sludge collection storage and disposal facility complying EPA-1986 with Hazardous Waste Rules 1989.
- 25.6** The applicant shall have to submit the returns in prescribed form regarding water consumption and shall have to make payment of water cess to the Board under the Water Cess Act – 1974.
- 25.7** Contractor shall construct the pipeline and other infrastructure by adopting safety measures as per the standards & specification laid down by the concerned agencies from time to time. All the safety and personnel protection measures shall be properly provided to meet any mishap / hazard / during operation and HDD method.
- 25.8** Contractor proponent is required to comply with the manufacturing, Storage and Import of Hazardous Chemicals Rules-1989 framed under the Environment (Protection) Act-1986.
- 25.9** On completion of all temporary work structures, surplus materials and wastes shall be suitably disposed off.
- 25.10** An Onsite-Offsite Emergency plan shall be prepared & submitted to Disaster Management Authorities under intimation to the state pollution control board.
- 25.11** The contractor shall act as per recommendation of the concerned authorities regarding safety measures and OHSAS-18002.

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CENTRAL U.P. GAS LIMITED (CUGL)

LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS

PTS - QUALITY ASSURANCE / QUALITY CONTROL

| | | | | | |
|-------------|-------------|--------------------|--------------------|-------------------|--------------------|
| | | | | | |
| 0 | 14.04.2021 | Issued for Tender | KK | MKS | NN |
| Rev. | Date | Description | Prepared By | Checked By | Approved By |

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1.0 INTRODUCTION

This document covers and describes the Project Quality Data Requirements and Contractor's other obligations towards Quality Assurance which shall form a part of every Material Requisition (MR)/ Technical Specifications released by Contractor or documents submitted for approval, so as to ensure that all purchased products/ services consistently conform to planned Quality and project's stated and implied needs are met to Owner / Owner's Representative total satisfaction.

The TPIA is engaged for a defined motive to ensure that all quality related requirements during manufacturing are followed as per Owner/Owner's representative specifications and other approved documents. The extent of TPIA involvement as indicated in this document shall be binding on the contractor and no activity shall be accepted if not approved/certified by TPIA.

2.0 SCOPE

The requirements of this document are applicable to all Vendors/Contractors for supply of Packages, Equipments and Materials, which are purchased on behalf of Owner or directly by Contractor.

This document also indicates general quality control requirements for various activities pertaining to Gas Pipeline Projects.

3.0 DEFINITIONS

3.1 "Contractor" shall mean EPC Contractor appointed by Owner for execution of the project.

3.2 "Vendor" shall mean the person(s), firm, and company, organisation from which Contractor procures products/ services.

3.3 "Sub-Contractor", "Sub-Vendor", "Supplier", "Seller", "Agents" are considered synonymous to "Vendor".

3.4 "Third Party Inspection Agency (TPIA)" means the agency other than the in-house quality control department appointed by the Vendor from the list of such approved agencies as indicated in the tender document.

3.5 Certification shall have the meaning as provided by EN 10204 Code and summarised as follow. "The manufacturer's authorised inspection representative independent of the manufacturing department."

3.6 Certification shall have the meaning as provided by EN 10204 Code and summarised as follow. "The manufacturer's authorized inspection representative independent of the manufacturing department and either the purchaser's authorised inspection representative or the inspector designated by the official regulations."

3.7 MR means Material Requisition.

4.0 CERTIFICATION - QUALITY ASSURANCE & QUALITY CONTROL

All material and equipment to be permanently incorporated in the project shall be duly Quality Controlled - Inspected and certified for full compliance with the "Laws - Rules - Codes & Standards" prevailing for the project and as per approved quality assurance plan.

Quality Control, Inspection and Certification shall be as follow:

4.1 Basic Principles

Equipment Vendors must be duly approved, qualified and certified for their ability to supply basic materials and to fabricate the equipment according to the Codes and Specifications.

Sub-Contractors must be duly qualified and certified for their ability to assemble, erect, install, test commission, proceed to Civil Works, etc. as necessary to implement the project

All basic materials and equipment shall be the subject of 3.1. Certification before leaving the mills. The same applies to shop prefabrication or field construction/erection.

In addition, some activities may, as mandatory by Law or at the discretion of Owner/Owner's representative, be audited and/or subjected to 3.2 Certification.

4.2 Quality Plan

Vendor/Contractor shall, on due time, establish and submit to approval of Owner/Owner's representative a comprehensive Quality Assurance Program and Quality Plan stating clearly the organisation it proposes to set-up and the ways it intends to organise the Certifications.

It is responsibility of Vendor/Contractor to set-up any such organisation that is necessary to supervise and control the good execution of the agreed Quality Plan and to procure sub-contractors to achieve the necessary goals.

4.3 Certification Specific to Gas Related Facilities

Notwithstanding any other control-aimed necessary by Vendor/Contractor, Vendor/Contractor shall assure the Certification of its activities or works as well as of any Sub-contractors as follow:

4.3.1 Certification

Document issued by the manufacturer in which he declares that the products supplied are in compliance with the requirements of the order and in which he supplies test results.

The test unit and the tests to be carried out are defined by the product specification, the official regulation and corresponding rules and/or the order.

The document is validated by the manufacturer's authorised inspection representative, independent of the manufacturing department.

It shall be permissible for the manufacturer to transfer on to the inspection certificate 3.1 relevant test results obtained by the specific inspection or primary or incoming products he uses, provided that the manufacturer operates traceability procedure and can provide the corresponding inspection documents required.

4.3.2 Certification

Document prepared by both manufacturers authorized inspection representatives, independent of the manufacturing departments and either the purchaser's authorized inspection representatives or the inspector designated by the official regulations and in which it is declare that the products supplied are in compliance with the requirements of the order and in which test results are supplied.

It shall be permissible for the manufacturer to transfer on to the inspection certificate 3.2 relevant test results obtained by the specific inspection or primary or incoming products he uses, provided that the manufacturer operates traceability procedure and can provide the corresponding inspection documents required.

Owner reserves the right to nominate one or more Third Party Inspection Agency (TPIA) to execute in its name all inspection and Certification it aims necessary or is mandatory by Law.

Owner/Owner's representative may also be nominated to act in name of Owner for the purpose and present for specific items or activities; in that case, "Owner" shall also mean "Owner's representative" in the frame of its "Commitment".

Owner/Owner's representative presence to Certification events and/or final issue of Certificates shall, in no way, reduce the obligation of Vendor/Contractor to proceed to its own 3.1. Certification or release Vendor/Contractor from its duties, obligations and liabilities.

Vendor/Contractor shall, in its Quality Assurance Plans (QAP), propose procedures to inform Owner/Owner's representative, on due time, to allow for 3.2 Certification. Events subjected to 3.2 Certification shall be confirmed to Owner/Owner's representative, in advance, according to the Plan and to actual time-schedule.

Too late notification to Owner/Owner's representative and resulting absence of its staff to Certification event shall lead to rejection of the event up to when Owner/Owner's representative will reasonably be able to be present.

For what relates to line pipes, valves, fittings, hot factory made bends and in general piping works, such 3.2 Certification shall at least cover the following:

- a) Audits of the overall Certification of the Vendors/Contractors and their sub-contractors;
- b) Audits of the 3.1. Certification Procedures and Organisation of the Vendor/Contractor, its sub-contractors and Vendors and sub-contractors/Vendors thereof;
- c) Audits of the 3.1. Certification process, from time to time at Owner/Owner's representative discretion;
- d) Assistance to main acceptance tests for line pipes, valves and main fittings.

As a general rule, 100% of all pipe welds shall be radio graphed with some specific weld to be submitted to ultrasonic testing also as per procedure and requirement of Owner's Representative.

Prior to shop prefabrication and field welding, the welding procedures shall be submitted to Owner/Owner's representative for comments. Vendor/Contractor shall proceed to all necessary Destructive and Non Destructive testing as provided by the codes and/or specifications for all Qualification Welds or Joints. The results thereof shall be submitted to Owner/Owner's representative for final approval. In case of rejection by Owner/Owner's representative, Vendor/Contractor shall modify or adapt the proposed procedures and start again the entire process of approval by Owner/Owner's representative.

Each individual welder shall pass welding qualification in presence of Owner/Owner's representative, which may reject the qualification in case of non-conformity.

For shop prefabrication and field welding, Vendor/Contractor shall proceed to all necessary Non Destructive Testing and shall submit their results for Owner/Owner's representative 3.2 Certification.

Field Welds to be Non Destructively Tested in presence of Owner/Owner's representative shall be designated by Owner/Owner's representative; interpretation by Owner/Owner's representative shall be done as soon as reasonably possible; "non rejection" notification of the Weld shall be issued by Owner/Owner's representative as soon as reasonably possible. Such Welds shall not be coated nor backfilled before the issue of this "non rejection" notification.

Direct costs and relating travel expenses of Owner/Owner's representative's staff and/or compensation of the Third Party Inspection Agency appointed by Owner for 3.2 Certification shall be born by Owner for so far the relevant Certification is granted. Should the audited item be found faulty or not confirm, Vendor/Contractor shall remedy with no delay to the default at no cost for Owner/Owner's representative and ask for a new audit. All cost incurred by Owner/Owner's representative for such new audit shall be borne by Vendor/Contractor.

All other costs incurred by Vendor/Contractor or its sub-Vendors or sub-Contractors for the audits or giving the auditor due evidence of conformity shall be borne by Vendor/Contractor.

4.4 Testing

Final acceptance tests (pressure and tightness) of the completed installation shall be performed in presence of Owner/Owner's representative or Third Party Inspection Agency and subjected to 3.2 Certification.

Pipelines shall be divided into sub-sections as necessary.

4.5 Non tested Tie-ins Welds

All tie-ins Welds (called "Golden Welds") which have not been the subject to Pressure Final Testing shall be 100% Radiographic and ultra-sonic controlled (steel Welds) and tightness tested under gas pressure (all Welds/joints) in presence of Owner/Owner's representative or Third Party Inspection Agency and duly 3.2 Certified.

5.0 INSTRUCTIONS

5.1 Third Party Inspection Agency (TPIA) appointed by Contractor.

Vendor shall appoint an independent Third Party Inspection Agency, which shall maintain/review/monitor all Quality of the equipment as per the QAP approved by Owner/Owner's representative.

The Inspection Agency shall be appointed from the approved list of Third Party Inspection agency as indicated in tender documents.

5.2 Quality Assurance Plan

Vendor during bidding stage shall confirm to the compliance to the Quality Assurance Plans (QAP) attached with this document. However, in post order stage they shall submit the detail QAP complying with all the requirements already confirmed by them in pre order stage duly reviewed by the Owner / Owner's Representative.

Other documents such as procedures covering various activities like design and engineering, material procurement, manufacture, inspection and testing, documentation, despatch to site, erection and commissioning where applicable and maintenance of Quality records shall be submitted for the review of Owner/Owner's representative.

Vendor shall submit the above documents duly reviewed within week time from the date of receipt of purchase order indicating the deviations/exceptions if any for approval.

5.3 Inspection & Test Plan

Vendor shall submit Inspection and Test plan for approval within 2 weeks or before to Owner/Owner's representative and obtain their approval before commencement of manufacture duly reviewed by the Owner / Owner's Representative.

5.4 Drawing Schedule

Vendor shall submit a total index of drawings and documents required for review / records based on the Vendor data requirement given in the MR along with the scheduled data of submission of each drawing/document within a week by Telefax/ Letter of Intent duly reviewed by the Owner / Owner's Representative. The drawing schedule shall be specific with regard to drawing/ document number.

5.5 Progress Report and Schedule

Vendor shall submit Fortnightly / Monthly Report and updated procurement, engineering and Manufacturing Schedule every month, beginning within 2 weeks and Telefax/ Letter of intent.

5.6 Waiver & Deviation

Vendor shall strictly comply with Purchase Order stipulations and no deviation shall be permitted. However, if the need for deviation arises under exceptional circumstances, on the post order stage, such deviation shall be subject to the approval of Owner/Owner's representative and shall be submitted through Owner / Owner's representative in the prescribed "WAIVER /DEVIATION /EXCEPTION REQUEST" format. The WAIVER /DEVIATION / EXCEPTION REQUEST shall also indicate the cost benefit to the Owner.

5.7 Procurement of Bought out Materials

All critical materials such as casting, forging, fittings, pressure holding parts, electrical and instrument accessories, etc. shall be purchased by the Vendors from approved Vendors meeting Qualification Criteria stipulated, if any. Vendor shall submit a list of bought out materials and sub-Vendors for these bought out materials for Owner/Owner's representative approval within 2 weeks by Telefax/ Letter of Intent.

5.8 Calibration Records

Vendor shall use only calibrated measuring and test instruments and maintain calibration records. Vendor shall furnish records of calibration of measuring and Test instruments including recalibration records to Third Party Inspection Agency.

5.9 Inspection Test Status

Inspection test status of products shall be identified by using markings, authorised stamps, tags, route cards, inspection records etc. during the course of manufacture to clearly indicate acceptance/rejection of tests/stages of inspection performed during its manufacturing cycle. The identification of inspection and test status shall be maintained and records thereof shall be submitted as and when demanded by Owner/Owner's representative or Third Party Inspection Agency.

5.10 Quality Records

Vendor shall maintain quality records as per his procedures. Inspection Reports & Test Record copies shall be furnished to Owner/Owner's representative duly accepted by the Third Party Inspection Agency.

5.11 Non-Conformity Reports (NCR)

TPIA will issue a NCR on observing any deviation to Owner/Owner's representative technical specifications or approved documents for Owner/Owner's representative approval. On Receipt of NCR, the Vendor/Contractor shall submit a detailed corrective action procedure for Owner/Owner's representative approval, and shall carryout all necessary corrective action so required to the satisfaction of Owner/Owner's representative/TPIA.

5.12 Identification and Traceability

5.12.1 Vendor shall establish and maintain a standard written procedure for identifying the products from applicable drawings, specification or other documents during all stages of production, delivery and installation. A copy of this standard procedure shall be made available to Owner/Owner's representative.

5.12.2 Besides other usual requirements for other equipment, Vendor shall pay due attention towards detailed traceability of all equipments which are subjected to pressurised gas under normal operation. For such equipment, the following shall apply:

- All items of line pipes, pipefitting, valves and equipment to be permanently integrated in the project shall be duly identified such that its origin and history can be traced during the whole life of the project.
- When pipes are cut in piece, each piece shall be duly marked and identified.
- No piece shall be integrated in the project if not duly identified.

- All Welds shall be identified (up-stream and down stream line pipe identification and length) and date and circumstances of execution (including welder identification-results of "Quality Control"-etc.) recorded in adequate log book; identification code shall be indicated on the Weld itself by suitable marking system (stamping is strictly forbidden) before coating; after coating, the same code shall be indicated on the top of the Weld by suitable marking system.
- When line pipes are bent on site, the characteristics of the bend (original line pipe identification number-degree of bending-length of remaining straight sections) shall be duly recorded in the above logbook.
- Logbooks shall be setup under the form of a comprehensive computer Database using Microsoft Access software or similar system.

As Built Survey:

All Welds, bends and fittings/equipment shall be duly topographically surveyed when in final place but before back filling and exact co-ordination added to the Weld logbook as well as on the "As built" drawings.

5.12.3 On job-to-job basis, Vendor shall confirm its validity and only revisions/deviations, if any, shall be submitted for approval. The Vendor shall ensure that each product, which is going in the process of fabrication/manufacture/construction/erection, has proper identification throughout the process including the final output.

The extent of TPIA involvement is indicated in the various quality control sheets attached with this document and also shall be as per final approved QA/QC procedures or as per codes and standards, wherever applicable. For items/construction activities for which, Assurance Plan are not attached, Vendor shall require to submit the Quality Control Sheets and Quality manual and shall obtain Approval of Owners/Owner's representative prior to start of any activity pertaining to supply of material or carrying out construction at site. Owner/Owner's representative shall get the above documents reviewed by the TPIA.

5.13 Contractor Documents for Owner/Owner's Representative's Review/ Records

5.13.1 General

- 1) All Documents shall be in ENGLISH language and unit of working shall be SI system.
- 2) Review of the Contractor drawings by Owner/Owner's representative would be only to review the compatibility with basic design and concepts and in no way absolve the Contractor of his responsibility to comply with Purchase Order requirements, applicable codes, specifications and statutory rules/regulations.
- 3) Unless otherwise agreed, submission of documents for Review/Records shall commence within 4 weeks from the date of Telefax/ Letter of Intent or as per the mutually agreed duration as per the duration of project.
- 4) Unless otherwise agreed, Contractor shall submit all Drawings and Documents in number of copies as stipulated in the Contractor Data Requirement. The Documents shall be supplied in soft copies where specified.
- 5) The Drawing/ Documents shall be checked, approved and duly signed / stamped by Contractor before submission. Revision Number shall be changed during submission of the revised Contractor Documents and all revisions shall be highlighted by clouds. Before submitting any sub-contractor drawings for review by Owner/Owner's representative, the Contractor shall ensure that these sub-Contractor drawings have been reviewed shall not be entertained.

- 6) While resubmitting the Drawings/ Documents, the Contractor shall send in a covering letter, specifically confirm whether all the comments have been incorporated if not, shall furnish reasons with justification.
- 7) Multi-sheet Document other than Drawings shall be submitted in their entirety in the event of a resubmission even if only few sheets are revised.

5.13.2 Documents under Records Category

Documents under this category are meant for Owner/Owner's representative Records. These documents would not be returned to Contractor. However, comments, if any, will be communicated to Contractor.

5.13.3 Final Documentation

Final Drawings/ documents consisting of Technical Data Manual/ Mechanical Catalogue are a compilation of "as built" certified, drawings and data, manufacturing and test records, installation and operating and maintenance instructions shall be submitted to Owner and Owners representative in multiple sets.

6.0 ATTACHMENT (WAIVER / DEVIATION PERMIT)

Waiver / Deviation Permit.

ATTACHMENT

Report No.:

Date:

WAIVER / DEVIATION FORMAT

(TO BE RAISED BY CONTRACTOR / VENDOR)

Project :
Client :
Consultant :
Third Party Insp. Agency :
Order/Contract No :
Contractor :
Originator :

Recommended by Owner (Site):

Date:

Signature:
Name & Seal:

Recommended by TPIA (When required):

Date:

Signature:
Name & Seal:

Final Approval by PM (Owner):

Date:

Signature:
Name & Seal:

Acceptance by Contractor/ Vendor:

Date:

Signature:
Name & Seal:

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| | PTS – THIRD PARTY INSPECTION AGENCY | |
| | Doc. No. P.014714 G 11077 M004 | |

CENTRAL U.P. GAS LIMITED (CUGL)

LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS

PTS - THIRD PARTY INSPECTION AGENCY

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| Rev. | Date | Description | Prepared by | Checked by | Approved by |

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1.0 INTRODUCTION

The objective is to specify the role of Third-Party Inspection Agency (TPIA) appointed by Contractor for supply items and appointed by Owner for construction work.

The Contractor will appoint an independent approved Third-Party Inspection Agency (TPIA) whose role shall be to witness, review and certify all quality related issues for supply of material. The TPIA shall ensure that all quality related requirements during manufacturing are strictly followed as per Owner/Owner's representative specifications and approved documents. Owner shall appoint its TPIA for witness, review and certification of all the construction activities.

This PTS also indicates general quality control requirements for various activities pertaining to Gas Pipeline Projects and the extent of TPIA involvement as indicated in tender shall be binding on the contractor.

2.0 SCOPE OF WORK

2.1 Role of TPIA for Supply Items

TPIA, as appointed by the Contractor from Owner's approved list, shall witness, review and certify all quality related activities for supply of material for Mechanical, Civil, Electrical and Instrumentation system. The extent of TPIA involvement as a minimum is indicated in the various Quality Control Sheets attached with the tender document and shall be as per final approved QA/QC procedures or as per codes and standards, wherever applicable.

2.2 Role of Owner / Owner's Representative for Supply Items

For supply items, Owner / Owner's Representative reserves the right to carryout independent inspection / audit of the plant during manufacturing. The extent of inspection shall be at the discretion of Owner / Owner's Representative. All costs related to the same (excluding travel expenses) shall be borne by Contractor

2.3 Role of TPIA for Construction Activity

TPIA, as appointed and paid by Owner will be involved in all inspection, witness & certify construction work. The extent of TPIA involvement will be shown in the various Quality control sheets prepared by Contractor and approved by Owner/ Owner's representative.

Prior to commencement of any activity pertaining to construction at site, Owner/Owner's representatives shall get the documents reviewed by the TPIA.

2.4 The various Hold points' involvement as mentioned in various QC sheets is indicative minimum. However, actual involvement shall be decided by Owner/Owner's Representative during review of documents, and Contractor shall be bound by the same. Contractor shall also submit the calibration certificates of all the equipment/instruments, which are part of manufacturing/Inspection & testing for TPIA review TPIA shall also be responsible to check /witness the necessary calibration of such equipment/Instruments during visit to contractor's works.

3.0 ROLE OF CONTRACTOR

Contractor shall have to carryout all necessary inspections and testing which are indicated in approved documents and shall have to provide all necessary latest tools & tackles, measuring instruments and facilities, which are required by the TPIA/Owner /Owner's representatives and all necessary assistance to carryout inspection/testing at contractor's cost. Owner/Owner's representative shall have a right to inspect any activity.

4.0 CO-ORDINATION WITH TPIA

Contractor on award of the Contract/LOI shall submit the detail procurement and construction schedules within fifteen (15) days to Owner/Owner's representative for their approval. The detail item wise Manufacturing schedule indicating dates and location of manufacturer works shall be submitted by the Contractor within One (1) week from the date of issue of their internal Indent /Purchase order to sub vendor.

Contractor shall inform in writing minimum One (1) week in advance to inform the Owner/Owner's representative for Inspection Notice/Call. All coordination among Owner/Owner's representative/TPIA and Contractor's/ Vendor's works shall be the responsibility of Contractor. In case the Contractor fails to honour its inspection calls/notice, contractor has to reimburse all costs incurred by the Owner/Owner representative at actual.

Inspection of site construction activities shall be coordinated on daily basis and adequate notice shall be given to Owner/Owner's representative to mobilize TPIA, this shall be as per site conditions and requirements.

5.0 INVOLVEMENT OF TPIA

5.1 The Minimum requirements are indicated in the Quality Control Tables attached in tender document.

5.2 Civil

All procured items required for execution activities for civil works should satisfy the following conditions:

- It should be of reputed make having proven record of being successfully used in similar works earlier and as per approval by Owner / Owner's Representative.
- All materials shall be of standard quality and shall be procured from renowned sources / manufacturers approved by Owner/ Owner's representative.
- All tests of the materials as specified by the relevant codes should be carried out by the contractor in an approved laboratory and the test reports should be duly authenticated by the laboratory and should be submitted to TPIA for his approval. If so desired by Owner/ Owner's representative, tests shall be conducted in his presence or in presence of his authorized nominee.
- Quality and acceptance of materials not covered under general technical specifications shall be governed by relevant codes.
- The Contractor shall submit manufacturer's test reports on quality and suitability of any material procured from them and their recommendations on storages/ application/ workmanship etc. for the intended use. Submission of manufacturer's test reports does not restrict Owner/ Owner's representative from asking fresh test results from an approved laboratory of the actual materialssupplied even from an approved manufacturer.
- Contractor shall furnish the QAP for all supply and construction works.

5.3 Electrical

All procured items for required execution activities for electrical works should satisfy the following conditions:

- Contractor shall furnish the QAP for Panels, Cables, UPS etc. for Owner's review.
- QA Plan will commence at the instigation of the requisition and follow through to equipment acceptance thus ensuring total conformity to the specifications.
- Type test certificates of similar equipment shall be provided.

- Routine tests shall be carried out on the panels, Cables, UPS, Flame proof equipment and other items as per ISS.
- Owner/Owner's Representative reserve the right to witness routine acceptance tests at the manufacturer works as indicated in QAP & ISS.
- Owner/Owner's Representative will witness the routine tests on Panels, UPS at the manufacturer works prior to despatch, to prove compliance with specifications.
- Owner/Owner's Representative shall carry out the inspection of the erection of equipment and witness the testing & commissioning of the equipment at site and approve the test certificates.

5.4 Instrumentation

All procured items for required execution activities for Instrumentation works should satisfy the following conditions:

- Contractor shall furnish the quality assurance procedure for field instruments and cables for review of Owner/ Owner's representative.
- QAP will commence at the instigation of the requisition and follows through to equipment acceptance. Thus, ensuring total conformity to the specifications.
- Type test certificates of similar equipment shall be provided.
- Owner/Owner's Representative shall carryout the inspection of erection of the equipment and witness the testing and commissioning and approve the certificates.

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CENTRAL U.P. GAS LIMITED (CUGL)

**LAYING OF 3 LPE COATED CARBON STEEL PIPELINE
IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS**

PTS – HEALTH, SAFETY & ENVIRONMENT

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1.0 SCOPE

This specification establishes the Health, safety and Environment (HSE) aspects to be complied with by the contractor during construction at site.

2.0 REFERENCES AND CODES

This document should be read in conjunction with following.

General Condition of Contract (GCC)

Special Condition of Contract (SCC)

Job Specifications

Relevant IS codes

Reporting Formats

RELEVANT CODES FOR 'PERSONAL PROTECTION EQUIPMENTS'

| | |
|---------------------------|---|
| IS: 2925 – 1984 | Industrial Safety Helmets |
| IS: 47701 – 1968 | Rubber Gloves for Electrical Purpose |
| IS: 6994 - 1973 [Part-I] | Industrial Safety Gloves [Leather & Cotton Gloves] |
| IS: 1989 - 1986 [Part-II] | Leather Safety Boots & Shoes |
| IS: 5557 – 1969 | Industrial & Safety Rubber Knee Boots |
| IS: 6519 – 1971 | Code of Practice for Selections, Care & Repair of Safety Footwear |
| IS: 11226 – 1985 | Leather Safety Footwear Having Direct Molding Sole |
| IS: 5983 – 1978 | Eye Protectors |
| IS: 9167 – 1979 | Ear Protectors |
| IS: 3521 – 1983 | Industrial Safety Belts & Harnesses |

3.0 RESPONSIBILITY & ORGANISATION

Safety activities at site shall be under control of contractor's RCM. He shall be responsible for implementation of HSE provisions. The nominated or designated safety engineer/ officer shall assist and perform day to day HSE work as per his advice.

4.0 GENERAL REQUIREMENT

- 4.1. The contractor should follow HSE policy of owner as applicable to construction site.
- 4.2. The contractor shall deploy a full time HSE engineer / officer to coordinate the site.
- 4.3. The HSE officer shall be duly qualified in Industrial Health & Safety management with an experience of 4 -5 years.
- 4.4. The contractor shall ensure that HSE requirements are clearly understood & faithfully implemented at all level, at each site.
- 4.5. The contractor shall organize safety awareness programs regularly.
- 4.6. The contractor shall ensure his participation in the every HSE meeting called by owner/owner representative.
- 4.7. The contractor's shall conduct daily tool box talk.
- 4.8. The contractor shall submit Monthly HSE reports (Form attached in ANNEXURES).
- 4.9. The contractor shall provide all help and support to the injured person got injury at site during construction work and arrange compensation as per insurance policy / Act.
- 4.10. The contractor shall adhere consistently to all provisions of HSE. In case of non-compliance or continuous failure the owner/ owner representative may impose stoppage of work without any cost time implication to owner. A penalty amount of Rs 1000/-shall be imposed on the contractor for the serious HSE violation.
- 4.11. Three times of this penalty may count as a serious violation of contractor in line with HSE. This may affect to new work assignment/award of contractor.

5.0 SPECIFIC REQUIREMENT

- 5.1. Preferably, the Contractor should have a documented 'HSE Policy' to cover commitment of their organization to ensure health, safety and environment aspects in their line of operations or they must follow the 'HSE policy' of CUGL for safe execution of work.
- 5.2. The Contractor shall ensure that the CUGL's 'Health, Safety and Environment [HSE]' requirements are clearly understood and faithfully implemented at all level, at sites.
- 5.3. Contractor shall promote & develop consciousness for Health, Safety & Environment among all personnel working for the Contractor. Regular work-site meetings (Tool box talk) shall be arranged as 'HSE' activities to cover hazards involved in various operations during executing their jobs, location of First Aid Box, trained personnel to give First Aid, Assembly Points, and fire protection measures such as water and fire extinguishers etc.
- 5.4. Non-conformance of 'HSE' policy and directives as per CUGL by Contractor [including their sub-Contractors] as brought out during review/audit by CUGL / external agency authorized by CUGL, shall be complied by Contractor and its report to be submitted to CUGL.
- 5.5. Contractor shall adhere consistently to all provisions of 'HSE' requirements. In case of non-compliance of continuous failure in implementation of any of the 'HSE' provisions, CUGL may impose penalty and subsequent stoppage of work for non-compliance. The decision of imposing monetary penalty & work-stoppage shall be taken by EIC with consultation with Safety Officer of CUGL.
- 5.6. All fatal accidents and other personnel accidents shall be investigated for root cause by CUGL and Contractor shall extend all necessary help and cooperation in this regard. Recommend corrective and preventive actions of findings will be communicated to Contractor for taking suitable actions should be taken by the Contractors to avoid recurrence of such incidences.
- 5.7. Contractor shall ensure that all their staffs and workers, including their sub-Contractor(s), shall wear 'Personal Protective Equipment [PPEs]' such as safety helmets, safety shoes, safety belts, dust mask, ear plug, protective goggles, gloves, etc., as per job requirements. All these gadgets shall conform to relevant IS specifications or equivalent.

- 5.8. Contractor shall assign competent & qualified personnel for carrying out various tasks/jobs as per requirement.
- 5.9. All equipment should be tested and certified for its capacity before use.
- 5.10. Contractor shall ensure storage and utilization methodology of materials that are not detrimental to the environment. Where required, Contractor shall ensure that only the environment-friendly materials are used.
- 5.11. All persons deployed at site shall be knowledgeable of and comply with the environmental laws, rules and regulations relating to the hazardous material substances and waste. Contractor shall not dump release or otherwise discharge or dispose-off any such materials without the express authorization of EIC of CUGL.
- 5.12. Contractor should obtain all work permits before start of activities [as applicable] like hot work, cold work, confined space, electrical isolation, work at heights and its use & implement all precautions mentioned therein.
- 5.13. Contractor should display at site office and work locations caution boards, provide posters, banners for safe working to promote safety consciousness, etc.
- 5.14. Contractor should properly barricade the facility where work is in progress for safe working and reclaim the work zone after completion of work to promote safety consciousness.

6.0 ACCIDENT, INCIDENT AND NEAR-MISS REPORTING

Accident

Unintended occurrence arising out of and in the course of employment of a person, which results in to injury with or without damage to plant/equipment/materials.

Incident

means an unplanned and uncontrolled event which results in damage to plant or equipment or loss of material without causing any injury to persons, like fire, spill, leak, property damage etc.

Near-miss

An unexpected, unwanted event not causing loss, injury or illness but which under slightly altered conditions can lead to an accident.

can be defined as “Any event which under slightly unfavorable circumstances, may have resulted in any of the following:

- Injury, fatal or otherwise or ill health to people
- Loss of property, damage to plant or materials
- Damage to the environment
- A business interruption”

Accident, Incident and Near miss reporting form listed in ANNEXURES

7.0 HSE REQUIREMENTS AT SITE

6.1 Personnel Protective Equipments

The contractors shall provide sufficient numbers of following personal protective equipments (PPEs) to workmen and supervisors/engineers to use them properly at work site.

Following five numbers of Personnel protective equipments are identified as MANDATORY for all.

Safety Helmet
Coverall
Safety shoes/footwear
Safety Glasses
Hand Gloves (as per job requirement)
Other PPEs are depends upon nature of job like
Arc Welding – Welding face shield
Grinding – Grinding face shield
Height work – Full Body harness (above 2 meters)

Ask site supervisor for proper use and selection of protective clothing / equipment for specialised jobs

6.2 Welding

Ensure that welding machine is in order and approved by site engineer.
Ensure that welding cables are in order.
Ensure that welding machine is properly earthed.
Remove all combustible material from welding area to avoid fire
Place a fire extinguisher near by welding premises.
Ensure welding holder, cable and its lugs in good condition and use only industrial power socket and plugs (3 Pin) to avoid electricity risk.
Make sure that welding machine is provided with ON/OFF switch and is earthed/grounding.
Do not over load electrical appliances and cable, Shocked pin etc,
Ground the work piece separately from the welding return connection only.

6.3 Gas Cutting

Check the cylinder and its valve or leakage and move out any leaking cylinder immediately.
Ensure that flash back arresters are installed with torch and NRV (Non return valve) on the gas cylinders side.
Ensure cylinders in vertical position (Cylinder trolley) and far away from fall of sparks and hot metal.
Check the regulator and torches that they are inspected prior to every use.
Check for leaks around regulators, hoses/fittings & nozzle with soap solution.
Check the entire hose length if it is cracked or worn out cut that length of hose or replace the hose.
Check that flash back arrester used for the purpose is of approved make/specification only.
Place a fire extinguisher near by welding premises.

6.4 Grinding Operation

Grinding wheels should be stored in dry place.
After expiry date, grinding wheel must be condemned, broken in to pieces.
Power supply cable of adequate current carrying capacity shall be used and it should be in good workable condition without abrasions, cuts or puncture in outer insulation.

Socket pin provided at supply end and On/off switch in working condition.

Proper earthing of the body in case of metallic body.

Wheel guard properly fitted in position.

Machine body without any damage like crack etc.

Moving part (wheel) must be properly fixed to the machine with the help of spanner.

Grinding wheel must be of suitable size as per the speed of grinding machine.

Grinding wheel without manufacturer's sticker showing size, speed and expiry date must be condemned.

Don't use portable grinding machine as bench grinder.

Don't fit over size wheel than recommended size by machine/wheel manufacturer.

Don't grind small, unstable object without fixing it in the vice.

Don't over press the grinding wheel against the job for fast removal of metal.

Put OFF the main switch, while machine is not in use (tea break etc.)

Don't chip off grinding/cutting wheel for achieving fast cutting rate.

PPEs:

Use of helmet, face shield or safety goggles (where face shield is not possible.) and hand gloves.

6.5 Use of Power Tools and Cables

All electrical equipment and tools used by the contractors and their employees shall be properly checked by contractor's supervisor before use.

All power tools must have proper guard at all time.

Leads /cables must be placed so that they do not create a tripping hazard.

6.6 Material Handling and Storage

The Contractor will only use crane/Hydra and lifting equipment that has been tested and certified as fit for purpose by 3rd Party. All crane operators and riggers will be adequately trained and certified. The Contractor will keep records of tests and certification of all lifting equipment crane employed on the Works.

Maintenance records shall be routinely inspected by the Contractor and made available for Safety audits.

LIFTING GEAR: Lifting machine, chains, ropes and lifting tackles used at site shall conform to the following:

All parts shall be good construction, sound material and adequate strength and free from defects.

Shall be properly maintained, thoroughly examined, load tested by competent person.

No lifting machine and no chain, rope or lifting tackle shall except for purpose of test be loaded beyond safe working load and this safe working load must be plainly marked on the gear concerned.

All material must be properly stacked and secured to prevent sliding, falling or collapse.

Stairs and passage ways must be kept clear at all time.

6.7 Trenches and Excavation

Before commencing any excavation work the Site incharge will ensure that the proposed works have been adequately assessed and planned to ensure that they are executed safely and without risks to Health and safety. The factors to be assessed and planned will include: -

The nature and stability of the material being excavated and the need for any support of walls.

The effect of excavation on nearby area.

The foreseeable presence of hazardous contaminants.

The proximity of mobile plant.

The provision of edge protection (fall prevention of people and materials)

Access and egress

6.8 Pipe Transportation and lowering

All drivers shall hold a valid driving license for the class of vehicle.

Securing of the load shall be according to established and approved methods.

All overhangs shall be made clearly visible and restricted to acceptable limits.

Load shall be checked before moving off and after traveling a suitable distance.

All vehicles used by Contractors shall be in worthy condition and in conformance to the Land Transport requirement.

Use of certified side booms after 3rd Party inspection.

Effective communication should be done among all involved personals.

Signaling shall be done by authorized foreman only.

Ensure appropriate measures are taken for overhead hazards.

Persons are not allowed towards trench side / under the boom at the time of lowering.

Co-ordination of lowering in by a single man only.

Inspection of equipment before use.

All personnel should stay clear of moving equipment.

Use of certified lifting tools and tackles.

6.9 Pressure / Leak Testing

Hydraulic and Pneumatic Test

Access to the test area shall be limited to essential personnel only before the test commences compliance is required with the following points:

Persons supervising pressure or leak tests must have sufficient knowledge and experience of testing to fully understand the hazards of the activity and the precaution, which must be taken.

Effective communication, including formal procedures, must be established between sites whenever the test envelope extends beyond one site, for example, pipelines.

The area shall be cordoned off (using tape, shields or barriers, etc) at an adequate distance from the equipment to be tested, as specified on the Permit to Work

Warning signs shall be posted at access ways, at other strategic positions, and on the equipment to be tested (including the doors of test workshops or other designated areas

Pressuring equipment shall be provided with suitably calibrated pressure control / regulator devices.

Pressuring equipment shall not be left unattended at any time during the test.

Pressuring equipment shall be isolated from the equipment under test and where practicable disconnected, when the test pressure has been reached.

Care must be taken to ensure that materials of construction have the required ductility at the test temperature to prevent brittle fracture.

A safety valve should be fitted to the equipment/system being tested, set to relieve at a pressure that will prevent over pressurization

Sufficient venting / draining points shall be provided in order to prevent trapping of pressurizing medium behind non-return valves, check valves, between isolation valves, or within dead legs of the pressure envelope

The equipment/plant to be pressure tested must be subjected to thorough examination prior to testing. It may be necessary to 100% inspect all welds using visual, radiographic or other NDT techniques

The gas supply must be isolated when test pressure has been achieved

The pressure envelope must contain sufficient vents, to a safe location.

De-pressurization after pneumatic testing must be gradual

6.10 Scaffolding and Ladder

All working platform must be constructed with the specific requirement of job.

All portable ladders must be in good condition as per the site norms.

If the working platform is not permanent then safety belt must be used.

There shall be firm foundation for all scaffoldings. All scaffolding shall be made of sound material.

Scaffolding material shall be inspected and used, only if found in good condition.

Provide metal base plate is used under all upright or standard scaffoldings. Correct type of couplers shall be used for all connections.

Plumb and level scaffoldings as erection proceeds, so that braces will fit without forcing. Fasten all braces securely.

Working platforms shall be provided with guards. This should consist of top rail, mid rail, and toe board. The toe board shall be of minimum height 100 mm, while the mid rail and top rail shall be at heights of 600 mm and 1200 mm respectively.

Do not use ladders or makeshift devices on top of scaffoldings to increase the height.

Shall be placed at least 75 deg. to the floor.

Ladder shall extend 3' to 4' above the point of Landing and topmost 3 rungs shall not be used.

Ladder is checked visually for defects before every use.

Ladders shall not be used in a horizontal position as runways or scaffoldings.

Ladders shall not be placed in front of a door that opens toward the ladder unless the door is locked, blocked or guarded.

Fall arrestor to be used wherever applicable.

6.11 Work Permit Procedure

For working at more than 10' height the permission must be obtained from site in-charge.

For doing any Hot work in the fire risk areas the permission must be obtained from site in charge or safety officer.

For any Excavation work it must be ensured that there are no underground utilities like cables, Water pipeline etc.

For any work inside confined space, entry permit must be obtained from site engineer.

6.12 Barricades and Warning Signs

Area where work is being carried out above man height or below 1' ground depth must be barricaded.

Follow the instruction of all types of warning signs like "NO SMOKING" "NO ENTRY" "DANGER"

"Work at height"

6.13 Emergency Plan and Procedures

All Contractor's employees should be aware of site Emergency control plan

Periodic drill to train employees for their awareness & information should be followed.

6.14 Road Safety Norms

For roadside working site to be barricaded as per approved barricading norms given in drg. No. 7452-L-15-0107. Penalty clause for road safety & barricading shall be applicable as per relevant clause of commercial part of tender.

Only eligible driver can drive required vehicle inside site

Speed limit norms of site must be followed

No riding or travelling on the back of open end vehicle, fork lift or trailers should be done.

6.15 Labour Welfare & Legal Requirement

All mandatory provisions with regard to safety as prescribed under contract Labour (Abolition & Regulation) Act 1970 and Rules made there under are applicable.

Workmen compensation insurance and registration under ESI should be maintained.

Time to time, all rules and regulations suggested by safety committee of site must be followed and implemented.

7. Guidelines for imposition of punitive fines

Punitive fines on contractors are imposed for violation of safety rules & regulations during execution of jobs. Objective of punitive fines is to work as deterrent for contractors in violation of safety rules & regulation and to improve safety atmosphere in general at all site.

Proposed guidelines for imposition are described below:

- 7.1. For first time violation of safety rules & regulation by any contractor, HSE-officer will issue a warning letter to contractor with intimation to EIC of work centre with a copy to MD & DC.
- 7.2. In case of second time violation of safety rules & regulations by same contractor, EIC will call contractor in person and will have a meeting to discuss reason for repetitive violation along with HSE- Officer. A warning letter will also be issued by EIC to contractor.
- 7.3. In case of further violation, punitive fines will be imposed on contractor. Amount as fine will be decided as per severity of violation of safety. However, minimum fine would be Rs.5,000/- and in multiple of Rs.5,000/-, thereafter for every instant.
- 7.4. This will be limited to 5% of contract value, as maximum cumulative penalty.
- 7.5. This practice of punitive fines is to be implemented across all CUGL sites for all contractors.
- 7.6. Practice of punitive fines will be applicable for projects sites also and would be over and above the deduction made by M/s CUGL for safety violation from running bills.

ANNEXURE – A

RELEVANT IS-CODES FOR PERSONNEL PROTECTION

| | | |
|-----------------------------------|---|--|
| IS : 2925 – 1984 | : | Industrial Safety Helmets. |
| IS : 4770 – 1968 | : | Rubber gloves for electrical purposes |
| IS : 6994 – 1973 (Part – I) | : | Industrial Safety Gloves (Leather & Cotton) |
| IS : 1989 – 1986 (Part – I & III) | : | Leather safety boots and shoes |
| IS : 3738 – 1975 | : | Rubber knee boots |
| IS : 5557 – 1969 | : | Industrial and Safety rubber knee boots |
| IS : 6519 – 1971 | : | Code of practice for selection, care and repair of Safety footwear |
| IS : 11226 – 1985 | : | Leather Safety footwear having direct moulding sole |
| IS : 5983 – 1978 | : | Eye protectors |
| IS : 9167 – 1979 | : | Ear protectors. |
| IS : 3521 – 1983 | : | Industrial Safety belts and harness |

2.0 : MONTHLY CHECKLIST CUM COMPLIANCE REPORT REGARDING HSE (1/6)

Project: _____ Contractor : _____
 Date: _____ Owner : _____
 Inspection By : _____

Note: write 'NC' (Not Concern) wherever any of the items are not applicable

| Item | Yes | No | Remarks | Action |
|--|-----|----|---------|--------|
| HOUSEKEEPING | | | | |
| Waste containers provided and used | | | | |
| Sanitary facilities adequate and Clean | | | | |
| Passageways and Walkways Clear | | | | |
| General neatness of working areas | | | | |
| Proper Material Storage | | | | |
| Wooden Boards properly stacked and nails removed | | | | |
| Cords, leads out of walk and traffic ways | | | | |
| Scraps removed from the work site | | | | |
| Other | | | | |
| PERSONNEL PROTECTIVE EQUIPMENT | | | | |
| Goggles : Shields | | | | |
| Face protection | | | | |
| Hearing protection | | | | |
| Safety Shoes provided | | | | |
| Hand protection | | | | |
| Respiratory Masks etc. | | | | |
| Safety Belts | | | | |
| Safety Helmets | | | | |
| Other | | | | |
| EXCAVATIONS / OPENINGS | | | | |
| Excavation permit | | | | |
| Excavated earth kept away from edge | | | | |
| Dewatering pump kept away from edge | | | | |
| Safe access into excavated area | | | | |

| | | | | |
|--|--|--|--|--|
| Opening properly covered or barricaded | | | | |
| Excavations shored | | | | |
| Excavations barricaded | | | | |
| Overnight lighting provided | | | | |
| Other | | | | |

MONTHLY CHECKLIST CUM COMPLIANCE REPORT REGARDING HSE (2/6)

| Item | Yes | No | Remark | Action |
|--|-----|----|--------|--------|
| Welding Cutting | | | | |
| Valid not work permit | | | | |
| Flashback arrester provided for cylinders | | | | |
| Power cable not crossing the welding cable | | | | |
| Adequate earthing provided | | | | |
| No combustible materials kept near welding & cutting works | | | | |
| Gas cylinder chained upright & kept in trolleys | | | | |
| Cables and hoses not obstructing | | | | |
| Screens or shields used | | | | |
| Flammable materials protected | | | | |
| Fire extinguisher (s) accessible | | | | |
| Other | | | | |
| SCAFFOLDING | | | | |
| Fully decked platform | | | | |
| Guard and intermediate rails in place | | | | |
| Toe boards in place & tied properly | | | | |
| Adequate shoring | | | | |
| Adequate access | | | | |
| Other | | | | |
| LADDERS | | | | |

| | | | | |
|--------------------------------------|--|--|--|--|
| Extension side rails 1 m above | | | | |
| Top of landing | | | | |
| Properly secured at top & bottom | | | | |
| Angle $\pm 70^\circ$ from horizontal | | | | |
| Other | | | | |

| Item | Yes | No | Remark | Action |
|--|-----|----|--------|--------|
| 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 | | | | |
| Singh/ barricades provided | | | | |
| Signals observed and understood | | | | |
| Qualified operators | | | | |
| Other | | | | |
| MACHINERY, TOOLS AND EQUIPMENT | | | | |
| Proper instruction | | | | |
| Safety devices | | | | |
| Proper cords | | | | |
| Inspections and maintenance | | | | |
| Other | | | | |
| VEHICLE AND TRAFFIC | | | | |
| Rules and regulations observed | | | | |
| Inspection and maintenance | | | | |
| Licensed drivers | | | | |
| Others | | | | |

| Item | Yes | No | Remark | Action |
|--|-----|----|--------|--------|
| TEMPORARY FACILITIES | | | | |
| Emergency instruction posted | | | | |
| Fire extinguishers provided | | | | |
| Fire-aid equipment | | | | |
| Secured against storm damage | | | | |
| General nemeses | | | | |
| In accordance with electrical requirements | | | | |
| Other | | | | |
| Fire Prevention | | | | |
| Personnel instructed | | | | |
| Fire extinguishers checked | | | | |
| No smoking in prohibited areas | | | | |
| Hydrants clear | | | | |
| Other | | | | |
| ELECTRICAL | | | | |
| Proper wiring & earthing | | | | |
| ELCB's provided | | | | |
| Ground fault circuit interrupters | | | | |
| Protection against damage | | | | |
| Prevention of tripping hazards | | | | |
| Proper electrical cable joints | | | | |
| Light poles secured | | | | |
| Clear way to power distribution board | | | | |
| Proper rating of fuses | | | | |
| | | | | |

| Item | Yes | No | Remark | Action |
|---|-----|----|--------|--------|
| HANDLING AND STORAGE OF MATERIALS | | | | |
| Properly stored or stacked | | | | |
| Passageways clear | | | | |
| Other | | | | |
| FLAMMABLE GASES AND LIQUIDS | | | | |
| Containers clearly identified | | | | |
| Proper storage | | | | |
| Fire extinguishers nearby | | | | |
| Other | | | | |
| WORKING AT HEIGHT | | | | |
| Erection plan | | | | |
| Safety nets | | | | |
| Safety belts tied properly | | | | |
| Illumination | | | | |
| No loose material at height | | | | |
| No body under working area | | | | |
| All openings covered | | | | |
| Other | | | | |
| ENVIRONMENT | | | | |
| Chemical and other Effluents properly disposed | | | | |
| Cleaning liquid of pipes disposed off properly | | | | |
| Seawater used for hydrotesting disposed off as per agreed proceeding | | | | |
| Lubricant Waste/ Engine oils properly disposed | | | | |
| Waster from Canteen office, sanitation etc. disposed properly | | | | |
| Disposal of surplus earth stripping materials, Oily rags and combustibile materials done properly | | | | |
| Green belt protection. | | | | |

MONTHLY CHECKLIST CUM COMPLIANCE REPORT REGARDING HSE (6/6)

| Item | Yes | No | Remark | Action |
|---|-----|----|--------|--------|
| HEALTH CHECK | | | | |
| Hygienic conditions at labour camps OL | | | | |
| Availability of First Aid facilities | | | | |
| Proper sanitation at site, office and labour camps | | | | |
| Arrangements of medical facility | | | | |
| Measures for dealing with illness | | | | |
| Availability of potable drinking waters for workmen & staff | | | | |
| Provision of cretches for children | | | | |
| ERECTION | | | | |
| Slings/D'shackle checked | | | | |
| Signal Man | | | | |
| Tag line for guiding the load | | | | |
| Protecting the slings from sharp edges | | | | |
| No loose materials at height | | | | |
| Ladder & platform welding inspected | | | | |
| No one under the suspended load | | | | |
| Stay rope | | | | |
| SWL | | | | |

Signature of Resident
Engineer with Seal

**Monthly Health, Safety & Environmental (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 | This Month | Cumulative |
|--|------------|------------|
| Total strength (Staff – Workmen) | | |
| Number of HSE meeting organised at site | | |
| Number of HSE awareness programmes conducted at site | | |
| Whether workmen compensation policy taken | Y/N | |
| Whether workmen compensation policy valid | Y/N | |
| Whether workmen registered under ESI Act | Y/N | |
| Number of Fatal Accident | | |
| Number of Loss Time Accident (Other than Fatal) | | |
| Other accident (non loss time) | | |
| Total No. of accident | | |
| Total man-hours worked | | |
| Man-hour loss due to fire and Accident | | |
| Compensation cases raised with insurance | | |
| Compensation cases resolved and paid to workmen | | |

Remark

Date: ____ / ____ / ____

Safety Officer/RCM
(Signature and name)

To: OWNER.....1 COPY
RCM/SITE-IN-CHARGE 1 COPY

SUPPLEMENTARY ACCIDENT, INCIDENT & NEAR MISS REPORT

Project: _____ Supplementary to Report No.: _____

(Copy enclosed)

Site: _____ Date: _____

Contractor: _____

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

BRIEF DESCRIPTION & CAUSE OF A ACCIDENT

NATURE OF INJURY / DAMAGE

COMMENTS FROM MEDICAL PRACTITIONER WHO ATTENDED THE VICITIM/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 1 COPY

ACCIDENT REPORT

(To be submitted by Contractor after every accident within 2 hours of accident)

Report

No. _____

Date: _____

Name of Site: _____

COTRACTOR _____

NAME OF THE INJURED
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

Date : ____/____/____/

SIGNATURE OF CONTRACTOR WITH SEAL

To : OWNER..... 1 COPY
: RCM/SITE-IN-CHARGE 1 COPY

CENTRAL U.P. GAS LIMITED (CUGL)

**LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN
BAREILLY, KANPUR & UNNAO AND JHANSI GAS**

PTS - TEMPORARY CATHODIC PROTECTION SYSTEM

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6. APPROVED MAKE OF EQUIPMENT / COMPONENTS FOR C.P. SYSTEM 26

1. INTRODUCTION

This specification covers requirements of design, engineering, supply of material installation, testing and commissioning of temporary cathodic protection [TCP] system of external surface of City Gas Distribution underground pipeline/structure including corrosion survey, investigation for interference / interaction detection and mitigation with adjoining structures.

The Temporary cathodic protection [TCP] specification defines the basic guidelines to develop a suitable temporary cathodic protection [TCP] system for the structure [CUGL underground pipeline for city gas distribution] required to be protected. All data required in this regard shall be taken into consideration to develop an acceptable design and for proper engineering of the TCP system.

- 1.1.** Compliance with these specifications and/or approval of the Contractor's documents by Owner shall in no case relieve the Contractor of his contractual obligations.
- 1.2.** All work to be performed and supplies to be effected as a part of contract shall require specific approval of Owner or his authorised representative. Major activities requiring approval shall include but not be limited to the following:
- a) Methodology of Corrosion survey site data generation / verification and interpretation report and design basis for Temporary Cathodic Protection [TCP] System.
 - b) CP system design engineering package including calculation for CP System, pipeline layout with all crossing details and TCP Components in Graphical form (Chainage wise), graphical representation of soil resistivity survey and formula used & Design Calculation.
 - c) Quality Assurance and Control (QA/QC) methodology.
 - d) Detailed engineering package including Procedures, ITPs, QAPs, Data Sheets and Drawings for fabrication and construction.
 - e) Field testing and commissioning procedure.
 - f) Post installation system monitoring procedures.

2. ABBREVIATIONS:

| | | |
|-------|---|--|
| TCP | – | Temporary Cathodic Protection |
| PCP | – | Permanent Cathodic Protection |
| ICCP | – | Impressed Current Cathodic Protection |
| CPTRU | – | Cathodic Protection Transformer Rectifier Unit |
| PSP | – | Pipe to soil Potential |
| TLP | – | Test Stations |

3.1 Site Conditions

The cathodic protection equipment shall be designed for the following site conditions:

| | |
|------------------------|--|
| Min / Max. Temperature | (-) 20 ⁰ C to (+) 60 ⁰ C |
| Design Temperature | (+) 60 ⁰ C |
| Relative Humidity | 90% |

| | |
|---|--|
| Height above MSL | < 1,000 M |
| Atmospheric Pollution | To withstand the site conditions, dust, vapour |
| Hazardous area classification for plant | Zone 2, Gas Group IIA, IIB Temp. Class T3 |
| Control Room / Electrical Room/ | |
| Guard Room | Safe Area |

3.2 SCOPE OF WORK

This specification defines the requirements of design, engineering, installation, testing and commissioning of temporary cathodic protection system for 3LPE city gas pipeline including pipeline corrosion surveys, investigation for interference / interaction problems and mitigation of the same.

Major activities covering complete scope of work include the following:

1. **Temporary cathodic protection system:** Temporary cathodic protection system should include:
 - Soil resistivity survey along the length of the pipeline at every 1000 mtrs and every 500 mtr in marshy area, HT line >66 kV crossing /parallel , foreign anodebed locations, foreign pipeline crossing at a depth of 1 meter, 2 mtr and 5 mtr.
 - Soil chemical analysis at 2 meter depth at every 10 km
 - Design, detailed engineering, supply, installation of TLP and sacrificial anodes, testing, quality assurance (QA) and quality control (QC), inspection, pre-commissioning and commissioning of the TCP system as per specification and to the satisfaction of Consultant/Purchaser.
 - Monitoring of TCP system for 2 year or till commissioning of PCP.

All data required in this regard, including site surveys and CP performance parameters of the any operational foreign pipeline in the ROW, shall be taken into consideration by the CP contractor for proper engineering of the TCP systems.

Compliance with project specifications and/or approval of any of the contractor's documents shall in no case relieve the contractor of his contractual obligations of providing cathodic protection system.

3.3 Major Activities Covering Complete Scope Of Work Include The Following

3.3.1. Pre-design surveys, Design and detailed engineering

- Soil resistivity survey and soil ionic and microbial analysis.
- Soil resistivity survey shall be conducted for Pipeline ROU and anode bed area.
- Design, detailed engineering of TCP and approval from Owner including design calculations with formulae's, bill of quantities, technical specifications and post commissioning monitoring methodology, data recording formats, quality assurance control(QA/QC) methodology and necessary drawing and documents demanded by owner /Consultant.
- It is advised to collect all the additional data wherever required for design and evaluation of CP System.

- OWNER supplied data regarding soil resistivity, chemical analysis data, soil aggressivity etc. at the selected sites should be spot checked for verification. This would include anode bed location areas and locations which visually display probable changes from prior recorded values.

3.3.2. Procurement

Procurement which includes supply, factory inspection, transportation, loading and unloading of cathodic protection sacrificial anodes (magnesium/ zinc) , cathodic protection cables, test stations, permanent reference cells, polarization coupons, spark gap arrestors, zinc grounding cells and all other material required for complete TCP work .

Submission and obtaining approval of all documents (vendor documents) related to procurement of items as mentioned above.

3.3.3. Installation & Commissioning

Installation, testing, pre-commissioning and commissioning of TCP work as defined in the project specification / tender including job procedure for field testing, pre-commissioning and commissioning.

The installation of the CP system shall be supervised by a competent person from the CONTRACTOR'S side whose qualification and experience have been duly approved by the OWNER/CONSULTANT/ OWNERS REPRESENTATIVE or by any recognized professional body of reputation duly approved by OWNER/CONSULTANT/ OWNERS REPRESENTATIVE.

All civil works associated with complete cathodic protection work – TCP shall be included in the scope of CP contractor. This shall include providing cable trenches, foundation for equipment etc. In case transformer rectifier unit have to be located outside, proper kiosk to prevent direct sunlight shall have to be supplied by CP contractor.

Liaisoning with local authorities / statutory bodies / foreign utilities to obtain permissions for TCP work, if required. However, fees applicable to obtain permissions from concerned authorities/local bodies will be paid by Owner.

3.3.4. Temporary cathodic protection -System monitoring

- The Contractor shall monitor installed temporary cathodic protection, once every month as per Owner approved methodology and submit to Owner monitoring report every month for review.
- In case of any deficiency observed during monthly monitoring the TCP system, the contractor shall augment it, so as to ensure adequate levels of protection as specified in TCP acceptance criteria for this project.

3.3.5 Submission of As-built documentation

As-Built document submission including O&M manual and handing over the entire system.

3. **CODES AND STANDARDS**

The system design, performance and materials to be supplied shall conform to the requirements of the latest revision of following standards as a minimum:

| | |
|----------------------|--|
| NACE SP-0169-2013 | Recommended practice control of external corrosion on underground or Submerged metallic piping system |
| NACE SP-0286-2007 | Recommended Practice- the electrical isolation of cathodically protected pipe lines |
| NACE SP-0200-2014 | Cathodic Protection for metallic cased crossings |
| NACE SP-0177-2014 | Recommended Practice- Mitigation of AC and lightning effects on metallic structures and corrosion control systems |
| NACE 54276 | Cathodic protection monitoring for buried pipes |
| NACE SP-0572-2007 | Recommended practice- Design, Installation, operation and of impressed current deep ground beds |
| NACE TM0101-2012 | Measurement techniques related to criteria for cathodic protection |
| NACE TM0497-2012 | Measurement techniques related to criteria for cathodic protection on submerged metallic piping system |
| ASTM B418 | Cast and Wrought Galvanic Zinc Anodes |
| ASTM B843 | Magnesium Alloy Anodes for cathodic protection |
| ASTM G57 | Field measurement of soil resistivity using wenner four pin electrode method |
| ISO 15589-1: 2016 | Petroleum and natural gas industries-CP of pipe line transportation systems- on land pipelines |
| IS 8062 part-2: 2006 | Code of Practice for Cathodic Protection of Steel Structures, Part II: Underground Pipelines [MTD24: Corrosion Protection] |
| IS 3043: 2007 | Code of practice for Earthing |
| BS EN50162:2004 | Protection against corrosion by stray current from direct current systems |
| BS EN15280:2013 | Evaluation of AC corrosion likelihood of buried pipelines applicable to cathodically protected pipelines |
| IEEE 80 | Guide for Safety in Substation Grounding |
| IS 1554 PART-1 | PVC Insulated heavy duty cables |
| IS 5571-2009 | Guide for selection of electrical equipment for hazardous Area |

| | |
|--------------|--|
| IS 2148:2004 | Flame proof equipment for Hazardous Area |
| IS 5572-2009 | Classification Of Hazardous Areas (other Than Mines) Having Flammable Gases And Vapors For Electrical Installation |
| OISD-RP-188 | Corrosion monitoring of offshore and onshore pipelines |
| OISD-RP-226 | Natural gas transmission pipelines and city gas distribution networks |

4. SOIL RESISTIVITY AND SOIL ANALYSIS

The Cathodic Protection [TCP] system to be based on site data generated from the pipeline ROW as per following:

- **SOIL RESISTIVITY:** Soil resistivity survey along the length of the pipeline at every 1000 mtrs and every 500 mtr in marshy area, HT line >33 kV crossing /parallel , foreign anodebed locations, foreign pipeline crossing at a depth of 1 meter, 2 mtr and 5 mtr.
- Measurements at each location using Wenner’s 4-pin method to be at depths 1, 2, 5 m depth.
 - At proposed anode-bed locations:
 - Shallow type: Additional measurements to be done similarly using Wenner’s 4-pin method at each location at depths 2, 3, 4, 5, 6 m.
 - Deep Well anodebed: Additional Soil Resistivity to be measured at 15, 20, 25, 30, 35, 40,45, 50M100 m depths.
- **SOIL ANALYSIS:** Soil /Water samples to be collected from pipeline ROW at 2 meter depth at every 2 km for following analysis :
 - Ionic Loading from an aqueous extract of the soil.
 - Sodium, Potassium, Calcium, Magnesium [all in ppm].
 - Chloride,Sulphate,Sulphide,Carbonate,BiCarbonate,Sulphite,Phosphate,Nitrate, Nitrite [all in ppm]
 - Microbial Loading - Sulphate Reducing Bacteria [Presence/Absence of bacterial colonies] P_H, Total Dissolved Solids [TDS], Redox Potentials, Moisture (%).

ADDITIONAL DATA TO BE COLLECTED

The following data shall be collected to generate design data for evaluation of interaction/interference possibilities due to presence of other services in ROW/in vicinity.

- i. Route and types of foreign service/pipeline in and around or crossing the right of way (including those existing and those which are likely to come up during contract execution) with pipe diameter , type of coating , type of cathodic protection , location of anode groundbeds, output current and voltage of CP Power supply Unit.
- ii. CP Contractor shall conduct necessary potential gradient surveys for existing anode ground beds that may interfere with the CP system of the pipelines covered under this project.

- iii. Existing and proposed DC/AC power sources and systems using earth return path such as HVDC substations/ earthing stations, fabrication yards with electric welding etc. in the vicinity of the entire pipeline route.
- iv. Crossing or parallel running of any existing or proposed HVAC (66 kV & above) overhead power lines along with details of voltage.
- v. Voltage rating, phases, sheathing details of underground power cables running along ROW or in its vicinity.

5. TEMPORARY CATHODIC PROTECTION SYSTEM

5.1. Temporary Cathodic Protection Design Parameters

Unless expressly varied and otherwise specified in the project specifications, following parameters shall be used for design of temporary cathodic protection (TCP) system.

Those parts of sacrificial anode cathodic protection (TCP) system which shall be integrated with permanent CP system(PCP) such as Reference Cu-CuSO₄ electrodes, Test Lead Points, Junction Boxes, Epoxy encapsulated thermit welds , Markers, Polarization coupons, Casing pipe protection, additional protection to carrier pipe inside casing, Grounding cells etc. shall be designed based on permanent CP parameters.

Within 60 days of lowering of each continuous segment of pipe, it should be protected at minimum -950mV potential level by Mg anode as part of TCP. For the soil resistivity profile for the Trunk line & Spur line attached elsewhere in the tender, at locations where soil resistivity is more than 100 ohm-m, those locations shall be treated as high soil resistivity.

5.2. Protection Current Density

Pipelines having three layer polyethylene coating:

| Pipeline surrounding | Protection Current density Temporary CP (µA/m ²) |
|---------------------------------|---|
| Marshy (< 10 Ohm mtr) | 50 |
| Normal (10 Ohm mtr–100 Ohm mtr) | 25 |
| High resistivity > 100 Ohm mtr | 15 |

*Actual current density to be adopted shall be decided based upon soil/water corrosivity and other environmental conditions obtained as per detailed chemical & microbial analysis and presence or absence of interfering elements, proximity of foreign pipelines and structures resulting in interference in close vicinity of pipeline ROW.

Where considered necessary for satisfactory protection of pipeline the current density shall be suitably increased by contractor with appropriate justifications.

5.3. Other Parameters for design

Other parameters to be considered for (TCP):

- Safety factor for current density : 1.3
- Anode utilisation factor for Magnesium anode : 0.5

Anode utilisation factor for Zinc anode : 0.85
Anode utilisation factor for Ribbon anode : 0.5

Unless otherwise specified in project specification the design life of temporary CP shall be 2 year or till commissioning of the permanent CP whichever is earlier.

*Note: To be measured from upcoming/existing structure in the same soil matrix.

5.4. Temporary Cathodic Protection Design Criteria

The pipe to soil potential measurements shall be between (-) 0.95V “ON” and (-) 1.5V “ON” w.r.t. Cu-CuSO₄ reference electrode.

At the location of Polarization coupons, the coupon to soil potential measurement shall be between (-) 0.85 “OFF” minimum and (-) 1.2 V “OFF” maximum w.r.t. Cu-CuSO₄ reference electrodes, measured using a reed switch in circuit.

In rare circumstances a minimum polarisation shift of (-) 100 millivolts w.r.t. Cu-CuSO₄ reference electrode shall indicate adequate levels of cathodic protection for the pipeline subject to Owner’s approval.

5.5. Temporary Cathodic Protection- Scope

The TCP system unless specified otherwise, shall include the following major equipment/ sub-systems as per approved design:

- Sacrificial anodes(Zn or Mg) ground beds in chemical back-fill
- Test stations
- Surge Diverter
- Permanent reference Cu-CuSO₄ electrodes
- Polarization coupons for measurement of “OFF” potentials
- Solid state decoupler
- Zinc Grounding cell
- Interconnecting cathodic protection cables
- Pin brazing/ thermit welding for cable to pipe connections with epoxy encapsulation.
- Markers for cable route
- Sacrificial based CP system at cased crossings

5.6. Equipments

All equipment shall be new and TCP contractor to source these from approved manufacturers of repute with proven track record and approved by the owner for the supply for this project. Equipment offered shall be field proven. Equipment requiring specialised maintenance or operation will not be acceptable and hence shall be avoided, as far as possible and prototype equipment shall not be accepted. Make and construction of all materials shall be subject to Owner’s approval.

The detailed specification of each system and equipment shall be furnished by the contractor. However, certain minimum requirements for the major equipment are highlighted in this document.

5.7. Equipment Location in Hazardous / Non-Hazardous Area

As far as possible, equipment including power source, test stations, anodes, junction boxes, TLP etc. shall be located in safe area. However, **all equipment located in hazardous areas shall be of flame proof type as per BIS: 2148, IEC 79 for gas groups IIA & IIB and temp. Class T3 (200⁰ C).**All equipment to be located in Hazardous area should conform to and comply with BIS 2148 and IEC 79 (or equivalent) code requirements. All indigenous flame proof equipment should be certified by CMRS. All flame proof equipment of indigenous origin should also be BIS marked.

5.8. Sacrificial Anode Temporary Cathodic Protection

Along ROW where soil resistivity is predominantly higher than 10 Ω -m Magnesium (Mg) anodes shall be provided.

Where magnesium anodes are used for protection of 3LPE coated pipeline, the anodes shall preferably be of low potential (-1.55 V_{CSE}) type.

Anodes shall be installed along the pipeline at suitable intervals as per pipeline protection voltage attenuation calculations and ground bed resistance/current output of anode installations.

Each electrically continuous section of pipeline shall preferably be protected totally by one type (material) of anodes (either Zn or Mg) to avoid inter-anode (Zn ↔ Mg) circulation currents. Grounding cell should also conform to this specific requirement. In case (TCP) is done using Mg anodes, grounding cell using Mg anodes only to be used thus avoiding inter anode current.

The anodes shall be installed at sufficient depth to preferably reach perennially moist soil (ascertained by ground water table data) but minimum 2 meter depth from grade level and shall be separated linearly from the pipe line by at least 5 meter and 2 meter for Magnesium (Mg) and Zinc (Zn) anodes respectively. The sacrificial anodes shall be placed away from the proposed pipeline as well as existing pipelines(if any) so that it should not come between the existing and proposed pipelines. The anode connections to pipe line shall be routed through test stations with suitable resistance and current shunts in the circuit to be made for testing complete installation at site.

Pre-packaged Mg anodes shall be installed completely dry and shall be lowered into augured holes by rope slings or by grasping cloth together and separated from the protected pipeline at least 5 meter and below the 6 o clock position of the pipeline with suitable length of anode tail which shall also run and terminate into the test station.

The annular space of anode auger hole shall be backfilled with fine soil in 150 mm compacted layers. No damage should be done to anode or its tail during this operation.

Anodes shall be installed as per approved scheme/drawings and any change required for any reason shall not be allowed without the OWNER/CONSULTANT/ OWNERS REPRESENTATIVE'S approval.

However, environment suitability (such as excessive carbonate, bi-carbonates, sulphates, chlorides, nitrates, pH etc. which could result in anode passivation) should be checked prior to lowering of sacrificial anodes (Mg or Zn) in the anode beds.

At the temporary CP anode ground bed, the leads of all the anodes shall be connected individually through shunt and resistor (for controlling each anode output individually) in the test station.

For sacrificial anode CP system, the anodes shall be supplied with tail cable (1c x 10 mm² XLPE/PVC copper conductor single core multi-strand cable) of sufficient length so as to reach test station, for termination, without difficulty. No joints are permissible on the cable run from anode tail to Test station box.

The tail cable connection with the iron insert of cable shall be tightly done followed by epoxy encapsulation so as to ensure that no necking takes place which could result in snapping of cable connection due to spark and matching with the anode size and approved make. Anode cap of heat shrinkable PE material shall be able to ensure this.

During the pipeline laying, temporary cathodic protection shall also have to be provided for small pipeline sections which for reasons beyond the control of the mainline laying contractor are not electrically continuous for a time period of more than one month to prevent any external corrosion on these isolated pipeline sections.

The temporary galvanic anode shall be kept buried and connected till the commissioning of permanent cathodic protection system. The same shall be disconnected only upon commissioning of Permanent CP system or in the event of over protection. The anodes shall be disconnected only through the isolating link installed in the test station.

5.9. Magnesium Anode

The anodes can be low or high potential magnesium anodes however the same can be confirmed based on the soil resistivity of the area at the time of design. The magnesium (**Mg**) alloy anode shall be packed in special back fill and suitable for use with three layer extruded polyethylene coating. The anode to conform to ASTM B-843 specifications. The metallurgical composition, potential and consumption rate of anode shall be as below:

| <u>Element</u> | <u>Weight</u> (High potential type) | <u>Weight</u> (Low potential type) |
|--------------------------------|--|---------------------------------------|
| Manganese | 0.5 - 1.3 % | 0.15 - 0.7 % |
| Copper | 0.02 % max. | 0.02 % max. |
| Silicon | 0.05 % max. | 0.1 % max. |
| Zinc | - | 2.5 % - 3.5 % |
| Aluminium | 0.01 % max. | 5.3 % - 6.7 % |
| Iron | 0.03 % max. | 0.003 % max. |
| Nickel | 0.001 % max. | 0.002 % max. |
| Calcium | - | - |
| Other metallic elements | | |
| - Each | 0.05 % max. | |
| - Total | 0.3 % max. | 0.3 % max. |
| Magnesium | Balance | Balance |

| | | |
|-----------------------------------|---------------------|---------------------|
| ii) Anode open circuit. Potential | 1.75 volts | 1.55 volts |
| iii) Anode consumption rate | 7.9 Kg/ (A.Yr) max. | 7.9 Kg/ (A.Yr) max. |

5.10. Zinc Anode

The Zinc anode shall conform to ASTM B 418 standard. The anode (other than ribbon anode) shall be packaged with special back fill. The metallurgical composition of anode, potential and consumption rate shall be as below:

i. Composition:

| Element | Weight |
|----------------|------------------|
| Aluminium | 0.3 – 0.5 % max. |
| Cadmium | 0.075-0.1 % max. |
| Copper | 0.005 % max. |
| Iron | 0.002 % max. |
| Silicon | 0.005 % max. |
| Lead | 0.005 % max. |
| Zinc | Remainder |

- ii. Anode open circuit potential (-) 1.1 volts w.r.t. CSE
- iii. Anode consumption rate 11.24 kg / (A yr) Max.

Contractor shall furnish spectrographic analysis from each heat both for Zinc and Magnesium anodes along with electrochemical test results .CP Contractor shall mention specifically the method of Spectrography (Atomic Absorption / Emission Spectrometry / Photometrics) for Owner’s Approval.

5.11. Special Backfill for Sacrificial Anodes

The composition of special backfill for sacrificial anodes shall be as below:

| | |
|-----------------|-----|
| Gypsum | 75% |
| Bentonite | 20% |
| Sodium sulphate | 5% |

5.12. Specific Requirements for sacrificial anodes are as follows:

- The anodes shall be provided with cable tail of sufficient length to reach test station as applicable in single run without tension and without in between joints.
- The anode surface shall be free from cracks (which may reduce the performance of the anode.).
- Any cracks which follow the longitudinal direction of elongated anodes shall not be acceptable.
- Small cracks in the transverse direction of elongated anodes and in anodes of other shapes may be accepted provided the cracks would not cause any mechanical failure during service of the anode considering that the combination of cracks and lack of bond to the anode core is detrimental.
- For transverse cracks the acceptable limits shall be furnished by the bidders along with the offer.

- The anode shall be free from excessive shrinkages - maximum 10% of the depth of anode or 50% of the depth of the anode core whichever is less. The depression may be measured from the edges of one side.
- The surface of the anodes shall be free from coatings and slag/ dross, inclusions etc.
- The maximum deviation from straightness shall not exceed 2%.
- The weight tolerance on individual anodes may be taken as $\pm 5\%$. The total weight of the anodes shall not have negative tolerance.
- Recommended dimensional tolerance shall be as follows:

| | |
|------------------|-------------|
| Length | $\pm 2.5\%$ |
| Width/ thickness | $\pm 0.5\%$ |

- One Anode per heat shall be radiographed to evaluate slags, voids, inclusion etc.
- At least 10% number of anodes from each heat to be checked for conformity to dimensions & weight.
- One anode, at least shall be tested destructively to check bond between anode material and steel insert, slag, inclusion etc. Failure of one anode during the test shall make the entire anode lot liable for rejection.

5.8 Test Stations

Test stations shall be provided at an average distance of 1Km interval along the pipeline ROW for monitoring the performance of the cathodic protection system.

Test station enclosure shall be made of metal-clad cold rolled, sheet steel of at least 3 mm thickness for Non-Hazardous area, Aluminium Alloy LM-6 of requisite thickness for Hazardous area and shall be suitable for GI pipe post mounting. Test stations shall have weatherproof enclosure having degree of protection IP-55 with vandal proof arrangement. Flame proof type Ex'd' suitable for installation in Zone-I, Gas Group IIA & IIB wherever installed in hazardous areas and hinged lockable shutter. The inner and outer surfaces of test stations shall be epoxy painted. All TLPs installed in safe area shall be weatherproof type. The TLPs to be installed in hazardous area shall have flame proof and weather proof enclosure suitable for installation in zone-I/II, Gas Group IIA/IIB. Minimum IP-55 shall be applicable for all outdoor equipment.

The following locations shall be considered for Test stations:

- a. At the locations of TCP anodes.
- b. At both sides of metallised road crossings where cased crossing is considered for the crossing. At one side of the road crossing where casing pipe is not considered for the crossing. In case more than one such uncased road crossing occurs within 1Km, then only one such uncased road crossing shall be provided with test station within 1Km.
- c. At all insulating joints.
- d. At locations of reference cells, surge diverters, polarization coupons, Electrical Resistance probes, pipeline grounding through polarization cells, zinc and magnesium anodes.
- e. At both sides of railway line crossings.
- f. At both sides of major river crossings.
- g. At EHV/ HV AC/ DC overhead line crossings and along routes where EHV/ HV

- h. Overhead lines are running in parallel.
- i. In the vicinity of DC networks or grounding systems and HVDC grounding systems where interference problems are suspected.
- j. At crossings of other pipelines/ structures.
- k. Locations where interference is expected.
- l. At locations of (SV/ IP/ DT/ RT) stations.
- m. Current measurement test station for each leg of each SV cum CP stations.
- n. At any other locations considered necessary by OWNER/ OWNER's representative.
- o. The test station locations mentioned above shall override the same mentioned vide cathodic protection system general specification of TCP and PCP.

| Type of Test Station | Purpose |
|----------------------|---|
| Type-A | Potential measurement test station. There are two cables of 1c x 6 sq mm from pipeline to the test station. The minimum number of terminals on the terminal plate is four (4). Two for connection of cable and two spare. |
| Type A+1 | Galvanic Anode test station This test station is same as potential measurement test station, however it has two extra terminals for Galvanic (magnesium /zinc anodes). The minimum numbers of terminals on the terminal plate are six (6). Four for connection of cables and two spare |
| Type-B | Current Measurement Test Station There are two cables of 1c x 6 sq mm from pipeline to the test station and two cables of 1c x 10 sq mm from pipeline to test station. The minimum number of terminals on the terminal plate is six (6). Four for connection of cables and two spare. |
| Type-D | Cased Crossing with casing test station There are two cables of 1c x 6 sq mm from carrier pipeline to the test station and two cables of 1c x 6 sq mm from casing pipe to test station. In addition to the above, if the casing is coated, there are also galvanic anodes connected to the casing pipe for protection. The minimum number of terminals on the terminal plate is ten (10). Four for connection of cables, two for anodes and rest spare. |
| Type- E | Foreign Pipeline Crossing Test Station/Bond Box There is one cable of 1c x 6 sq mm from each pipeline to the test station and one cables of 1c x 25 sq mm from pipeline to test station for bonding with resistors and shunts. The minimum number of terminals on the terminal plate are eight (8). Six for connection of cables, resistors etc and two spare. |
| Type-F | Insulating Joint test station There two cables of 1c x 6 sq mm and 1c x 25 sq mm each, one from underground section of the pipeline and other from the above ground side of the pipeline to the test station .The minimum number of terminals on the terminal plate are six (6). four for connection of cables and two spare. |
| Type-H | High Tension Line Test Station |

| | |
|-------------------|--|
| | This test station shall be vandal proof type and the size should be suitable to install DC decoupling device in it. There are two cables one of 1c x 6 sq mm and other of 1c x 25 sq mm from the pipeline into the test station, one end of the 25 sq mm cable is connected to DC decoupling device and to the other connection of the device Zinc grounding Cell with 1c x 25 sq mm cable are connected for grounding the AC current. |
| Type –A+PC | <p>Polarization Coupon Test Station</p> <p>The Test station shall be same as potential measurement test station, with minimum 6 terminals for cable connection and two spare.</p> <p>There are two cables of 1c x 6 sq mm from pipeline to the test station.</p> <p>Two cables of 1c x 6 sq mm from polarization coupon, one for connection to pipeline for protection and other for potential measurement. The protection cable shall be connected through a magnetic reed switch inside the test station to enable measurement of coupon 'OFF' potential.</p> <p>A permanent reference electrode shall be installed adjacent to the coupon in a manner so as to measure the representative potential of the coupon.</p> |

Between the pipeline and foreign pipelines or structures that may exist in common ROW. Test stations for bonding shall be provided with shunt and resistor as a means to monitor and control current to ensure zero net flow of current from one to the other.

A section of pipeline under consideration may be laid parallel to existing pipelines. Due consideration is to be given to avoid any mutual interference with the existing pipelines and during mutual interference survey, if required, bonding station shall be provided.

The bond stations will be essentially similar to test station in construction. Provision shall exist for the isolation of the bonding by means of a suitable link. The location of the bond stations shall be as per the approved system design & site conditions. Bonding point shall also be provided at the crossing points wherever these lines cross each other.

Test stations used for sacrificial anodes shall have shunt for measurement of individual anode current, and provision of resistance to limit & control the anode current output.

Test station with current measuring facility shall be provided at each intermediate CP station drainage point (to measure pipeline current on any one or both side of the pipeline from drainage point), at interference prone areas, on both sides of major river crossings and at least at two additional locations along the pipeline ROW between two CP stations.

The test stations shall be installed with the front of the test station facing the pipeline. The name plate of test stations shall in minimum carry following information.

- Test station number
- Chainage in km
- Test station connection scheme type
- Distance from pipeline in meters
- Direction of product flow

Terminal blocks and different scheme of wiring as required shall be provided in the test station as per the test station connection scheme sketch.

The location of all the test stations, shall be marked with their connection schemes and other relevant information on alignment sheets. A detailed test station schedule shall be prepared.

5.9 Painting

The sheet steel used for fabrication of TLP's / junction boxes / pipe support structures shall be thoroughly cleaned and degreased to remove mill scale, rust, grease and dirt and shall be pickled and then rinsed to remove any trace of acid. The cleaned steel surface shall then be primed by applying a coat of phosphate paint and a coat of yellow zinc chromate primer. The primed surfaces shall be free from all imperfections before undertaking the finished coat. After preparation of the priming the steel surface, spray painting with two coats of final paint shall be done. The final paint shall be 1 Coat of 2 Pack high build epoxy with Polyamide hardener cure @100 µ DFT/coat followed by 1Top coat of Acrylic Polyurethane finish paint @40 µ DFT/coat.

The finished junction box/ TLP's shall be dried in oven in dust free atmosphere. The final finished coat be free from imperfections like pin holes, orange peels, run off paint etc.

All unpainted steel parts shall be cadmium plated to prevent rust formation.

5.10 CP at Cased Crossing

At other cased crossings, it is advised properly install casing and carrier such as no shorting is observed between the casing and carrier pipe. Casing /carrier testing to remove any shorting. The contractor is to make sure the casing and carrier are isolated at the time of installation. If shorted, it is advised to remove the shorting at the time of installation and then hook-up the pipeline.

The ends of the casing and carrier pipe shall be properly sealed using a good quality and reputed make casing end seal to avoid any ingress of water.

The coated casing shall be protected additionally by independent (from carrier pipe protection system) sacrificial anode installations. The sacrificial anode installations shall be provided at both ends of casing. The anode installation shall be sized based on the permanent CP design parameters specified for the main pipeline.

5.11 Polarization Coupons

The Polarisation coupons as of the same material as the pipeline and shall be installed along the pipeline to monitor the adequacy of the CP system to polarize/protect coating holidays. Coupon shall be installed at CP station drain points, mid points along the pipeline, at locations where pipeline is bonded to foreign pipeline/structures, interference prone areas, marshy areas and at other locations such that minimum one coupon is installed maximum every 10 km approximate or the maximum interval specified in the project specification/data sheet, along the pipe line.

Coupons shall be installed at bottom 1/3rd portion of the pipeline and 250mm approx away from the pipe surface.

Coupons are the exact replica of the pipeline, a steel plate of size 100 mm x 100 mm where an artificial coating defect of 1 cm² is created and exposed to soil. Two cables one for connection to pipeline for protection and other for potential measurement shall be provided for each coupon. The protection cable shall be connected through a magnetic reed switch inside the test station to enable measurement of coupon 'OFF' potential.

A permanent reference electrode shall be installed adjacent to the coupon in a manner so as to measure the representative potential of the coupon.

5.12 Cables

Cables shall be annealed high conductivity, tinned, stranded copper conductor, XLPE insulated 650V/1100V grade, PVC sheathed FRLS. The cable details are:

- 1c x 10 mm², un armoured , anode tail cable from anode to test station and pipeline to test station. The length of cable shall be sufficient enough to reach the test station.
- 1c x 10 mm² cable from pipeline to test station at current measurement test stations.
- 1c x 6 mm² potential measurement cable from pipeline to test station at potential measurement test station location.
- 1c x 25 mm² , SWA, cable for bonding, polarisation cell / grounding cell and surge diverter connection purpose.
- Reference electrode cable / Polarization coupon Cable: The cables for reference cells and coupon shall be of size 1c x 6 mm² and shall be un-armoured

5.13 SURGE DIVERTER

Surge diverter shall be connected across each monolithic isolation joint to protect it from high voltage surges.

Surge diverter shall be provided for the protection of insulating joints located at the ends of the pipe line/at terminals & in between.

The total system including cable, cable termination, anodes/surge diverters shall be suitable for the anticipated fault current magnitude at the location of its installation. The surge diverters shall be of spark gap type and explosion proof type.

Surge diverters shall have the following minimum rating:

| Description | Rating |
|---|--|
| Type | Spark gap, explosion proof type |
| Current (10/350 micro second) | 50/ 100 kA |
| Power frequency spark over AC voltage – 50 Hz | Max 1.2 kV |
| Spark over AC voltage - Impulse (1.2/50 micro second) | 2.2 kV |
| Class of Lightning current carrying capability | H |
| Tested as per standard | EN/IEC 62561-3 |
| Pre-wired cable length | Specific length based on pipeline diameter |

5.14 SOLID STATE DECOUPLER & GROUNDING CELL

At the crossing or parallel run of pipeline and overhead HT line of 66 KV and above, the pipeline shall be grounded through solid state de-coupler /device for blocking cathodic protection DC voltage while allowing a conducting path for steady state AC current, AC induced fault current and lightning surges. The ac induced potential recorded on the pipeline in the vicinity of HT line shall not exceed 15V at full operational load of the powerline.

In case of parallelism, the TLP shall be installed every 1km, however if the induced AC is greater than 15V, additional protection TLP shall be provided as per decision of the EIC.

The solid state decoupler shall be grounded through a zinc grounding cell minimum weight 20 kg(2 plate), which shall either be of a 2 or 4 plate design to ensure the overall ground resistance to be less than 5 ohm.

The grounding system comprising of a combination of DC de-coupler and grounding cell shall be decided based on the AC interference mitigation report, to ground any surges in the pipeline potential that may appear in case of faults (phase to phase or phase to ground) in overhead transmission line.

Solid State Decoupling Device with tubular zinc anodes shall be installed near HT line crossings and at MOV locations in the mainline.

The solid state decoupler device shall be installed in a vandal proof steel housing by the contractor.

Unless otherwise specified the minimum rating of grounding cell and polarisation cell shall be as below:

i. **Grounding Cell(Zinc)-Solid anode**

| | | | |
|---|-------------------------|---|--|
| - | Type | : | 2 or 4 plate type |
| - | Dimension of Zinc Anode | : | As per vendor |
| - | Bare weight | : | 20 Kg(2 plate) |
| - | Weight of backfill | : | 70 Kg. |
| - | Prepackaged weight | : | 110 Kg. |
| - | Open Circuit potential | : | -1.05 to -1.11V (W.r.t. Cu-CuSO ₄) |
| - | M.S. Insert Dimension | : | As per vendor |
| - | Tolerance | : | Length $\pm 2.5\%$, Width $\pm 5\%$, Thickness $\pm 5\%$ |
| - | Current capacity | : | 750 Amp Hr/Kg |
| - | Actual consumption | : | 11.2 Kg/Amp-Year |

ii. **Solid state DC Decoupler**

| | | | |
|---|---|---|---------------------------|
| - | Type | : | <i>Solid state device</i> |
| - | Block DC Voltage (Blocking level) | : | (-) 2 V to (+) 2 V |
| - | AC rms steady state current rating at 50 Hz | : | 45 Amp |
| - | Fault current capacity at 50 Hz (0.5 sec) | : | 5 kV |
| - | Lightning surge current rating (10X 350 μ s waveform) | : | 100kA |
| - | Mounting | : | Flat surface |

The Zinc (Zn) grounding cell shall be sized for the life of the permanent CP system and the surge magnitude taking into account the current discharge from the anodes. The grounding system shall have minimum resistance to earth to restrict the pipeline voltage (PSP) as per NACE protection criteria.

5.14 Installation

5.14.1 Installation of test lead points (TLP):

The TLPs consist of a weather proof test lead box made up of sheet steel with a minimum 200 mm x 160 mm x 6 mm bakelite strip fitted inside, a M.S. pipe of 100 mm nominal dia heavy gauge conforming to IS:1239, threaded and connected to the test lead box at one end, with a Tee connection at the other end for taking out the lead cable and with a mild steel base plate welded at bottom measuring 250 mm x 200 mm x 6 mm, cement concrete grouted underground and for bolting the TLP post to the foundation MS galvanized anchor bolt M 10 x 150 shall be used. The enclosure of TLP box shall be vandal proof and shall also have Godrej concealed lock with master key locking etc. The TLP box shall be at a minimum height of 1.2 m above ground. The TLP box shall be installed at 1.2 M from the pipeline on the narrower side of the pipeline ROW.

The TLP box shall be hinged type and additionally fixed further with the help of many allen studs and nuts as a step towards vandal proofing. All cable connections shall be from inside onto brass studs fixed on bakelite strip with studs projecting outside the box, kept fastened with the box plate surface to facilitate easy access from outside for taking PSP readings.

A separate top shelf has to be included in the TLP box for keeping PSP record card which may have a separate small cover overlapping with main cover, having hinge at upper end and studs at lower end. The bakelite strip inside the test lead box shall have minimum twelve terminal points with 4 mm brass bolts and ON/OFF toggle switch for corrosion coupon, with double nuts and washers. Length of the bolts shall be minimum 50 mm. The TLP from the pipeline shall be brought upto the bakelite strip and connected to one of the brass terminal bolts by using a copper cable end lug of appropriate size connected to the end of the lead cable either by soldering or by crimping.

It shall be the endeavor of the contractor to see that jointing of CP cables to the pipe are mostly made at the "Cut back areas" of the pipe wherever possible, but not at the weld seam of the pipe. In case the jointing is made at the "Cut back areas", no separate PERP repair patch is required, as the same will be taken care with joint coating sleeve itself. Where the yard coating is removed for the purpose of cables jointing to pipe, PERP repair patch or equivalent detailed earlier should be used for repairing the damaged coating.

5.14.2 Cable Laying

Cables shall be laid in accordance with approved layout drawings to be prepared by the contractor. No straight through joint shall be permitted in a single run of cable. Cable route shall be carefully measured and cables cut to required length.

All cables inside station / plant area shall be laid at a depth of 0.70 meter. Cables outside station / plant area shall be laid at a depth of 1.5 meter. Cables shall be laid in sand under brick cover back filled with normal soil. Outside the station / plant area the routes shall be marked with polyethylene cable warning mats placed at a depth of 0.9 meter from the finished grade.

RCC or GI pipes of proper size shall be provided for all underground cables for road crossings.

Cables shall be neatly arranged in trenches in such a manner that crisscrossing is avoided and final take off to equipment is facilitated.

Cable root markers shall be installed above ground at suitable intervals.

In no case cables shall pass from below underground pipeline. All cables shall be placed above underground pipeline and tightened with tape.

5.14.3 Cable to Pipe Connections

All cable connections to the pipeline including charged foreign pipeline (if any) shall be made using an (Owner) approved exothermic process e.g.: Pin Brazing or cad welding.

The pin brazing to have the following characteristics:

- Extremely low contact resistance $\leq 0.1 \Omega$.
- Low transition resistance 7.5 to 14 $\mu\Omega$ per brazed joint
- High mechanical strength Binding strength 490 N/mm²
Shear Strength 245 N/mm²
- Brazing temperature 650^o C
- Time per Braze 2 Seconds
- Weather Effect Suitable for all weather operation
- Life 35 Years

REPAIR OF DAMAGED COATING:

The Coating removed for the purpose of thermit welding/ Pin brazing, the lead cable to the pipe shall be duly repaired by the contractor including supply of required material. The coating being yard coated, 3LPE type, proper material and method to be chosen for repairing of coating.

The contractor should submit the detailed procedure for such repair for approval of the OWNER/CONSULTANT/ OWNERS REPRESENTATIVE.

5.14.4 Civil Works

All civil works associated with the complete cathodic protection work shall be included in the scope of CP contractor. This shall include providing cable trenches, foundation for equipment and all test stations etc.

5.14.5 Testing and Inspection At Works

Owner/ Owner's representative shall visit the works during manufacture of various equipment (Anodes, Cables, Test Lead Points etc.) to assess the progress of work as well as to ascertain that only quality raw material and fabrication technology is used for the same. All necessary assistance during such inspections shall be provided by the contractor/fabricator to Owner's representative.

Pre-packaged anodes damaged as a result of improper handling or due to any other reason, shall be replaced / re-packaged to OWNER's/CONSULTANT's satisfaction

The minimum testing, inspection requirements for all components / equipment shall conform to the requirements as defined in the relevant codes and standards. Detailed inspection and testing procedures along with the acceptance criteria, including various stages where hold points, review etc shall be for owners inspection, shall be prepared by CONTRACTOR for Owner's approval.

Test certificates including test records, performance curves etc. shall be furnished. All test certificates shall be endorsed with sufficient information to identify equipment to which the certificate refers to and must carry project title, owner's name and purchase order details etc.

Owner reserves the right to ask for inspection of all or any item under the contract and witness all tests and carry out inspection or authorise his representative to witness test and carry out inspection. CONTRACTOR shall notify the Owner or Owner's representative at least 20 days in advance giving exact details of tests, dates and addresses of locations where the tests would be carried out.

Inspection and testing for TCP materials shall be as per the quality assurance plan.

5.14.6 Packing and Transport

All equipment/ material shall be protected for inland/ marine transport, carriage at site and outdoor storage during transit and at site. All packages shall be clearly, legibly and durably marked with uniform block letters giving the relevant equipment/ material details. Each package shall contain a packing list in a water proof envelope. Copies of the packing list, in triplicate, shall be forwarded to owner prior to despatch. All items of material shall be clearly marked for easy identification against the packing list.

Storage arrangements shall be approved by the OWNER/CONSULTANT/ OWNERS REPRESENTATIVE/ OWNERS REPRESENTATIVE.

5.13.7 Commissioning

TCP commissioning shall be in parts along with pipeline lowering. However, the final commissioning shall be considered after laying of the complete section (IJ to IJ) of the pipeline , upon providing protection to the pipeline section.

The natural pipe to soil potential shall be measured before connecting the anode to pipeline & recorded in the given format.

The open circuit potential of anodes shall be measured and recorded in the approved format.

The anodes shall then be connected to the pipeline through the test station. The instant OFF pipe to soil potentials (PSP) shall be measured & recorded after connecting anode to pipeline in the given format. Also, the amount of current shall be recorded via shunt provided with the anode. The pipe to soil potential observation shall be repeated after connecting the anodes and allowing sufficient time for polarisation (48-72 hrs).

At the locations of cased crossing, the PSP of the casing pipe before and after connection of anodes shall be recorded. It has to be ensured that there is no shortening of casing with the carrier pipe.

At the location of IJ, the PSP on the protected and unprotected side of IJ shall be recorded. It has to be ensured that Zinc grounding cell connected to the unprotected side of IJ shall be disconnected prior to recording of readings. Confirmation on shortening of IJ shall be provided in the report.

At all TLP locations, Induced AC on the pipeline shall be recorded, the same shall be less than 15V. Also, the grounding resistance of the Zinc grounding cell shall be checked and recorded, it shall be less than 5 ohm.

At the locations of polarisation coupon, natural potential of the coupon before connection to the pipeline shall be recorded .Also, the ON potential of the coupon after connection to the pipeline along with Instant OFF potential on the coupon to be recorded.

Monitoring of TCP system shall be carried out every month till commissioning of PCP system.

In case of insufficient protection as per the NACE CP design criteria on any section of the pipe line, CONTRACTOR shall carry out necessary additions/ modifications to the provided protection in consultation with the ENGINEER so that NACE criteria is met without any cost implication.

5.13. SYSTEM TESTING

5.13.1.1. SYSTEM TESTING AT SITE

Contractor shall furnish the detailed field testing and commissioning procedure for approval. Field tests as per the approved procedures shall be carried out on the equipment / systems before being put into service. The acceptance of the complete installation shall be contingent upon inspection and field test results being satisfactory.

Before the CP facilities are placed in operation all necessary tests shall be carried out to establish that all equipment, devices, wiring and connection, etc. have been correctly installed, connected and are in good working condition as required for intended operation.

Owner / Owner's representative may witness all the tests. At least one week's notice shall be given before commencing the tests.

All tools, equipment and instruments required for testing shall be provided by CP CONTRACTOR.

Generally following tests shall be carried out and recorded in format given in subsequent clauses.

| | | |
|------------|---|---|
| Checking | : | Visual inspection, comparison with drawings and specifications. |
| Inspection | : | Detailed physical inspection & dimensions measurement |
| Testing | : | Simulation tests of equipment to determine its operational fitness. |

i. Cables

- Cable no.
- Voltage grade
- Conductor cross section
- Continuity check
- Voltage test
- Insulation resistance values between core and earth and two cores.
- All control cables shall be tested by 500 V megger and all low tension power cables shall be tested by a 1000 V megger.

ii. Insulating Joints

Checking of insulating joint for leakage, before and after energisation of C.P by means of insulating joint tester. Structure-to-electrolyte potential of both protected and non-protected sides of insulating joint shall be checked before and after energisation of CP system. Surge divertor shall be connected thereafter.

iii. Surge diverter

- Location/ identification number
- Ratings
- Check for healthiness

iv. Solid State decoupler

- Location/ identification number
- Rating
- Check for continuity
- Check for wiring
- Check for standby current drain with CP energisation (current drain with respect to voltage across the device/cell shall be recorded).

Copies of all test results shall be submitted as specified and as approved by the OWNER/CONSULTANT/ OWNERS REPRESENTATIVE. The Contractor shall duly attest these copies of test.

The Contractor shall provide skilled labour, personnel, tools, equipment and instruments required for testing. The equipment that has been tested to the satisfaction of OWNER/CONSULTANT/ OWNERS REPRESENTATIVE shall be provided with a tag. The tag shall be dated and signed by Contractor and OWNER/CONSULTANT/ OWNERS REPRESENTATIVE.

5.14. DRAWINGS AND DOCUMENTS

General

Within two weeks from the date of issue of PURCHASER ORDER, CONTRACTOR shall submit six copies of the list of all drawings/ data manuals/procedures for approval, identifying each by a number and descriptive title and giving the schedule date. This list shall be revised and extended, as necessary, during the progress of work.

All drawings and documents shall be in English and shall follow metric system. Number of copies of each submission shall be as follows unless otherwise specified.

Within two weeks after award of work, CONTRACTOR shall submit the list of all drawings, data, manuals, procedures, schedule for approval, identifying each by a number and descriptive title and giving the schedule data. This list shall be revised and extended, as necessary, during the progress of work.

| <u>Submission</u> | <u>No. of copies</u> |
|---|-------------------------|
| a. For review / approval | 6 copies |
| b. Final/ As built drawings execution/ construction | 6 copies + 2 set of(CD) |
| c. Drawings issued for execution/ construction | 6 copies + 2 set of(CD) |

- d. Operation/ Maintenance manual, vendor data 6 copies + 2 set of(CD)
- e. Original permissions for Interference detection and Mitigation from other utility owners.
- f. The Original deed for Anode Bed Plot shall be handed over to Owner.

All drawings shall show the following particulars in the lower right hand corner, in addition to CONTRACTOR'S Name :

- a. OWNER's name
- b. Project title
- c. Title of drawing
- d. Scale
- e. Date of drawing
- f. Drawing number
- g. Space for OWNER's reference.

In addition to the information provided on the drawings, each drawing shall carry revision number, date of revision and brief details of revisions carried out.

5.15. CONTRACT DRAWINGS AND DOCUMENTS

As a part of the contract, drawings and documents shall be furnished this shall include but not be limited to the following:

Drawings submitted by CONTRACTOR for review/ approval shall be returned to CONTRACTOR duly commented. It shall be the responsibility of the CONTRACTOR to correctly incorporate all the comments conveyed by OWNER/CONSULTANT/ OWNERS REPRESENTATIVE on the drawings.

- a. Report on corrosion survey
- b. Design basis and calculations, equipment selection criteria, sizing calculations.
- c. Bill of material, material requisitions, purchase requisitions.
- d. Quality assurance / Quality control procedures

5.16. DRAWINGS AND DOCUMENTATIONS

CONTRACTOR shall within two weeks after award of work be required to submit following drawings for OWNER/CONSULTANT/ OWNERS REPRESENTATIVE's approval prior to procurement of materials and fabrication.

- a) TCP system design calculation, material selection and sizing calculations
- b) Bill of Materials for complete TCP system
- c) General arrangement drawing of Sacrificial anode
- d) Installation and connection scheme drawing for different types of test stations.
- e) Installation and connection scheme drawings with following variations:
 - Single anode installation

- Multi anode installation

- f) Procedure for Thermit welded jointing / Pin Brazing.
- g) Vendor drawings, catalogues and test certificates
- h) Marked alignment sheets for installation and identification along with a separate schedule of Test Station
- i) QA/QC Procedures
- j) Field testing and commissioning procedure
- k) Commissioning report including various measurement data at each test stations
- l) Work progress formats
- m) Monitoring and testing report formats
- n) Pipe coating repair procedure
- o) Thermit welding/ Pin brazing procedure for connection of cable to pipe
- p) Magnesium Anode installation procedure

Detailed construction drawings (including as built status)

- a. Sacrificial anode fabrication drawings
- b. Typical layout drawing for anode ground bed installation and connection.
- c. Equipment layout, cable layout and schedules.
- d. TLP Erection / Installation Details Drawing
- e. Polarisation coupon and Permanent Cu-CuSO₄ reference electrode installation drawing
- f. Fabrication, installation details of surge diverter.
- g. Any other required drawing as per direction of Engineer-in-charge.
- h. Cable- to-pipe joint details for charged and non charged pipelines.
- i. Detailed commissioning report including various measurement data at all test stations etc.
- j. Vendor drawings and catalogues, test certificates.
- k. Equipment inspection and testing procedure
- l. Construction, installation procedures
- m. Field testing and commissioning procedures
- n. Procedure for monitoring of cathodic protection after commissioning
- o. Miscellaneous

6. APPROVED MAKE OF EQUIPMENT / COMPONENTS FOR C.P. SYSTEM

All CP material /Equipment shall be supply as per CUGL approved vendor list (Enclosed with tender).

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|--|---|--|
| | PTS – ELECTRO FUSION FOR PE PIPES & FITTINGS | |
| | Doc. No. P.014714 G 11077 M007 | |

CENTRAL U.P. GAS LIMITED (CUGL)

**LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN
BAREILLY, KANPUR & UNNAO AND JHANSI GAS**

PTS – ELECTRO FUSION FOR PE PIPES & FITTINGS

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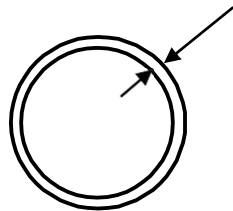
1.0 ELECTRO FUSION FOR PE PIPE..... 2

1.0 ELECTRO FUSION FOR PE PIPE

1.1 Electro Fusion Fitting Jointing

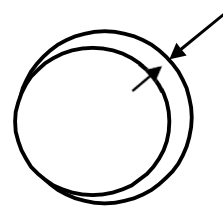
- 1.1.1 For electro fusion fitting jointing, an electrical resistance element is incorporated in the socket of the fitting which, when connected to an appropriate power supply, melts and fuses the materials of the pipe and fitting together.
- 1.1.2 The effectiveness of this technique depends on attention 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 surfaces area clean. Also, the pipe should be checked for ovality. If ovality causes a gap between concentrically located pipe and the fitting to exceed 1% of the pipe OD, the pipe must be re-rounded 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.

Max gap 1% of pipe OD



Concentrically
Located

Max gap 2% of pipe OD



Eccentrically
Located

- 1.1.3 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.
- 1.1.4 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.
- 1.1.5 The equipment and procedures following relate to fittings with center stops. If fittings without center stops are used, the maximum insertion depth must be clearly marked on the pipe ends prior to jointing (felt tip pen).

Equipment

- a. The control box input supply is to be from a nominal 240V generator, which is normally of approximately 5kVA capacity. The nominal output of the generator is to be 240V + 15%, - 10% between no load and full load. Control boxes are to include safety devices to prevent excessive voltages being present at the control box output. The safety device 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 into the trench.

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

- e. Protection against adverse weather conditions.

1.2 Electro Fusion Jointing Method / Procedure

Preparation

- a. Ensure there is sufficient space to permit access to the jointing area. In a trench, a minimum clearance of 150 mm is required.
- b. Check that the pipe ends to be jointed are cut square to the axis of the pipe and any burrs removed.
- c. Wipe pipe ends using clean lint-free material to remove traces of dirt or mud, etc...
- d. Mark the area over which the oxidized pipe surface is to be removed, i.e. In excess of the insertion depth, on each pipe to be jointed 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 be removed from the packaging at this stage.

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

- h. Remove the fitting from its packing and clean the scraped 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 Regulations.

- i. Check that the pipe clamps are of the correct size for the pipes to be jointed.
- j. Insert the pipe ends into the fitting so that they are in contact with the center stop.
- k. Using the pipe clamps, secure the pipes so that they cannot move during the fusion cycle. Check that the pipe ends and the fitting are correctly aligned.
- l. Check that there is sufficient fuel for the generator to finish the joint. Start the generator and check that it is functioning correctly.
- m. Switch on the control box.
- n. Connect the control box output leads to the fitting terminals and check that they have been fully inserted.

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

Note 1: Automatic control boxes are available which obviate the need to enter the fusion time.

Note 2: Gloves and goggles should be worn during the Fusion process.

- o.** Press the start button on the control box and check that the heating cycle is proceeding as indicated on the display.
- p.** On completion of the heating cycle, the melt indicators should have risen. If there is no apparent move in the melt indicators, the joint should be cut out and a fresh joint made (See note 3 below).
- q.** If a satisfactory joint has been made, the joint is to be left in the clamps for the cooling time specified on the fitting or 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 generator. **DO NOT** attempt a second fusion cycle within one hour / cooling of joint at Ambient Temperature of the first attempt.

1.3 Records

Records of appropriate servicing and calibration shall be kept.

1.4 Training

It is necessary that operators, inspection and supervisory personnel acquire the skills of electro fusion fitting fusion. The necessary training should be carried out by a 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 fitting joints from pipes and fittings of different sizes.
- ❖ Inspect for and identify joints of acceptable quality.

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.

1.5 Electro Fusion Saddle Jointing

- a.** With electro fusion saddle jointing, an electrical resistance element is incorporated in the base of the saddle which, when connected to the appropriate power supply, melts and fuses the material of the fitting and the pipe together.
- b.** The success of the technique depends on effective preparation of the jointing surfaces, in particular the removal of the oxidized surface of the pipe over the area equivalent to the area of the saddle base, and cleaning of the pipe surfaces.
- c.** Methods of holding the tapping tee saddle during the fusion cycle are used namely, top loading and under clamping. The general parameters are similar. In some cases, if the manufacturer's procedure for holding the fitting is provided, then the same should be followed during the fusion cycle.

1.6

Electro Fusion Saddle Jointing Method / Procedure

Preparation

- a. Expose the pipe onto which the tapping tee is to be assembled, ensuring there is sufficient clear space around the pipe. In a trench, a minimum clearance of 150 mm is required.
- b. Clean the pipe over the general area on which the saddle is to be assembled using clean, disposable lint -free material.
- c. Without removing the fitting from its packaging, place it 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.
- d. Remove the surface of the pipe to a depth of 0.2 to 0.4 mm over the full area marked using a suitable tool. Remove the swarf.
- e. Connect the electro fusion control box input leads to the generator.
- f. Check that the reset stop button, if fitted on the control box, is in the correct mode.
- g. Remove the two halves of fitting from its packing and clean the scraped 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 again that while Iso-propanol is a suitable cleaner, its use is subject to local Health and Safety Regulations.

- h. 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 the scraped pipe.
- i. Check that there is sufficient fuel for the generator to complete the joint. Start the generator and check that it is functioning correctly.
- j. Switch on the control box if applicable.
- k. Connect the control box output leads to the fitting terminals and check that they have been fully inserted.
- l. 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 is shown on the control box display.

Note 1: Automatic control boxes are available which obviate the need to enter the fusion time.

Note 2: Gloves and goggles should be worn during the jointing process.

- m. Press the start button on the control box and check that the heating cycle is proceeding as indicated on the display.
- n. 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 joint from its base.

- o.** 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 by 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 generator. DO NOT attempt a second fusion **cycle within one hour of the first attempt.**

Note 4: 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.

Note 5: DO NOT attempt to tap the main with the integral cutter for at least 10 minutes after completion of the cooling cycle.

1.7 Records

Records of appropriate servicing and calibration of Electro Fusion machines/ joints shall be kept.

1.8 Training

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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.

1.9 Stopping the gas flow

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

1.10 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 the outside of the pipe. The bars are brought together, either manually or hydraulically, squeezing the pipe material together until a seal is formed where the upper and lower walls meet.
- c.** The hydraulic machines should have a spring return for the jack and locking to prevent accidental release of pressure during operation. All squeeze-off machines should be fitted with check plate or stops to avoid over compression of the pipe.
- d.** Where the pipe walls are compressed the polyethylene pipe will be severely deformed in the regions of maximum compression. The pipe will eventually regain its original shape after squeezing but there will be some reduction in the pressure bearing properties.
- e.** A complete stop may not always be obtainable because of wrinkling of the inside of the pipe. If a complete stop is required then a second squeeze can be used, with an intermediate vent to remove the gas which passes the first squeeze from say the trench area. A second squeeze-off procedure should be a minimum of three pipe diameters and right angles to the initial 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 a squeezing operation.

1.11

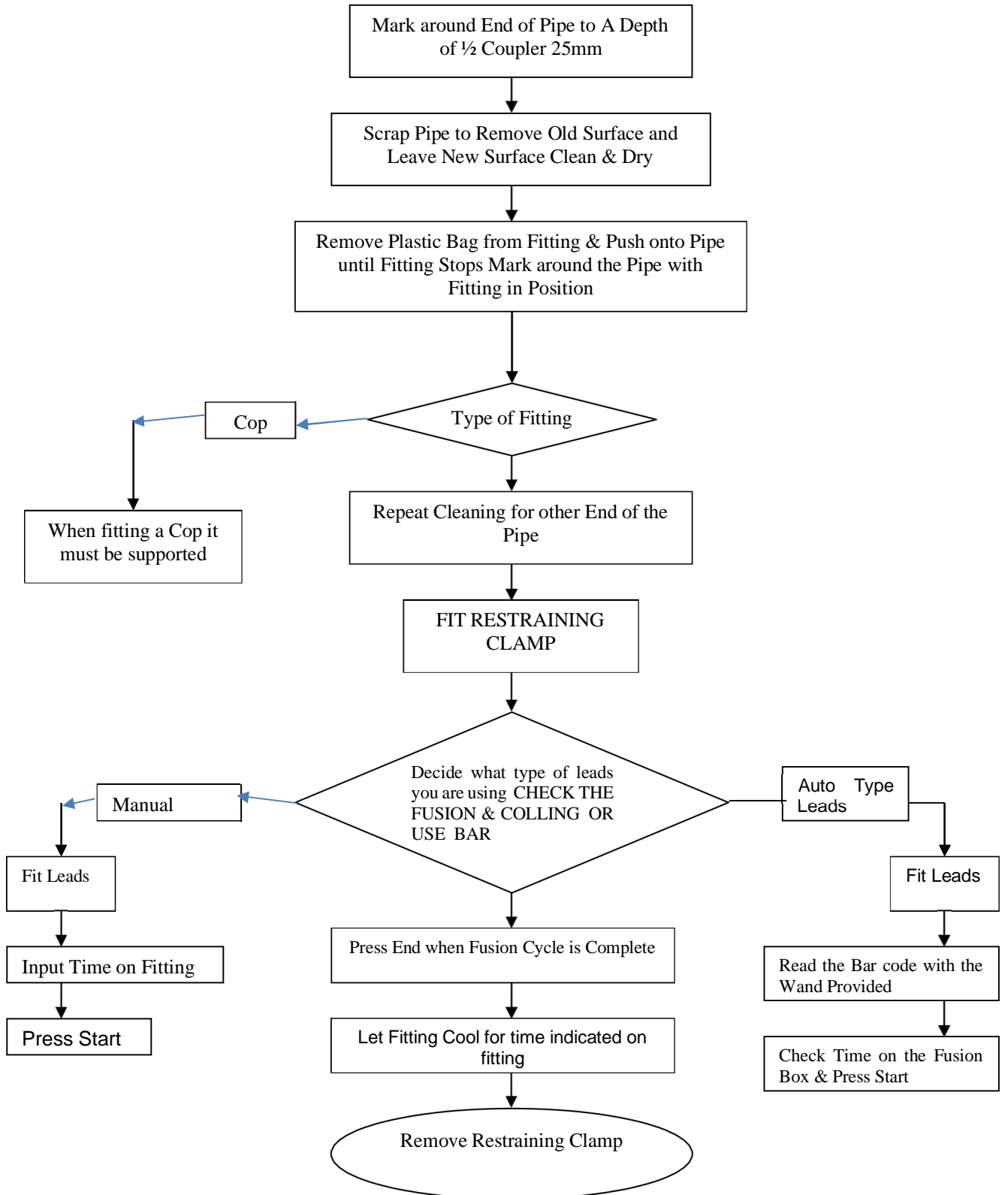
Bending-Back

Bending back of the pipe may be performed where the pipe has been severed damaged and stopping the gas flow is imperative. Its application is of a temporary nature, and will provide 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 severe ness of the bend back operation. The need for 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 a service may be achieved by opening up on an installed saddle tee and winding down the internal tapping tool to shut off the flow into the service pipe.

ATTACHMENT # 1

FUSION COUPLERS FROM 20MM TO 180MM



CENTRAL U.P. GAS LIMITED (CUGL)

**LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN
BAREILLY, KANPUR & UNNAO AND JHANSI GAS**

PTS – FITTINGS & FLANGES

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1.0 GENERAL

Central U.P Gas Limited (CUGL) plans to augment PNG network under City Gas Distribution Project. It supplies natural gas to domestic & commercial consumers in the city of under City Gas Distribution Project in Bareilly, Kanpur & Unnao and Jhansi GAs.

The fittings & flanges have to be delivered in accordance to the particular specification: Codes, Norms and standards (latest revision); but not limited to:

| | |
|------------------------|---|
| ANSI B16.5 | Pipe flanges and flanged fittings |
| ANSI B16.9 | Factory - made wrought steel butt welding fittings. |
| ANSI B 16.11 | Forged steel fittings |
| ANSI B16.28 | Wrought steel butt welding short radius elbows and returns |
| ANSI B31.3 | ASME code for process piping. |
| ANSI B31.8 | Gas transmission and distribution piping systems. |
| ANSI B36.10 | Welded and seamless wrought steel pipe |
| ANSI B16.25 | Butt Welding Ends |
| ASTM A 105/ A 105 M | Forging, carbon steel, for piping components. |
| ASTM A 203 | Pressure vessel plates, alloy steel, nickels |
| ASTM A 234/ A 234 M | Piping, fittings of wrought carbon steel and alloy steel for moderate and elevated temperatures |
| ASTM A 333 | Seamless and welded steel pipe for low temperature |
| ASTM A 350/ A 350 M | Forging, carbon and low alloy steel, requiring notch toughness testing for piping components. |
| ASTM A 370 | Mechanical testing of steel products. |
| ASTM A 420/ A 420 M | Piping fittings of wrought carbon steel and alloy steel for low temperature service. |
| ASTM E 112 | Standard methods for determining the average grain size. |
| MSS SP 25 | Standard marking system for valves, fittings, flanges and unions. |
| MSS SP 55 | Quality standard for steel castings for valves, flanges and fittings and other piping components (visual method). |
| MSS SP 75 | Specification for high test wrought butt welding fittings. ASME Boiler and Pressure Vessel code. |
| MSS SP 44 | Specification for Steel Pipeline Flanges |
| MSS SP 97 | Specification for Forged Carbon steel branch outlet fittings – Socket, Threaded and Butt Welding ends. |
| DIN 2413 | Design of Steel Pressure Pipes |
| EN 10204 | Type of Inspection documents |
| ISO 148 | Metallic Material - Charpy Pendulum impact test |

ISO 9001 Quality management standard

The present specification can confirm, complete or alter certain characteristics or tolerances of existing laws or specifications.

In his offer, the manufacturer or vendor shall specify all proposed modifications or alternatives to the present specification. In all cases, each modification has to be submitted to the Client/Consultant. All consequences after eventual order for non-respect of this obligation are at the manufacturer's charge and responsibility.

A valid copy of the ISO 9001 certificate shall be included in the offer.

The Owner / Owner's representative keeps the right to audit the manufacturer's and their subcontractor's manufacturing process and control methods.

The manufacturer's specification of the steel, the manufacturing procedure itself and the laboratories in which testing takes place, shall be approved by the client/consultant.

The Owner/ Owner's representative may verify the control equipment of the manufacturer, its calibration and the points at which it is located. If during the control of the fittings certain problems arise the Owner/Owner's representative may demand supplementary tests at the cost of the manufacturer.

At all times while work on the contract of the Client is being performed, the inspector representing the Client shall have free entry to all parts of the manufacturer's facilities and those of all subcontractors, who are involved in the manufacturing of the fittings. All reasonable facilities shall be afforded to the inspector to satisfy him that the product is being furnished in accordance with these specifications. All tests and inspections called for by these specifications will be made in the manufacturer's plant prior to shipment and at the manufacturer's expense, unless otherwise, and shall be conducted as not to interfere unnecessarily with the operations of the manufacturer's plant. The manufacturer shall notify the Client prior to completion or shipment of all fittings requiring such inspection.

Eventual interpretations and deviations to this specification by the Manufacturer shall be requested by writing in his offer with detailed justification and approved by the Client/Consultant before eventual order to the Manufacturer. The latter is responsible and shall indemnify the Client/Consultant for any damage resulting from the non-respect of this obligation.

An approval of documents can never be considered as an acceptance of deviations or relaxations to requirements. A deviation is only possible after specific request to the Client/Consultant.

1.1 Glossary

| | |
|---------------------------------|---|
| Client/Owner | Shall mean the Purchaser of fitting & Flanges as mentioned in “ Introduction” chapter. |
| Manufacturer | means the Manufacturer of the Fittings & Flanges |
| PTS | means the present «Particular Technical Specification » and all its appendices, if any. |
| Third Party | |
| Inspection Agency (TPIA) | means the Inspection Agency |

Representative

The entity of the Client or the company nominated by the Client to design the natural gas transport or distribution system and to specify the equipment

2.0 DESIGN AND CONSTRUCTION

2.1 The pressure temperature ratings for tee, weldolets, elbows and flanges shall be calculated respectively in accordance with ANSI B31.8, DIN2413 and ANSI B16.5. For all other types of fittings (caps, reducers, nipple) ASME section VIII shall apply.

The standard dimension shall be in accordance

Flanges such as weld neck flanges and blind flanges shall conform to the requirements as follows - ASME B16.5 upto sizes DN 600 mm (24") excluding DN 550 mm (22"),

- MSS-SP-44 for sizes DN 550 mm (22").

- With ANSI B16.9 for the tees, reducers and elbows (except for short radius elbows which should be in accordance with ANSI B16.28)
- All Butt welded end fittings up to 16" such as tees, elbows, reducers, etc. shall conform to ASME B16.9. Socket weld and screwed end fittings shall conform to ASME B 16.11.
- All butt welded end fitting above 16" such as tees, elbows, reducers, etc. shall be comply with the requirement of MSS-SP-75.

Fitting such as weldolets, sockolets, nipplet, etc shall be manufactured in accordance with MSS-SP-97.

With ANSI B 16.9 for the caps,

With ANSI B 36.10 for the nipples,

And with ANSI B16.5 / MSS SP 44 for the flanges

2.2 The temperature and pressure range shall be as per the relevant piping specifications.

2.3 The wall thickness shall meet the following requirements:

2.3.1 The maximum allowable stress in the base material and in the weld shall be equal to fourty per cent (40%) of the minimum yield strength guaranteed by the specification of the steel used.

2.3.2 The minimum wall thickness must be greater than the following:

- a. Thickness calculated in line with requirements given in ASME B 16.9 and cl. no.. 2.7 of this specification.
- b. Nominal Thickness of pipe

Thickness calculation is to be submitted to Owner/Owner's Representative for prior approval before manufacturing.

2.3.3 If the fitting has yield strength lower than the yield strength of the pipe to which it is intended to be welded, the wall thickness in each zone of the fitting is at least equal to the largest value define "tr" of either.

- The specified pipe wall thickness times the ratio of the minimum yield strength guaranteed by the standard of the steel of the pipe and the minimum yield strength guaranteed by the standard of the steel of the fitting;
- The absolute minimum thickness required by the applicable code(s).

2.3.4 The specified pipe wall thickness and grade (with reference to the equivalent grade in ASTM spec. or API 5L spec.) with which the fitting and flange is intended to be used is specified in the piping material specification. Fittings such as tees, elbows, reducers, etc. shall be either welded or seamless type. All welded fittings shall be subjected to heat treatment. All fittings (except weldolets) shall comply with The requirements of MSS-SP-75. Fittings such as weldolets etc. shall be manufactured in accordance with MSS- SP-97.

Welded pipes used for fittings shall be LSAW type only.

2.3.5 The thickness at the welding end shall not exceed 1.5 times the nominal wall thickness of the pipe to be matched.

2.3.6 All the above requirements also apply to the welding ends of the flanges.

2.4 The manufacturer shall submit for approval to the Client and consultant the dimensional drawings, calculations, and the material part lists for all the types of fittings and flanges. All the documents must be identified with the Client's order number.

2.5 The design shall take into consideration performance requirements prescribed in paragraph 2.6.

The design of tees, reducers or elbows must be established, by proof testing, in accordance with par. 2.7. The design of the other fittings must be established by mathematical analysis according to ASME code.

2.6 All fittings under this specification shall be designed to withstand a field hydrostatic test pressure with non corrosive water, after installation, during 24 hours at a following pressure level:

Minimum: $P = 1.5$ Design Pressure

Where:

P = hydrostatic test pressure, bar

Design Pressure = 49 barg.

2.7 Design Proof Test

This applies to fitting only and not to flanges.

- 2.7.1 In addition to the requirements of par. 2.3.1 to 2.3.4 proof tests shall be made as evidence of the adequacy to the design references. Records of design or successful proof tests shall be available at the facility for inspection by the Client and copy shall be added to the Certified Material Test Report (CMTR, par. 9.2.).
- 2.7.2 Unless otherwise agreed upon between manufacturer and Client, the only required proof test is a bursting strength test.
- 2.7.2.1 Prototype fittings, representatives of production (same size production fittings), selected for test shall be identified as to material, grade, and lot, including heat treatment. They shall be inspected for dimensional compliance to this standard.
- 2.7.2.2 Straight seamless or welded pipe sections, whose calculated bursting strength is at least as great as that calculated for the fittings, shall be welded to each end of the fitting to be tested. Any internal misalignment greater than 0.06 inch (1.6 mm) shall be reduced by taper boring at a slope not over 1:3. Length of pipe sections for closures shall be at least twice the pipe O.D. Shorter lengths may be used as follows:
- 2.7.3 The assembly must withstand at least 110 % of the pressure computed in 2.7.5.
- 2.7.4 Minimum length of pipe shall be one pipe O.D. for sizes NPS 8" and smaller. Test fluid shall be water or other liquid used for hydrostatic testing.
- 2.7.5 Hydrostatic pressure shall be applied until the fitting ruptures. The actual test pressure prior to rupture must at least be equal to the adjusted proof test pressure defined as follows:

$$P \text{ (adj.)} = P \times \frac{S(\text{act.})}{s}$$

where

P (adj.) = the adjusted proof test pressure, bar

P = the computed proof test pressure at burst of any part of the assembly, bar

S = minimum specified tensile strength of the pipe for which the fitting is intended to be used, N/mm²

S (act.) = the actual tensile strength of the material of the test fitting (determined on specimen representative of the test fitting), N/mm² The computed proof test pressure shall be determined as follows:

Which refers to the pipe which the fitting's marking identifies and, where

$$P = \frac{20St}{D}$$

Where

P = Computed bursting pressure of the pipe, bar

S = Minimum specified tensile strength of the pipe, N/mm²

t = Nominal pipe wall thickness, mm

D = Specified outside diameter of pipe, mm



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2.7.6 A successful proof test on a identical prototype fitting, selected as required in subsection 2.7.2.1., may be used to qualify other fittings from the same lot of production.

2.7.7 Vendor shall produce test certificate for the burst test.

2.7.8 Test shall be witnessed & certified (3.2 certification) by TPIA.

2.8 Fitting dimensions

One of the principles of this standard is the maintenance of a fixed position for the welding ends with reference to the centerline of the fittings or the overall dimensions, as the case may be.

Dimensional standards will be in accordance with §2.1.

2.9 Fitting and Flanges Tolerances

2.9.1 Tolerances for welding ends, out-of-roundness at the welding ends and inside diameter at the bevel are shown hereafter. Other tolerances wall thickness are as per corresponding codes: ANSI B16.9 standard and for short radius elbows ANSI B16.28 standard.

2.9.2 Welding ends

The welding end and bevel shall be in accordance with **Figure 1** for wall thickness up to 20.0 mm ; for thicker walls, refer to **Figure 2**. The welding end land of the fitting & flanges shall be machined flat and shall not vary from the plane by more than 0.03 in (0.8 mm) at any point. If a fitting & flange has a thickness unequal to the pipe with which it is intended to be used, the welding end preparation at the joint has to conform with applicable I-5 of ASME B 31.8 **Figure 3**.

2.9.3 Out-of-roundness at the welding ends

The out-of-roundness, defined as the difference between the maximum and the minimum inside diameter at the welding ends shall not exceed 1 % of the specified inside diameter for sizes NPS 4 and smaller. Fittings & flanges NPS 4 and larger shall be machined true round.

2.10 Inside Diameter

The inside diameter at any place at end (bevel) shall be the following:

| NPS | Tolerance of inside Øat end (mm) |
|------------|----------------------------------|
| 1/2" – 24" | + 1.6 - 0.4 |

(1) The tolerance refers to variation from nominal I.D. calculating by (O.D. nom. - 2 t nom.). (2) Flange Bore to match with I.D. of the pipe.

3.0 MATERIALS

3.1 The steel used in the manufacture of fittings & flanges shall be selected by the manufacturer and submitted for approval to the Client at the time of the offer. The manufacturer shall fill in the data sheet.

3.2 The chemical composition of the steel meets the requirements of Table 1.

3.3 The steel used has tensile properties conforming to the requirements prescribed in the ASTM standards.

3.4 The ratio of yield strength to tensile strength shall not exceed 0.90.

3.5 The material for fittings shall consist of blooms, billets, slabs, forging quality bar, plate, seamless or fusion welded tubular products with filler metal added.

3.6 The steel shall be fully killed, fine grain practice.

3.7 The steel used shall be suitable for field welding to other fittings, pipes, flanges, or valves manufactured under ASTM specifications A333, A350, A352, A381, A420, A694, A707 or API standards specifications 5L, 6D, 605 or MSS standards SP-44, SP-72, SP-75, EN 10208-2 in line with Piping Specification 6C1 attached with the tender document.

3.8 If preheating of the material is required to ensure proper weldability under normal field conditions, the manufacturer shall state so in the offer, specifying preheat requirements and if accepted by the Client this shall be permanently indicated on the fitting & flanges.

3.9 The Manufacturer must deliver a 3.2 certificate EN 10204, stating the quality, the mechanical properties (yield strength, tensile strength, percent elongation, impact test, chemical analysis, the process of manufacture and the marking (for example the heat number of material) of the steel.

3.10 Chemical Composition

3.10.1 For each heat the manufacturer shall check a chemical analysis of the steel (see Table 1).

3.10.2 Check analysis

Carbon equivalent shall be computed by the following equation:

$$C.E. = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{10}$$

And shall not exceed 0.43

4.0 FABRICATION AND TEST

For all forging materials, the specimen shall be taken from the integral part of the forging. The par.4.1 to 4.2 are only applicable on welded fittings.

4.1 Welding Fabrication

4.1.1 All welds and repair welds shall be performed according to written procedures. The welding procedure must be submitted for approval to the Owner/Owner's representative before any fabrication.

Only qualified & approved welders and welding operators shall be used in production.

4.1.2 The joints shall be furnished in accordance with the requirements of Section VIII of ASME Boiler and Pressure Vessel Code.

4.1.3 Machine welding shall be done by an electric process, preferably by submerged arc.

4.1.4 All butt welds shall have full penetration. Submerged arc machine welding shall be done with at least one pass from the inside, except when accessibility makes this impossible, then a manual or machine root bead may be employed provided that a visual inspection of the root bead is possible. Backing rings shall be not used.

4.1.5 Repair, chipping or grinding of welds shall be done in such a manner as not to gouge, groove, or reduce the original metal thickness by more than 6 1/2 % of nominal specified wall.

4.1.6 Except for bar in the tees, fillet welds shall not be permitted.

4.1.7 Welded-on braces, if used, should be removed before heat treatment and the weld spot shall be repaired and ground flush and smooth. However, when braces are required for heat treatment, they shall be cut out and the surface shall be ground flush and smooth after heat treatment. Except for bar in the tees, welding shall not be permitted after heat treatment. The ground areas shall be inspected by magnetic particle or liquid penetrant testing.

4.2 Welding Procedures

4.2.1 All welds, repair welds and repair by welding shall be performed according to written procedures. These welding procedures shall be qualified according to the requirements of the ASME Boiler and Pressure Vessel Code, Section IX.

The welding procedure tests are required on material which is on the high side of the chemistry specification.

The manufacturer shall maintain a weld record of the procedure and performance test results. The test coupons shall be submitted to the same fabrication and heat treatment as the actual fittings.

The welding procedure qualification must include an impact test set in the weld and in the HAZ with requirements of paragraph 5.1.2 and a macrographic examination described in paragraph 4.2.2. These tests shall be performed after eventual final heat treatment.

4.2.2 Macrographic examination: the etched surface of the macro test specimen viewed macroscopically must display the image of a well performed welded joint with sufficient penetration, free from linear defects and important inclusions. In case of doubt, the etched surface must be examined microscopically and additional macroscopical examinations of other areas may be required.

The macrographic examination will include hardness measurements in the weld and the HAZ. The hardness will not exceed the values measured on the parent metal by more than 80 points for the welds and 100 point for HAZ, with an absolute maximum of 350HV10.

The acceptance of inclusions can be decided upon with the NDE of the welded plates (see paragraph 6).

4.2.3 Transverse guided bend test

4.2.3.1. *Test method*

Transverse weld test specimens shall be subjected to face and root guided bend tests. The specimens shall be approximately 1.5 in (38 mm) wide, at least 6 in (152 mm) long with the weld at the centre, and shall be machined in accordance with Figure 4. The face bend specimen shall be bent with the inside surface of the pipe against the plunger, and the root bend specimen with the outside surface against the plunger. The dimensions of the plunger for the bending jig shall be in accordance with Figure 5 and the other dimensions shall be substantially as shown in Figure 5.

The manufacturer shall use a "jig" based on this dimension or a smaller dimension at this option.

4.2.3.2. *Test specimen*

The weld bend test specimens, as described hereabove shall be cut from the coupon. The specimens may be taken from a fitting or from sample plates as described in par. 4.2.3.1.

4.2.3.3. *Acceptance criteria*

The bend test shall be acceptable if no cracks or other defects exceeding 0.12 in (3.2 mm) in any direction are present in the weld metal or between the weld metal and the fitting metal after the bending. Cracks which originate along the edges of the specimen during testing and which are less than 0.25 in (6.4 mm) measured in any direction, shall not be considered unless obvious defects are observed.

4.2.3.4. *Retest*

If either test fails to conform to specified requirements, the manufacturer may elect to make retests on two additional specimens from the same lot, each of which shall conform to the requirements specified hereabove. If any of these specimens fail to conform to the requirements, the welding procedure qualification test is not accepted.

(*) A lot consists of all fittings/flanges from one heat of steel with same initial wall thickness, from the same furnace charge for final normalizing heat treatment, from the same shape and the same main pipe dimension.

4.2.4 Number of tests

The nature and number of tests are specified in the Table below and only one retest is allowed.

| | | Specification test | Number |
|--------------------------|------|---|----------------------|
| Non destructive test | | par. 6. | par. 6 |
| X-ray and U.S. testing | | par. 6 | par.6 |
| Destructive test | | All specimens shall be taken transverse to the weld | |
| Tensile | | par. 5.1.1. | 2 |
| Bend test | Face | par. 4.2.3. | 2 |
| | Root | par. 4.2.3 | 2 |
| Impact | Weld | par. 5.1.2. | 1 set of 3 specimens |
| | HAZ | par. 5.1.2. | 1 set of 3 specimens |
| Macrographic examination | | par. 4.2.2 | 1 |



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4.3 Normalising Heat Treatment

Start & stop temperature chart shall be signed by TPIA, also power failure log shall be maintained.

4.3.1 After forming and welding, all fittings & flanges shall be heat treated by normalising. Normalising shall be carried out in such a way that the base material acquires a fine grained perlitic structure. If the manufacturer can give proof by qualified manufacturing procedure that after forming, the steel of the fitting & flanges has a homogeneous fine grained perlitic structure, he can ask for a derogation supported by technical file to the Client and TPIA.

The normalizing procedure requires the approval of the TPIA. Good care shall be taken to avoid direct contact of the flames with the material to be heated.

During the normalizing period, the temperature of the heat treatment lot shall be automatically recorded by a sufficient number of thermocouples attached to the material surface. The thermocouples shall be adequately protected against the influence of heat radiation. Temperature variations shall be within ± 20°C. The manufacturer shall furnish time temperature charts of each heat treatment lot. The fittings & flanges belonging to each treatment lot shall be specified on the charts. Temperature measurements by other means are permitted only if approved by the TPIA.

4.3.2 The fine grained perlitic structure of the steel shall be verified by at least one micrographic examination per lot (definition in §4.2.4), according to ASTM E 112. The grain size shall be in the range of 8 to 12.

4.3.3 The manufacturer shall include in the CMTR data of this treatment

5.0 PHYSICAL TESTING

5.1 Mechanical Tests

The following mechanical tests shall be performed by the vendor under the supervision of the TPIA and the certificates shall be added to the CMTR.

Test specimens may only be cut after a marking transfer by the Authorised TPIA. All the tests shall be performed after final heat treatment.

Certification requirements to comply with EN 10204 – 3.2 certificates shall issued by TPIA

5.1.1 Tension test

5.1.1.1. Requirements

The material shall be in conformance with the ASTM standards and the ratio of yield stress to tensile stress shall not exceed 0.90.

For fittings containing welds, the fracture must be outside of the weld. If there is a fracture in weld or HAZ, the tensile strength shall at least meet the requirements for tensile properties as per ASTM standards.

5.1.1.2. Test specimen

The test specimen shall represent all forgings from the same lot. Test specimens shall be taken from the fitting after final heat treatment or from a piece of pipe or plate of the same nominal thickness, same heat of steel from which the fitting is made and which has been heat treated in a lot with any of the fitting(s) it represents. For welded fittings, this coupon (piece of pipe or plate) shall contain a weld in prolongation of the weld of the fitting.

5.1.1.3. Number of tests

For fittings NPS 2 and greater the following number of test shall be performed:

Base material : one tension test

Weld : one tension test

5.1.1.4. *Test locations and orientations*

For welds, the test specimen shall be orientated transversally to the weld. For base material, test specimens shall be orientated transversally and if this orientation is not feasible, it shall be orientated longitudinally.

For flanges, the test location shall be in accordance with ASTM A350§6.1.3.

5.1.1.5. *Test method*

Testing shall be performed in accordance with ASTM A 370 standard rectangular plate type 1-1/2" wide (Fig. 4- A370) or standard round (Fig. 5 or Fig. 6-A370). Yield strength shall be determined either by the 0.2 % offset or the 0.5 % extension under load (EUL) method.

5.1.1.6. *Retest*

If the tension test specimen from any lot fails to conform to the requirements of the particular grade ordered, the manufacturer may elect to make retests on two additional pieces from the same lot. If one or both of the retests fail to conform to the requirements, the whole lot of that specimen will be rejected.

5.1.2. Impact test

5.1.2.1. *Requirements*

For product, the Charpy V- Notch test shall be conducted as per following requirements:

| Material | Impact Test Temperature | Energy Absorption Value (Minimum) |
|-----------------------|-------------------------|---|
| Carbon Steel Material | 0 Deg C | - At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction. |

SMYS = Specified minimum yield strength.

5.1.2.2. *Test specimen*

The test specimen shall be machined from material obtained as in paragraph Test specimen for Tension test (par. 5.1.1.2.).

Flattening of test specimens are not allowed.

5.1.2.3. *Number of tests and orientation*

Three test specimens shall constitute one test set.

For fittings NPS 2 and greater, the following number of tests shall be performed :

Base material : 2 test sets, one set shall be orientated longitudinally and another one transversally.

Weld : 1 test shall be orientated transversally.

HAZ : 1 test shall be orientated transversally.

5.1.2.4. *Test method*

The notched bar impact test shall be made in accordance with ISO 148 - Charpy V - Notch.

If the wall thickness of the fitting or the coupon does not enable machining of full size specimens, the largest possible size must be used but not less than (10 x 5 mm). The axis of the notch shall be orientated through the wall thickness of the fitting.

5.1.3 Flattening test

This is not applicable to the flanges.

5.1.3.1. *Requirements*

Flatten to 1/3 original O.D. without cracks or breaks in the fitting, continue flattening until meeting opposite walls of the fitting.

No evidence of lamination of burnt metal may develop during entire test.

5.1.3.2. *Test specimen*

The test specimen represents all the fittings from the same heat of steel of the same shape and of the same main pipe dimension of the fittings.

5.1.3.3. *Number of tests*

For fittings size lower than 2" one flattening test shall be made per test specimen.

5.1.4 Retreatment

If the result of the mechanical tests does not conform to the requirements specified in par. 5.1.3.1., the manufacturer, with the acceptance of the Owner/Owner's Representative and the TPIA, may reheat treat the fittings as applicable and repeat all the tests specified.

5.2 Chemical Analysis

For each lot/item a new chemical analysis of the steel shall be done.

The chemical analysis shall conform to the ASTM requirements specified in the specification. The carbon equivalent shall be computed by "check analysis": see par. 3.10.2 with C.E. ≤ 0.43 . The reports shall be added to the CMTR reports and approved by the TPIA.

6.0 NON DESTRUCTIVE EXAMINATIONS (NDE)

The following mechanical tests shall be performed by the vendor under the supervision of the TPIA and the certificates shall be added to the CMTR.

6.1.1 Radiography

All butt and repair welds shall be 100% radiographed in accordance with ASME section V - non destructive examination - article 2 - using fine grain film and lead screens. Acceptance criteria shall be as be ASME B 31.4 or ASME B 31.8 as applicable and API 1104. Radiography shall be performed after the final heat treatment.

6.1.2 U.S., Magnetic, Visual and Dimensional examination

6.1.2.1. *Non destructive examinations*

In the presence of the TPIA, the manufacturer shall perform the following non destructive examinations on the fittings after the mechanical tests and according to an inspection procedure to be submitted for approval

For fitting with wall thickness larger than or equal to 6 mm, ultrasonic inspection on the whole surface (with angle probe and straight probe) to the maximum extent possible.

All finished wrought weld ends shall be 100% tested for lamination type defects by ultrasonic test. Any lamination larger than 6.35 mm shall not be acceptable.

When elbows of size > DN 450 mm (18") are manufactured, the first elbow of each radius, diameter and wall thickness shall be ultrasonically checked for sufficient wall thickness in areas where a minimum wall thickness is to be expected. This shall be followed by random inspection of one out of every three elbows of the same radius, diameter and wall thickness.

Magnetic Particle or Liquid Penetrant Examination shall be performed on cold formed. Butt welding tees with extruded outlets as per applicable material standard.

Welds, which cannot be inspected by radiographic methods, shall be checked by Ultrasonic or Magnetic particle methods. Acceptance criteria shall be as per ASME section VIII Appendix U and Appendix VI respectively.

Magnetic particle inspection on the whole external surface and the accessible internal surface.

6.1.2.2. *Ultrasonic inspection*

Ultrasonic inspection of all welds and 25 mm of base material at each side of the weld shall be done.

6.1.2.3. *Visual examination*

All fitting & flanges shall be visually examined.

6.1.2.4. *Test after machining*

After machining, all the finished bevels shall be submitted to the following tests:

Magnetic particle or liquid penetrant

For fitting and flanges with wall thickness larger than or equal to 6 mm, ultrasonic inspection on 25 mm of base material.

6.1.2.5. *Dimensional examination*

For fittings up to NPS 6, the TPIA shall choose 10 % with a minimum of one piece per item of the order and these pieces shall be submitted to a dimensional examination.

For fittings larger than NPS 6, all pieces shall be submitted to a dimensional examination

All flanges shall be submitted to a dimensional examination.

6.1.3 Acceptance criteria of the different NDE

6.1.3.1. *Visual examination*

The following defects are unacceptable:

Undercuts exceeding 1 mm in depth and 25 mm in length.

Undercuts of the outside weld which overlap undercuts of the inside weld.

Lack of penetration.

Continuous occurrence of under-cutting

6.1.3.2. *Magnetic particle inspection*

Magnetic particle inspection on the external surface. ASME code, section VIII, division 1, appendix VI.

6.1.3.3. *Ultrasonic inspection*

For the longitudinal welds: ASME code, section VIII, division 1, appendix 12.

For welding ends, see § 6.1.3.5.

For base material :

Procedure: ASME code, section V, art. 23, SA-388.

Criteria: ASME code, section VIII, division 1, UF-55 (angle probe will be used).

6.1.3.4. *Radiographic examination*

For longitudinal seam welds :

Criteria : ASME code, section VIII, division 1, UW 51

For girth welds :

Criteria: API standards 1104, section 6.0.

6.1.3.5. *Magnetic particle or liquid penetrant on the finished bevel*

The following defects are unacceptable:

Defects extending into the bevel provided the lamination is parallel to the surface and has a transverse dimension exceeding 6.35 mm.

All defects not parallel to the surface extending into the bevel.

7.0 INSPECTION AND TESTING

7.1 Information

The manufacturer shall inform the TPIA MIN. 5 working days (15 in case of foreign supplier) in advance of any intervention required by this specification and shall send a copy (fax) of it to the Client/Consultant.

Hydrostatic testing by the manufacturer is not required, but welding fittings shall be capable to withstand a field hydrostatic testing in accordance with par. 2.6.

7.2 Workmanship and Finish

7.3 Fittings & Flanges shall be free of injurious defects and shall have workmanlike finish.

7.4 Injurious defects are defined as those having a depth in excess of 6-1/2 % of specified nominal wall.

7.5 Machining and grinding of surface defects shall be treated as follows: sharp defects such as notches, scratches, scraps, seams, laps, tears, or slivers not deeper than 6-1/2 % of nominal

wall thickness shall be removed by grinding. Repair of injurious defects by welding shall be permitted only after agreement by the Client and the TPIA, except that welding of injurious defects shall not be permitted when the depth of defects exceeds 33-1/3 % of the nominal wall thickness, or the length of repair exceeds 25 % of the specified diameter. Defects must be completely removed and welding performed by a welder qualified specifically for repair welding, as per par. 4.2.1. Such repair welding shall be ground flush with the surface and all welding shall be done before final heat treatment. Repair welding shall be done with low hydrogen electrodes in shielded metal arc welding, gas metal arc process or submerged arc process. In no case, repair welding or cracks nor repair or repairs is allowed. Repair welding will not be permitted for flanges.

7.6 Repair welding shall be done before the last heat treatment. Adjusting weld preparations, intended for field welding, by means of welding is not allowed. For "standard fitting" repair by welding is not permitted.

7.7 Repair welding on the welds & in the body shall be 100 % radiographed and U.S tested.

7.8 At the discretion of the TPIA, finished fittings & flanges shall be subject to rejection if surface imperfections acceptable under cl. no. 7.3 are not scattered but appear over an area in excess of what is considered as a workmanlike finish.

7.9 Rejection

Each fitting or flange in which injurious defects are found during inspection and after delivery shall be rejected. The manufacturer shall be notified. In this case, the fitting shall be replaced immediately. All the costs involved, including wages and travel expenses of the TPIA/Client/ Consultant shall be borne by the manufacturer.

8.0 MARKING

8.1 All fittings and flanges furnished under this specification shall be clearly identified on the O.D. with the following information marked with low stress die stamps or interrupted dot stamps as noted (refer to MS SP25):

Manufacturer's name or trademark.

Heat code identity.

Fitting or flange number: the fitting or flange number shall be made up of six figures specified as follows:

the item and its number specified in the purchase order.

The monogram of the Owner/Consultant. This marking shall only be applied after complete approval of the Certified Material Test Report (see par. 9.2.).

8.2 In addition to the above, for NPS 2" and larger, it shall also include the following information:

Grade symbol: the grade symbol must designate the material of the fitting or flange.

8.3 Marking must be done prior to final inspection.

9.0 DOCUMENTATION

9.1 Before starting any control, the manufacturer shall submit for approval to the Third Party inspection agency and the Client/Consultant the following documents:

Detailed fabrication drawing and calculations.

Fabrication and control procedure (if new -not if upgraded).

List of Operations of Control (LOC) in accordance with PTS (if new -not if upgraded).

Material list.

Qualified welding procedures (if new -not if upgraded).

Welder's performances qualifications (if new -not if upgraded).

Heat treatment procedure-(if new -not if upgraded).

Non destructive testing procedures.

Each company dealing in the order by fabrication and/or control shall implement a LOC for all operations and interventions performed in its organization. They shall also be responsible for the implementation of the same by their subcontractors.

9.2 Certified Material Test Report

A Certified Material Test Report (CMTR) shall be furnished listing as built drawing and calculations, the LOC (see paragraph 9.1.), the proof test certificate, the base material certificate, the chemical check analysis. The certificate of the heat treatment, the mechanical tests, the non-destructive examination, the mechanical properties, the quality release note (see paragraph 9.3) and any special test required by the purchase order the fitting or flange individual number (see paragraph 8.1.1.) must be indicated in the CMTR to permit the correct traceability of each piece. The manufacturer shall furnish one copy of the CMTR to the TPIA and one original and one copy to the Client/Engineer.

9.3 IRN

After final approval of fittings/flanges and the acceptance of the CMTR, the Third Party inspection agency's delegate shall furnish to the Client/Consultant and to the manufacturer an Inspection Release Note (IRN). The manufacturer shall deliver one copy of the IRN with the fittings/flanges and one copy shall be included in the CMTR (see paragraph 9.2.)

All documents shall be in English language.

10.0 CORROSION PROTECTION

The corrosion protection will be applied by the manufacturer after final inspection by the TPIA. The product shall meet the following criteria:

- Guarantee a corrosion protection for a storage period in open air for at least 6 months.
- Shall be easily removable by wire brushing or by grinding.
- It shall not produce toxic vapour or smoke when heated by blow torches or during welding.

TABLE 1
CHEMICAL COMPOSITION FOR FITTINGS

Maximum limit of chemical elements which may be used in material under this standard.

| | % MAXIMUM |
|----------------|-----------|
| C | 0.230 |
| Mn | 1.60 |
| Si | 0.50 |
| P | 0.030 |
| S | 0.025 |
| Nb | 0.080 |
| V | 0.120 |
| Mo | 0.250 |
| N _t | 0.0150 |

Alternate alloy elements may be used but they shall be discussed with the user prior to delivery of the material. This table is not intended to represent the composition of any heat of steel, but merely to record the maximum permissible amounts of one element. The combination of elements of any heat must conform to the carbon equivalent, subsection 3.10.2.

For each heat the manufacturer shall analyse the following elements: C, Mn, Si, P, S, Nb, V, Cr, Mo, Ni and Cu.

The intentional addition of elements other than those specified is not permitted unless agreed upon by the Client.

In any case, for unintentional additions, the following limitations shall be respected :

$$\text{Ni} \leq 0.30 \%$$

$$\text{Co} \leq 0.01 \%$$

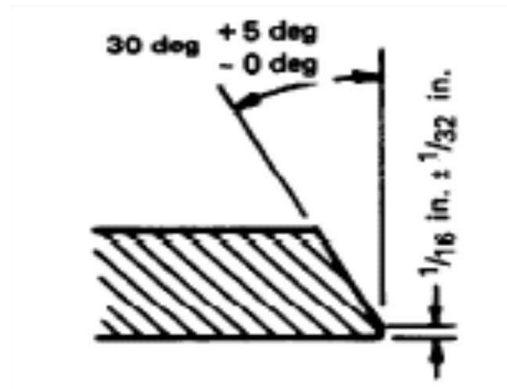
$$\text{Al} \leq 0.07 \%$$

The content of N total (N_t) may be up to 0.0150 % and must be guaranteed by the manufacturer. If the manufacturer cannot give any guaranty of N content, he shall analyse this element.

The total content for Nb + V will be limited to 0.150 %.

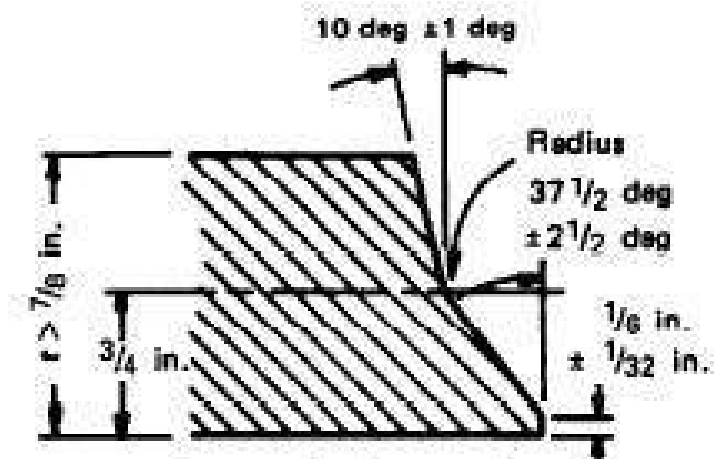
For each reduction of 0.01 % below the maximum carbon content, an increase of 0.05 % manganese above the specified maximum is permissible, up to a maximum of 1.70 %.

FIG. 1



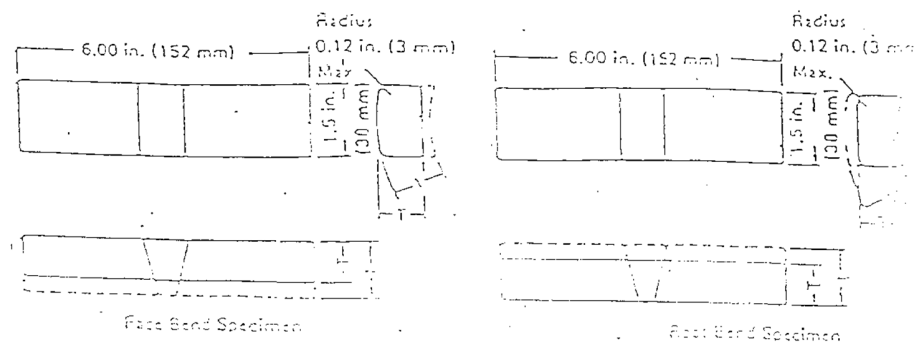
Fitting size 24" and smaller may be furnished with 37° ½ bevel at manufacturer's option. Recommended bevel for wall thickness (t) at end of fitting: 20 mm or less.

FIG. 2



Recommended bevel for wall thickness (t) at end of fitting, greater than 20 mm

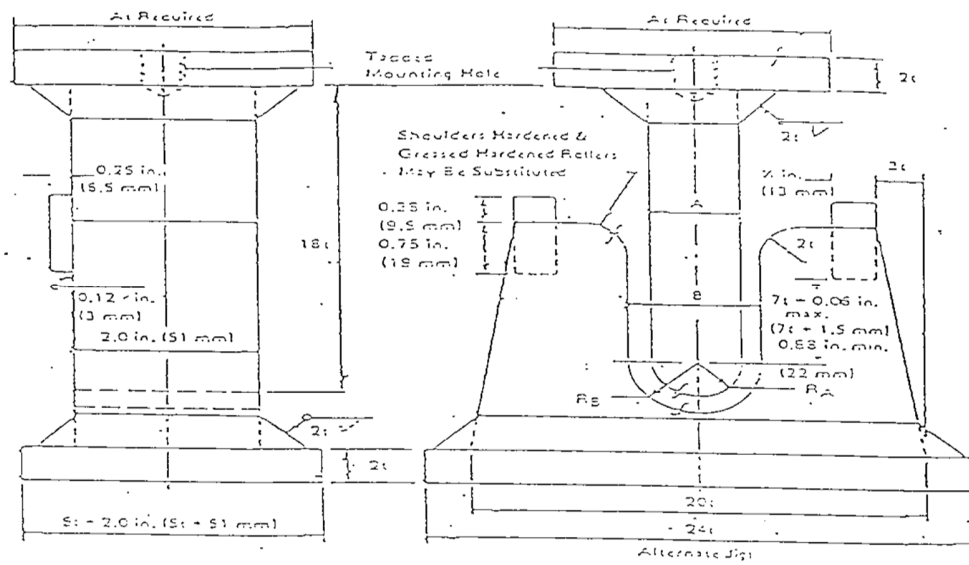
FIG. 3



TRANSVERSE FACE AND ROOT BEND TEST SPECIMENS

FIG 5

**GUIDED-BEND TEST JIG
DIMENSIONS**



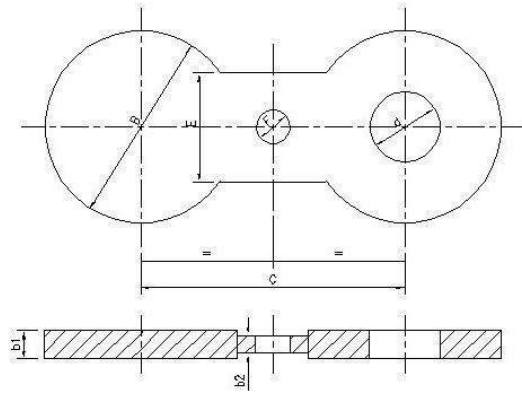
| Radius of male member R_A Radius of female member R_B Width of male member, A Width of groove in female member, B | CLASS OF STEEL | | | |
|--|-------------------|----------------|----------------|----------------|
| | Y52 and low-grade | Y56 | Y60 | Y70 |
| | $\frac{1}{2}A$ | $\frac{1}{2}A$ | $\frac{1}{2}A$ | $\frac{1}{2}A$ |
| | $\frac{1}{2}B$ | $\frac{1}{2}B$ | $\frac{1}{2}B$ | $\frac{1}{2}B$ |

t = specimen thickness

The manufacturer shall use a jig based on this dimension, or a smaller dimension at his option.

FIG. 6

**SPECTACLE
FLANGE**



| Size NB (inch) | Class 150 | | | | | | | Class 300 | | | | | | | Class 600 | | | | | | |
|-------------------|-----------|-------|------|----|------|----|----|-----------|-------|------|----|------|----|----|-----------|-------|------|----|-------|-----|----|
| | B | d | C | E | b1 | b2 | F | B | d | C | E | b1 | b2 | F | B | d | C | E | b1 | b2 | F |
| 1/2" | 44 | 16.0 | 60 | 25 | 6.5 | 4 | 16 | 51 | 16.0 | 67 | 30 | 6.5 | 4 | 16 | 51 | 16.0 | 67 | 30 | 6.5 | 4 | 16 |
| 3/4" | 54 | 22.0 | 70 | 30 | 6.5 | 4 | 16 | 63 | 22.0 | 83 | 35 | 6.5 | 4 | 16 | 63 | 22.0 | 83 | 35 | 6.5 | 4 | 16 |
| 1" | 63 | 28.5 | 79 | 35 | 6.5 | 4 | 16 | 70 | 28.5 | 89 | 40 | 6.5 | 4 | 16 | 70 | 28.5 | 89 | 40 | 6.5 | 4 | 16 |
| 1 1/4" | 73 | 35.0 | 89 | 40 | 6.5 | 4 | 16 | 79 | 35.0 | 98 | 45 | 6.5 | 4 | 16 | 79 | 35.0 | 98 | 45 | 6.5 | 4 | 16 |
| 1 1/2" | 82 | 41.5 | 98 | 50 | 6.5 | 4 | 16 | 92 | 41.5 | 114 | 55 | 6.5 | 4 | 23 | 92 | 41.5 | 114 | 55 | 6.5 | 4 | 23 |
| 2" | 101 | 54.0 | 121 | 50 | 6.5 | 4 | 19 | 108 | 54.0 | 127 | 28 | 6.5 | 4 | 16 | 108 | 54.0 | 127 | 28 | 6.5 | 4 | 16 |
| 2 1/2" | 120 | 66.5 | 140 | 50 | 6.5 | 4 | 19 | 127 | 66.5 | 149 | 35 | 6.5 | 4 | 23 | 127 | 66.5 | 149 | 35 | 6.5 | 4 | 23 |
| 3" | 133 | 79.5 | 152 | 60 | 6.5 | 4 | 19 | 146 | 79.5 | 168 | 40 | 9.5 | 6 | 23 | 146 | 79.5 | 168 | 40 | 6.5 | 4 | 23 |
| 3 1/2" | 158 | 92.0 | 178 | 45 | 6.5 | 4 | 19 | 162 | 92.0 | 184 | 45 | 9.5 | 6 | 23 | 159 | 92.0 | 184 | 45 | 6.5 | 4 | 23 |
| 4" | 171 | 109.0 | 191 | 50 | 6.5 | 4 | 19 | 178 | 109.0 | 200 | 50 | 12.5 | 8 | 23 | 190 | 105.0 | 216 | 55 | 6.5 | 4 | 23 |
| 5" | 193 | 133.5 | 216 | 55 | 9.5 | 6 | 22 | 212 | 133.5 | 235 | 60 | 12.5 | 8 | 23 | 238 | 130.0 | 267 | 70 | 22.5 | 14 | 23 |
| 6" | 219 | 159.0 | 241 | 60 | 9.5 | 6 | 22 | 247 | 159.0 | 270 | 45 | 16.0 | 8 | 23 | 263 | 155.5 | 292 | 45 | 25.5 | 18 | 23 |
| 8" | 276 | 209.5 | 298 | 70 | 12.5 | 8 | 22 | 305 | 209.5 | 330 | 55 | 19.0 | 10 | 23 | 317 | 203.0 | 349 | 55 | 32.0 | 20 | 23 |
| 10" | 336 | 260.5 | 362 | 65 | 16.0 | 8 | 26 | 359 | 260.5 | 387 | 45 | 25.5 | 14 | 23 | 390 | 257.0 | 432 | 45 | 38.0 | 24 | 23 |
| 12" | 406 | 305.0 | 432 | 70 | 22.5 | 10 | 26 | 419 | 305.0 | 451 | 50 | 28.5 | 18 | 23 | 454 | 305.0 | 489 | 40 | 44.5 | 30 | 23 |
| 14" | 441 | 336.5 | 476 | 70 | 25.5 | 14 | 29 | 476 | 336.5 | 514 | 45 | 32.0 | 20 | 23 | 489 | 336.5 | 527 | 40 | 51.0 | 38 | 23 |
| 16" | 505 | 387.5 | 540 | 70 | 25.5 | 14 | 29 | 530 | 387.5 | 572 | 50 | 36.5 | 22 | 23 | 562 | 387.5 | 603 | 50 | 57.0 | 40 | 23 |
| 18" | 540 | 439.0 | 578 | 70 | 25.5 | 14 | 32 | 587 | 439.0 | 629 | 45 | 41.5 | 24 | 23 | 609 | 439.0 | 654 | 55 | 63.0 | 50 | 23 |
| 20" | 597 | 489.0 | 635 | 65 | 28.5 | 18 | 32 | 645 | 489.0 | 686 | 50 | 44.5 | 24 | 23 | 679 | 489.0 | 724 | 50 | 70.0 | 64 | 23 |
| 22" | 657 | 548.0 | 692 | 65 | 35.0 | 20 | 35 | 702 | 548.0 | 743 | 50 | 44.5 | 24 | 23 | 730 | 540.0 | 778 | 55 | 70.0 | 64 | 23 |
| 24" | 708 | 590.5 | 750 | 75 | 35.0 | 20 | 35 | 765 | 590.5 | 813 | 60 | 54.0 | 40 | 23 | 787 | 590.5 | 838 | 55 | 82.0 | 68 | 23 |
| 26" | 782 | 641.5 | 806 | 70 | 51.0 | 32 | 35 | 822 | 641.5 | 878 | 50 | 73.0 | 60 | 23 | 851 | 641.5 | 915 | 50 | 101.0 | 85 | 23 |
| 28" | 828 | 692.0 | 864 | 60 | 51.0 | 32 | 35 | 895 | 692.0 | 940 | 60 | 73.0 | 60 | 23 | 911 | 692.0 | 965 | 55 | 101.0 | 85 | 23 |
| 30" | 870 | 743.0 | 914 | 65 | 54.0 | 34 | 35 | 940 | 743.0 | 997 | 60 | 85.0 | 70 | 23 | 959 | 743.0 | 1022 | 60 | 110.0 | 90 | 23 |
| 32" | 936 | 794.0 | 978 | 65 | 54.0 | 34 | 41 | 1003 | 794.0 | 1054 | 65 | 85.0 | 70 | 23 | 1119 | 794.0 | 1090 | 60 | 110.0 | 90 | 23 |
| 34" | 978 | 844.5 | 1029 | 55 | 57.0 | 34 | 41 | 1044 | 844.5 | 1105 | 70 | 98.0 | 80 | 23 | 1060 | 844.5 | 1130 | 65 | 117.0 | 100 | 23 |
| 36" | 1035 | 895.5 | 1086 | 60 | 57.0 | 34 | 41 | 1105 | 895.5 | 1168 | 55 | 98.0 | 80 | 23 | 1117 | 895.5 | 1194 | 65 | 124.0 | 110 | 23 |

CENTRAL U.P. GAS LIMITED (CUGL)

**LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN
BAREILLY, KANPUR & UNNAO AND JHANSI GAS**

PTS – SUPPLY OF MDPE FITTINGS AND VALVES

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Σ Σ

1.0 INTRODUCTION & SCOPE

The present document covers the technical specifications for the procurement of PE Fittings & Valves.

2.0 DEFINITIONS

| | |
|--------------------------------------|--|
| Manufacturer PTS | Means the Manufacturer of the PE Fitting, Valves Means the present <<Particular Technical Specification>> and all its appendix, if any. |
| Third Party Inspection Agency GTS | Means the Inspection Agency. Means the present <<General Technical Specification>> and all its appendix, if any. |

3.0 MATERIAL GRADE

The material grade of polyethylene PE Fittings shall be PE100. The bidder shall submit the details by clearly indicating the make, country of origin, part nos. /Product codes and catalogue number along with catalogues written in English for the Items quoted, in the Unpriced Bid.

The bidder shall provide approvals of internationally recognized authorities for their products along with their un-priced bids.

4.0 APPROVED MANUFACTURER FOR RAW MATERIAL

1. INEOS (Formerly SOLVAY)
2. BOROUGE
3. TOTAL PETROCHEMICALS
4. DOW
5. ELENAC
6. BOREALIS
7. LYONDELLBASELL

5.0 TRANSITION FITTINGS

Deleted

Not applicable for this Project.

6.0 MDPE PIPE MATERIAL

The raw material of MDPE pipe shall be PE 100, thick as per SDR11. The MDPE pipe shall confirm standards for polyethylene pipes for supply of gaseous fuels IS 14885 (latest edition).

7.0 MATERIAL REQUISITION

As per SOR/Contract

8.0 QUALITY ASSURANCE (QA)

Manufacturer to submit their Inspection and Test Procedure (ITP) for the approval of Owner/PMC.

9.0 DEFECT LIABILITY PERIOD

As per contract.

10.0 MARKING

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

- a) Owner name as CUGL.
- b) Manufacturer's name and/or trademark
- c) Material and Designation
- d) Design application series
- e) The size of the fitting in mm
- f) Fusion time in seconds
- g) Cooling time in minutes
- h) Fusion parameters in BAR code
- i) Traceability code (fittings) as per standard ISO 12176-4.
- j) Number of the system standard. This information can be printed/formed directly on the fitting or on a label associated with the fitting or on an individual bag
- k) Production period, year and month

The marking shall stay legible during normal manipulation, storage and installation.

The marking shall not adversely influence the performance of the fitting and prevent the nonconformity of the fitting.

11.0 PACKAGING

All the MDPE fittings of more than one piece shall be kept in single box/packets according to type and size during packaging.

Packing size to be mentioned to ensure uniformity in delivery conditions of the material being procured. Bidder shall submit the packaging details during offer and also complied with at the time of delivery. The material for each SOR Item is essentially required to be packed in one case/packet /box.

AMENDMENT TO GTS 70000/740/GTS/0011

3.2 ADD

Branch piping/tapping saddle of sizes upto 63 mm OD shall preferably be supplied along with integral PE Clamp which is to ensure sufficient pressure welding and is to be left in place after the welding. Further, the upper shell of the Tapping Tees shall be a single piece to avoid dual welds.

5.2 ADD

The raw material PE, used for accessory production, is in compliance with all prescription in EN 1555-1 standards.

The raw material shall be virgin material belonging to class PE 100

The following are strictly forbidden:

- Use of recycled raw materials
- Mixing of different raw materials
- The addition of supplementary additives to the raw material.

5.2.1 ADD

Material and end connection of transition fittings – NOT APPLICABLE.

6.3 REPLACE

All accessories shall be of yellow colour.

6.5.2 REPLACE

Classification

Electrofusion accessories are divided into three classes according to the voltage and/or current characteristics.

Class A Electrical supply based on voltage set between 8V and 42 V

Class B Electrical supply based on voltage set between 42 V and 220 V

Class C Electrical supply based on power supply settings.

All supplies, unless otherwise stipulated in the order, concern Class A accessories.

Unless stipulated otherwise in the order, only “wrap-around” saddles, Electrofusion and Transition fittings with integral pipe fixation device to be supplied upto 63 mm dia

Unless otherwise agreed between OWNER/PMC and the supplier, all electrofusion accessories must be “single wire“ type.

6.5.3 REPLACE

Connector (terminal pin) 4.0 mm/4.7mm shall be required.

6.6 REPLACE

The support drilling equipment to be designed so that during drilling the maximum immediate leak flow will never exceed 200 litres per hour at 5 bar pressure, in the main pipe. According to this flow rate, the supports are divided into two categories:- models 1 and 2 (refer to par. 3.2.) The required model will be specified when ordered.

The bell drill is equipped with a maneuver opening for the insertion of a requisite (range may vary from 5 mm to 21mm) hexagonal spanner/Allen Key.

The bell drill path is limited at the top by a limit block.

The drill mechanism is designed so that no additional tools (except the hexagonal spanner/Allen Key) are required for carrying out drilling operations. On placement of order the proposed sizes of hexagonal spanner/Allen Key required for various sizes of Tapping Saddle shall be informed by the bidder alongwith drawing of particular saddle for approval of OWNER.

6.7 REPLACE

| | | |
|------------|-------------|------------------------|
| Flow M3/hr | Saddle type | Maximum load loss Mbar |
|------------|-------------|------------------------|

| | | |
|----|--------|-----|
| 10 | 32x20 | 1.0 |
| 10 | 63x20 | 1.0 |
| 10 | 63x32 | 1.0 |
| 10 | 125x32 | 1.0 |
| 10 | 180x32 | 1.0 |
| 40 | 125x63 | 1.0 |
| 40 | 180x63 | 1.0 |

12 REPLACE

All electro fusion accessories must be printed with a bar code or bar code with an individual magnetic card (manual setting information for data transfer purposes must be supplied in bar code). The magnetic card contains the welding parameters that have been encoded in the magnetic track, as well as the bar code printed on the card. Coding must be carried out according to prescriptions included in ISO TR 13950 standards. The bar codes shall be laminated to ensure that the details are not damaged or erased.

AMENDMENT TO GTS 70000/740/GTS/0012

1 REPLACE

The Compounds that meet this specification must be PE 100.

The colour shall be yellow or black in accordance with the local requirements.

3.2 ADD

Minimum Required Strength (MRS 10)

Standardized class of compounds for which the LCL is equal to 10.

3.3 ADD

PE 100

Standard designation for PE compounds in class MRS 10

4.0 ADD

The PE compounds that are acceptable according to the requirements of this specification must conform to the requirements for PE 100 described in prEN 1555-1.

AMENDMENT TO GTS 70000/740/GTS/0015

1.0 ADD

It applies to bidirectional valves with spigot ends or electro fusion sockets intended to be fused with polyethylene pipes in accordance with the IS 14885 PE pipe specification and with spigot fittings in accordance with the TBL 70000/740/GTS/0011.

3.7 ADD

Base Plate

Model 2 is applicable for present project.

6.2 ADD

The valve will be designed for a maximum operating pressure (mop) equal to 10 bar.

6.3 ADD

BULLET: 2

The colour of the PE valve shall be black/yellow.

7.4 REPLACE

PRESSURE DROP AT LOW PRESSURE

| Nominal diameter dn | Flow M3/hr |
|---------------------|---------------|
| 32 | 10 |
| 63 | 60 |
| 125 | 450 |
| 180 | 765 |

8.0 ADD

Marking

b) Material and designation (e.g. PE 100)

DELETE

f) Traceability Code (Valve and Component as per standard ISO/FDIS 12176-4

Σ Σ Σ

CENTRAL U.P. GAS LIMITED (CUGL)

**LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN
BAREILLY, KANPUR & UNNAO AND JHANSI GAS**

PTS - PIPELINE VALVES

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Σ Σ Σ

1.0 SCOPE

This Document (PTS - Particular Technical Specification for PIPELINE VALVES) lists the Specification for Manufacturing of Valves, for the pipeline project for the service of natural gas.

The present specification has to be read in conjunction with General Technical Specification 70000/740/GTS/402 rev. 7 (The GTS) which it amends and/or complements.

The present specification can confirm, complete or modify certain sections/paragraphs of said «General Technical Specification». The PTS will govern the requirements for all such sections.

Add:

The present Particular Technical Specification relates to the manufacture of “Pipeline Valves” (for above and underground) for the pipeline project for the service of natural gas.

2.0 DEFINITIONS

| | |
|--------------------------------------|---|
| Client / Owner | Shall mean CENTRAL U.P GAS LIMITED (CUGL) |
| Manufacturer | Means the Manufacturer of the Valves as well as its sub-contractors. |
| EPC Contractor / Contractor | The party which carries out all or part of Engineering, Procurement, Construction, Pre-commissioning & Commissioning of the project. It shall mean EPC Contractor in the present context. |
| Third Party Inspection Agency (TPIA) | Means the Inspection Agency to be appointed by the EPC contractor |
| Consultant / Owner Representative | Shall means The entity of the purchaser or the company nominated by the purchaser to design the natural gas transport or distribution system and to specify the equipment |
| PTS | Means the present <<Particular Technical Specification P.014714 G 11077 M001>>and its entire appendix, if any. |
| GTS | Means “General Technical Specification 70000/740/GTS/402 Rev. 7” and all documents it refers to. |

3.0 PRELIMINARY STATEMENT

Add:

- In case of conflict between the requirements in technical documents, the most stringent requirements shall apply.
- A valid copy of API 6D monogram/certificate shall be included in the offer.

Modify para 10 & 11:

- For any control, test or examination required under the supervision of the Authorised Control authority (LOFC Intervention points included), the latter shall be informed in writing FIVE (5) working days in advance by the Manufacturer (Fifteen working days in case of supply of foreign origin) about place and time with a copy to the Client/Engineer. Wages and travel expenditure of the Authorised Control Authority are at the Client’s expenses.
- As the manufacturing is to be carried out under LOFC concept, the Manufacturer shall send for approval a List of Operation in Manufacturing and Control (see annex 1) to the Authorised Control Authority and

Client, TEN (10) working days before manufacturing. This list shall be in conformity with the annex 1 to this document. Before starting any manufacturing, the Manufacturer shall be in possession of this approved document, filled in with all intervention points.

4.0 GENERAL

Add:

Valve design shall meet the requirements of API Specification 6D and shall be suitable for the service conditions indicated in the Valve Data Sheet. The ASME Boiler & Pressure Vessel Code, Section VIII, Division 1 shall be used to design the valve body.

Allowable stress requirements shall comply the provisions of above code. In addition, corrosion allowance indicated in Valve Data Sheet shall be considered in valve design.

The manufacturer shall have valid license to use API monogram on valves manufactured as per API 6D. The ball valves shall be bi-directional.

5.0 CODES, NORMS AND STANDARDS

Add:

- API 598 : Valve Inspection and Testing
- ISO/DIS 14313 : Petroleum and Natural Gas Industries - Pipeline Transportation Systems – Pipeline valves.

Note:

In case of conflict between the requirements of this specification, Codes, Standards and Specifications referred in above, the most stringent requirement specification shall govern.

6.0 DESIGN AND CONSTRUCTION

6.1 Design

6.1.1 Welding ends

Add:

The valve manufacturer shall supply all butt weld valves with a welded pups/Transition piece at both ends which shall be considered as an integral part of the valve & hence such as strength test, hydrostatic test & Leak test should be done with pup-piece/transition piece weld on valve.

The chemical composition of the steel of the Pup/Transition piece meets the following requirements

Maximum limit of chemical elements which may be used in material under this Particular Technical Specification.

| % maximum | | % maximum | | % maximum |
|-----------|--|-----------|--|-----------|
| C 0.230 | | Mn 1.60 | | Si 0.50 |
| P 0.030 | | S 0.025 | | Nb. 0.080 |
| V 0.120 | | Mo 0.250 | | Nt 0.015 |

Alternate alloy elements may be used but they shall be discussed with the user prior to delivery of the material. This table is not intended to represent the composition of any heat of steel, but merely to record the maximum permissible amounts of one element. The combination of elements of any heat must conform to the carbon equivalent, computed like following:

Carbon equivalent shall be computed by "check analysis", the following equation is applicable:

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

and shall not exceed 0.40 %. The CE (IIW) limits shall not apply if C < 0.12% and shall not exceed 0.43

For each heat the manufacturer shall analyse the following elements: C, Mn, Si, P, S, Nb, V, Cr, Mo, Ni and Cu.

The intentional addition of elements other than those specified is not permitted unless agreed up by the Client.

In any case, for unintentional additions, the following limitations shall be respected:

Cr < 0.15% Mo < 0.05% Cu < 0.20%
 Ni < 0.30% Co < 0.01% Al < 0.07%

The content of N total (Nt) may be up to 0.0150% and must be guaranteed by the manufacturer. If the manufacturer cannot give any guaranty of N content, he shall analyse this element.

The total content for Nb + V will be limited to 0.150%.

In grades X42 through X70 for each reduction of 0.01% below the maximum carbon content, an increase of 0.05% manganese above the specified maximum is permissible, up to a maximum of 1.70%.

The choice and use of alloying elements made from low alloy steels to give the Mechanical Properties of API 5L Gr. X52 (in table hereafter), is of the responsibility of the manufacturer.

| Symbol | Yield Strength (min.) | | Tensile Strength (min.) | | Elongation in 2 in. |
|-------------|-----------------------|-----|-------------------------|-----|---------------------|
| | Ksi | Mpa | Ksi | Mpa | Min. percent |
| X 52 | 52.2 | 360 | 66.7 | 460 | 24 |

The ratio of effective yield strength to effective tensile strength of the steel shall not exceed 0.90 .

If the butt-welding end of the valve has a thickness and/or a steel grade not equal to the connecting pipe, butt-welding ends shall be in accordance with any of the suggestive figures given in Appendix I of ASME B 31.8 or an appropriate combination selected by the valve manufacturers to ensure that availability of uniform pig passage without sacrificing pressure-temperature design requirement.

Butt weld end valves shall be provided with pup piece. Pup piece length shall be of at least 1.5 ND or 300 mm, whichever is higher.

No repair is permitted on pup pieces. 100 % UT shall be performed on pup pieces.

Thickness of Pup Piece shall be determined by the Vendor as per Code requirements. The pipe end of thePup Piece shall match the Material, diameter and thickness of linepipe where the valve is required to be welded. Table below indicate the size, thickness, material of the linepipe for various sizes of Ball valves:

| Sr. No. | Size of Ball Valve (NB) | Material Grade as per API 5L, PSL 2 | Minimum Wall thickness (mm) |
|---------|-------------------------|-------------------------------------|-----------------------------|
| 1. | 4" | X 52M | 6.4 |
| 2. | 6" | X 52M | 6.4 |

| | | | |
|----|-----|-------|-----|
| 3. | 8" | X 52M | 6.4 |
| 4. | 10" | X 52M | 6.4 |
| 5. | 12" | X 52M | 7.1 |
| 6. | 16" | X 52M | 8.7 |
| 7. | 18" | X 52M | 9.5 |

The Valve Manufacturers shall submit all necessary details regarding welding of BW end of valve with Line pipe along with calculation for provided thickness for approval of Owner/Owner's representative.

The Charpy V-notch impact testing of pup piece (for API 5L material) as indicated in data sheet shall be carried out as following:

| Location | Impact Test Temp. | Impact Energy Absorption Value (Minimum) | |
|----------------------|-------------------|--|------------------|
| | | Avg. Value | Individual Value |
| For Base | 0 °C | 40 J | 32 J |
| For Weld & HAZ Metal | 0 °C | 27 J | 22 J |

In addition to above the Charpy V-notch impact testing of pup piece, Valve body and other pressure containing parts of valve (for CS or LTCS steel material) as indicated in data sheet / piping material specification shall be carried out as per following requirements

| Material | Impact Test Temp. | Impact Energy Absorption Value (Minimum) | |
|-----------------------|-------------------|--|--|
| | | Avg. Value (J) | Individual Value (J) |
| Carbon Steel Material | 0 Deg. C | SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. | It shall not be less than 80 % of the Minimum required average value, for the transverse direction |

The pup piece shall be subjected to all the testing (Charpy, Tensile, Hardness, NDT etc.) requirements as mentioned in QAP. Inspection frequency, acceptance criteria & reference standards shall be as per applicable specifications/QAP.

6.1.2 Design features

Add in Para 1:

For above ground valves, body design shall be either fully welded or bolted type. For buried valves, valve body design shall be fully welded type only. Valve body joints with threads are not permitted. In the valve body outlets also, threading is not permitted.

Ball shall be of single piece, solid type construction.

The full bore valve shall provide an unobstructed profile for pigging operations in either direction. Full bore valves shall be designed to minimize accumulation of debris in the seat ring region to ensure that ball movement is not impeded. Also, when the full bore ball valve is in fully open position, the ball shall not obstruct the passage of flow/pig run. Manufacturer shall demonstrate the same through manual and actuated operation.

Modify:

For 4" & above size, valve shall be trunnion mounted ball valve. All trunnion mounted ball valve shall be fitted with following devices:

Double piston effect: when the pressure is applied to one side, let us say upstream" side, and when upstream ball seat is leaking, transfer pressure shall have a positive shut-off effect on the downstream seat (acting, for instance, on the back face of this seat) and thus reinforcing the global tightness of the valve. (Not applicable)

Add :

Vent, sealant etc. shall be adequately supported on the stem and body using clamps

Corrosion allowance of ball valve shall be 2mm

For valves with primary metal to metal contact and secondary soft seats, O-rings or other seals if used for drip tight sealing shall be encased in a suitable groove in such a manner that it cannot be removed from seat ring and there is no extrusion during opening or closing operation of valve at maximum differential pressure corresponding to valve class rating. The seat rings shall be so designed as to ensure sealing at low as well as high differential pressures.

For soft seated valves seat rings may be provided with soft insert. The same shall be positively locked in position. All such ball valves shall comply fire safe design and qualified by fire testing as per API 6FA specification for Fire test for valves.

Valves shall be designed to withstand a sustained internal vacuum of at least 1 (one) milli-bar(a) in both open and closed positions.

Valve design shall be such as to avoid bimetallic corrosion between carbon steel and high alloy steel components. Suitable insulation shall be provided, if required.

Valve design shall ensure repair of stem seals/packing under full line pressure.

Valve shall be provided with ball position indicator and stops of rugged construction at the fully open and fully closed positions

6.1.3 Auxiliary Connection

Add / Modify:

Schematic for drain vent and stem /Sealant point for "Above Ground Installation" and "Under Ground Installation" refer Appendix – I.

6.1.4 Stem extension for underground valve

Add:

Stem extension material shall be equivalent to stem material or as indicated in the data sheets for below ground valves. Stem shall be single piece construction & no joints are permitted. The length of stem extension shall be as indicated in the MR.

Valves provided with stem extension shall have waterproof outer casing. Length of stem extension shall be as indicated in Valve Data Sheet. The length indicated corresponds to the distance between centreline of the valve opening and the top of mounting flange for valve operating device (gear operator/power actuator as applicable).

Outer casing of stem extension shall have 3/8" or 1/2" NPT plugs at the top and bottom, for draining and filling with oil to prevent internal corrosion. Outer casing material shall be ASTM A333 Gr. 6 & thickness shall be minimum Sch 160 for 2" and below.

6.2 Operation

6.2.1 Add:

Valves shall have a Gas over Oil (GOO) actuator or manual operator or hydraulic operator as indicated in the Valve Data Sheet. All mainline valves shall be equipped with Gas over Oil (GOO) actuators except where specifically indicated otherwise. Valves of size, DN upto 100 mm (4") shall be wrench operated, valves of size DN 150 mm (6") to DN 300 mm (12") shall be gear operated and valves of sizes above DN

300 mm (12") shall be hydraulic operated unless otherwise indicated in the valve data sheets. Actuated valve shall also have hand wheel for manual operation. Each wrench-operated valve shall be supplied with wrench. Valve design shall be such that damage due to malfunctioning of the operator or its controls will only occur in the operator gear train or power cylinder and that damaged parts can be replaced without the valve cover being removed.

The Gas over Oil (GOO) actuator shall be in accordance with the specification issued for the purpose and as indicated in the Valve and Actuator Data Sheet. Operating time shall be as indicated in Process Data Sheets for valves / Material Requisition. Valve operating time shall correspond to full close to full open/ full open to full close under maximum differential pressure corresponding to the valve rating. For actuated valves, the actuator's rated torque output shall be 1.25 times the break torque required to operate the ball valve under the maximum differential pressure corresponding to the Valve Class Rating.

Valves shall be subjected to Operational Torque Test as per API 6D (Annexure B) under hydraulic pressure equal to maximum differential pressure corresponding to the applicable ANSI class rating of valve.

6.2.2 Add :

Manufacturer shall also indicate the number of turns of hand wheel in case of gear operators (along with their offer) required for operating the valve from full open to full close position.

When indicated in Material Requisition, valves shall have locking devices to lock the valve either in full open (LO) or full close (LC) positions. Locking devices shall be permanently attached to the valve operator and shall not interfere with operation of the valve.

6.2.3 Add:

No casting is permitted for stem and stem extension material of all valves. Valve stem shall be capable of withstanding the maximum operating torque required to operate the valve against the maximum differential pressure corresponding to applicable class rating for a minimum of 500 open-close-open cycles for a design life of 40 years. The combined stress shall not exceed the maximum allowable stresses specified in ASME section VIII, Division 1. For power actuated valves, the valve stem shall be designed for maximum output torque of the selected power actuator (including gear box, if any) at valve stem

7.0 MATERIALS

7.1 Pressure Retaining Parts

Modify clause no. 7.2.1 as below:

Bodies, including end flanges and welding ends (other than for field welding), bonnet and covers of valves shall be made in material conforming to API 6D spec. (or another material specification accepted by the Client/Engineer) and be furnished with certificates EN 10204-3.2 stating the quality, the mechanical properties (yield strength, tensile strength, percent elongation, impact test value at the temperature specified under per Section 8.4.2 of GTS) the chemical analysis, the manufacturing process and the marking (e.g. the heat number) of the steel. These certificates shall be added to the CMTR.

7.1.1 Modify:

- The carbon equivalent shall not exceed 0.43
- Add:
In case of LTCS material of Ball and Seat Ring, ENP coating of 75 micron shall be applied as per ASTM B733 15. Minimum hardness of plating 48-50 HRC (as plated) and 62-63 HRC (after heat treatment).
- Modify:

The ratio of yield strength to tensile strength shall not exceed 0.90.

7.2 Bonnet, Cover and Body Bolting

Modify first paragraph as below:

Bonnet flange cover and body bolting shall be in conformance to ASTM A320 Gr. L7. Nuts shall conform to ASTM A194 Gr.4/Gr. 7. All bought out items shall be procured with certificates EN 10204-3.2 including Valve actuator. These certificates shall be added to CMTR.

Add:

All studs and nuts shall be hot dip zinc coated.

7.3 Non – Metallic Parts

Add:

Non-metallic parts of the valves (including O-rings, soft seals etc.) intended for hydrocarbon gas service shall be resistant to explosive decompression.

7.4 Sour Gas Service

Not Applicable

8.0 FABRICATION AND TEST

Prior to manufacturing a meeting shall be organised between EPC Contractor, vendor/contractor, TPIA appointed by EPC Contractor and Owner.

8.1 Welding Fabrication

Replace third point by:

The joints shall be furnished in accordance with the requirements of Section VIII of ASME Boiler and Pressure Vessel Code - Division 1 and Section IX.

Add:

Vendor shall provide detail instruction for carrying out welding; pre heating etc and testing of weld joints between pipe and valves at site. Vendor shall depute engineer for welding instruction at site

8.2 Heat Treatment

Add

Chemical composition and mechanical properties shall be checked as per this specification and relevant material standards, for each heat of steel used. All testing frequency shall be as per Inspection & Test Plan/ QAP. Heat treatment chart for forging material shall be witness & start/stop time signed by TPIA.

8.2.1 Impact test

Charpy V-notch test on each heat of base material shall be conducted as per API 6D-Clause 8.5, for all pressure containing parts such as body, ball, seat, stem, end flanges and welding ends as well as bolting material for pressure containing parts. The Charpy V-notch test requirements of applicable material standard shall be conducted. The impact test temperature shall be lower of the temperature specified in material standard and -45C.

8.3 Non-Destructive Examinations (NDE)

The following non destructive examination shall be performed by the Manufacturer under the supervision of the TPIA and the certificates shall be added to the CMTR.

8.3.1 List of NDE

Add :

- Body castings of all valves shall be radiographically examined as per ASME B16.34. Procedure and acceptance criteria shall be as per ASME B16.34. The extent of the radiography shall be 100% for all class rating of all sizes.
- Radiography shall be performed after the final heat treatment also.
- Internal surfaces for all castings shall be 100% wet magnetic particle inspected. Method and acceptance shall comply with ASME B16.34.
- All valves made by forgings shall be ultrasonically examined in accordance with the procedure and acceptance standard of Annexure E of ASME B16.34. Body fabricated from plates is not acceptable.
- Internal surfaces of all forgings shall be 100% wet magnetic particle inspected. Method and acceptance shall comply with ASME B16.34.
- Full inspection by radiography shall be carried out on all welds of pressure containing parts including 100% radiography of the weld joint between valve and pup pieces. Acceptance criteria shall be as per ASME B31.8 and API 1104.
- Welds & valve body weld joints, which in Company's opinion cannot be inspected by radiographic methods, shall be checked by ultrasonic or magnetic particle methods and acceptance criteria shall be as per ASME Sec. VIII Division 1, Appendix 12 and Appendix 6 respectively.

8.4 PRESSURE TESTING

8.4.1 Add

In addition to above the helium leak test shall be carried out as per ASME Sec. V, Subsection A, Article 10 (Detector Probe Technique), Appendix IV. Helium leak testing shall be done at 25% of rated pressure for 30 mins.

8.5 OPERATIONAL TORQUE TEST

GOV actuated & Hydraulic operated valves shall be tested after assembly of the valve and actuator, at the valve Manufacturer's works. At least five Open-Close-Open cycles without internal pressure and five Open- Close-Open cycles with maximum differential pressure corresponding to the valve rating shall be performed

on the valve actuator assembly. The time for Full Open to Full Close shall be recorded during testing. If required, the actuator shall be adjusted to ensure that the opening and closing time is within the limits stated in Process Data Sheets for valves.

Hand operator provided on the actuator shall also be checked after above testing, for satisfactory manual override performance.

The above tests shall be conducted on all valves.

8.6 ANTI-STATIC DEVICE TESTING

“If requested in the purchase order, all ball valves shall be submitted of to an anti-static electricity testing in accordance with BS 5146 and this certificate shall be added to the CMTR”.

Subsequent to successful testing as specified in above clause, one (1) valve per size out of the total ordered quantity shall be randomly selected by the EPC Contractor / Owner / Owner’s Representative for cyclic testing as mentioned below:

- a) The valve shall be subjected to at least 100 Open-Close-Open cycles with maximum differential pressure corresponding to the valve rating.
- b) Subsequent to the above, the valve shall be subjected to hydrostatic test and supplementary air seat test.

Air seat test shall be carried out at 7 barg and not 6 barg as mentioned in GTS.

In case this valve fails to pass these tests, the valve shall be rejected and two more valves of same size shall be selected randomly and subjected to testing as indicated above. If both valves pass these tests, all valves manufactured for that size (except the valve that failed) shall be deemed acceptable. If either of the two valves fails to pass these tests, all valves of that size shall be rejected or each valve shall be tested at the option of manufacturer.

Previously carried out test of similar nature shall be considered acceptable if the same has been carried out by Manufacturer in last two years. Valves of same size and rating previously tested shall be qualified.

9.0 MARKING

Add:

All valves shall be marked as per API 6D. The units of marking shall be metric except nominal diameter, which shall be in inches.

Valve ends shall be suitably protected to avoid any damage during transit. All threaded and machined surfaces subject to corrosion shall be well protected by Moly coat type grease or other suitable material. All valves shall be provided with suitable protectors for flange faces, securely attached to the valve s. Bevel ends shall be protected with metallic or high impact plastic bevel protectors.

All sealant lines and other cavities of the valve shall be filled with sealant before shipment

On packages, following shall be marked legibly with suitable marking ink:

- a) Order Number
- b) Manufacturer's Name
- c) Valve size and rating
- d) Tag Number
- e) Serial Number

10.0 INSPECTION

10.1 Information

Add:

In case of supply from foreign origin, the Manufacturer shall inform the Control Authority min. fifteen (15) working days in advance of any intervention required by this specification and shall send a copy of it to the Client/Engineer (by fax).

Valve's certification requirements shall comply with European Standard EN 10204 (latest edition) 3.2 Certificate.

Add:

PACKING

Ball valves are to be suitably packed, crated (seaworthy crate in the case of foreign vendors) and handled properly to prevent damages or deteriorations during transportation by sea (in the case foreign vendors) and road to the designated ware houses (as detailed in the commercial volume of the tender).

Vendors shall submit drawings and details of the proposed packing / crating method clearly indicating the following:

- Secure bolting arrangement of the ball valve to the robust base of the crate for packing.
- Lateral staying arrangement to prevent movement of the valve inside the crate resulting damage during transportation and handling.
- Also all extended parts such as drain and vent piping shall be securely supported to the valve body to prevent damage during transportation and also subsequent installation and use in operations.

10.2 Documents

Add:

Owner's representative shall obtain the following documents from manufacturer and verify before placement of order:

- General arrangement/ Sectional drawing & blow-up drawing of seat assembly shall be submitted.
- Number of turns for Gear Operated valves shall be indicated in the GA or shall be furnished separately.
- Torque curves for the power actuated valves along with the break torque and maximum allowable stem torque.
- Copy of valid API 6D Certificate.

In case of soft seated valves, copy of Fire Safe Test certificate of qualifying valve as per API 6FA carried out in last 10 years shall be furnished.

Details of support foot including dimensions and distance from valve centerline to bottom of support foot.

11.0 PAINTING AND COATING

Following coating specification shall be followed:

11.1 Underground Valves:

The external coating for underground valves shall be made of solvent free PUR / min. 1000 microns (Final Paint DFT) thickness in two layers Polyurethane as per code DIN 30677/2 (Type DIN 30677/2-PUR-50) alternatively high build epoxy corrosion protection coating with minimum 500 microns final DFT as per DIN 30677/2 is also acceptable.

For repair it would be as per manufacturer's recommendations which have to be approved by Owner/Engineer.

11.2 Aboveground Valves:

The surface of the valve will be shot-blasted SA 2 1/2 (Swedish standard SIS 055900). Before painting, the valve shall be cleaned from grease and dirt. The painting shall be as per ISO12944-5-2007 (Table A-5) Paint System No. S5.14 with durability C-5 (I) Very High Industrial. The final paint DFT shall be minimum 300 microns.

The nature of the products shall be specified in the offer and shall guarantee a corrosion protection for a storage period in a shop for at least one year.

Painting in accordance with Client/Engineer's specifications.

Painting and coating procedures shall be submitted for approval before manufacturing to the Control Authority and to the Client / engineer.

12.0 SPARES AND ACCESSORIES

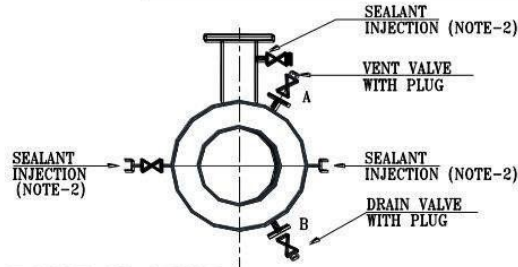
All spares required for start-up and commissioning of the valve shall be supplied along with the valve. Manufacturer shall furnish list of recommended spares and accessories required for two years of normal operation and maintenance of valves and price for such spares shall be quoted separately.

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Appendix –I

Schematic for drain vent and stem / sealant point

ABOVE GROUND INSTALLATION



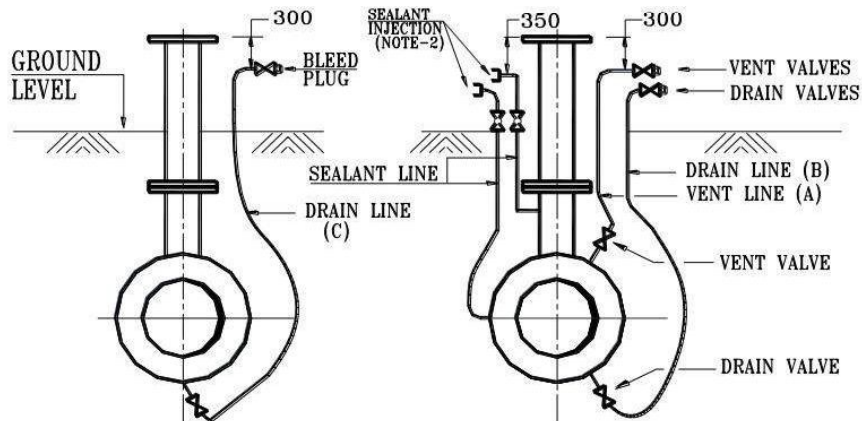
FULL BORE VALVES

| VALVE SIZE, DN(mm) | A, DN(mm) | B, DN(mm) |
|--------------------|-----------|-----------|
| 50 AND 150 | - | 15 |
| 200 TO 600 | 15 | 25 |
| 650 & ABOVE | 15 | 40 |

NOTES:-

- 1 ALL VALVES (BALL OR PLUG) AND PLUGS FOR A AND B SHALL BE APPROVED BY THE PURCHASER.
- 2 SEALANT POINTS SHALL BE PROVIDED FOR FULL BORE VALVES OF NOMINAL VALVE SIZE 200 mm (8") & ABOVE ONLY SEALANT LINES SHALL HAVE PROVISION TO REPLACE THE SEALANT INJECTION FITTING UNDER FULL LINE PRESSURE. SEALANT LINES SHALL HAVE BLOCK VALVE & INTERNAL NON RETURN VALVE.
- 3 ALL VENT/DRAIN CONNECTION SHALL BE WELDED WITH THE BODY.

UNDERGROUND INSTALLATION



FB VALVES DN 50 mm(2'') TO DN 150 mm(6'') FB VALVES > DN 200 mm(8'')

FULL BORE (FB) VALVES

| VALVE SIZE, DN(mm) | A, DN(mm) | B, DN(mm) | C, DN(mm) |
|--------------------|-----------|-----------|-----------|
| 50 AND 150 | - | - | 15 |
| 200 TO 300 | 25 | 25 | - |
| 350 TO 600 | 25 | 25 | - |
| 650 & ABOVE | 40 | 40 | - |

NOTES:-

- 1 ALL VALVES (BALL OR PLUG) AND PLUGS FOR A AND B SHALL BE APPROVED BY THE PURCHASER.
- 2 SEALANT POINTS SHALL BE PROVIDED FOR FULL BORE VALVES OF NOMINAL VALVE SIZE 200 mm (8") & ABOVE ONLY SEALANT LINES SHALL HAVE PROVISION TO REPLACE THE SEALANT INJECTION FITTING UNDER FULL LINE PRESSURE. SEALANT LINES SHALL HAVE BLOCK VALVE & INTERNAL NON RETURN VALVE.
- 3 ALL VENT/DRAIN CONNECTION SHALL BE WELDED WITH THE BODY.

ADDITIONAL NOTES:

1. **FOR ABOVE GROUND INSTALLATION:** ALL DRAIN & VENT CONNECTION SHALL BE EQUIPPED WITH ONE NO. (1) BALL VALVE, ONE NO. (1) NEEDLE VALVE, ONE NO. (1) DEPRESSURIZING PLUG AT THE TERMINATING END. NO THREADED CONNECTIONS ARE PERMITTED. ALL PIPES & FITTINGS SHALL BE SCH. 160 & 6000# RESPECTIVELY FOR ALL DRAIN, VENT & SEALANT CONNECTIONS.
2. **FOR UNDER GROUND INSTALLATION:** ALL DRAIN & VENT CONNECTION SHALL BE EQUIPPED WITH ONE NO. (1) BALL VALVE AT BODY TAP, ONE NO. (1) BALL VALVE, ONE NO. (1) NEEDLE VALVE, ONE NO. (1) DEPRESSURIZING PLUG AT THE TERMINATING END. NO THREADED CONNECTIONS ARE PERMITTED. ALL PIPES & FITTINGS SHALL BE SCH. 160 & 6000# RESPECTIVELY FOR ALL DRAIN, VENT & SEALANT CONNECTIONS. ALL BURIED DRAIN & VENT BALL VALVE AT BODY TAP SHALL BE KEPT IN OPEN POSITION AT THE TIME OF INSTALLATION.
3. THE DRAIN LINE IN UNDERGROUND VALVES SHALL BE PROTECTED BY STEEL GRATING SO THAT THEY ARE NOT DAMAGED DURING TRANSPORTATION OR INSTALLATION.

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CENTRAL U.P. GAS LIMITED (CUGL)

**LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN
BAREILLY, KANPUR & UNNAO AND JHANSI GAS**

PTS – MONOLITHIC INSULATING JOINT

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1. GENERAL

This specification describes the aboveground insulating joints to be installed in City Gas Distribution Project in Bareilly, Kanpur & Unnao and Jhansi GAs.

The insulating joints/couplings have to be delivered in accordance with code compliance as described in data sheet and technical specification:

Codes, Norms and standards:

| | |
|-----------------------|---|
| ANSI B16.9 | : Factory - made wrought steel butt welding fittings. |
| ANSI B31.8 | : Pipeline Transportation System for Gaseous Hydrocarbons. |
| ANSI B 16.5 / B 16.47 | : Pipe Flanges and Fittings |
| ASTM A 53 | : Pipe, steel, black and hot-dipped zinc coated welded and seamless. |
| ASTM A 105/A 105 M | : Forgings, carbon steel, for piping components. |
| ASTM A 106 | : Seamless carbon steel pipe for high temperature service. |
| ASTM A 234/A 234 M | : Piping, fittings of wrought carbon steel and alloy steel for moderate and elevated temperatures. |
| ASTM A 320/A 320 M | : Alloy steel bolting materials for low temperature service. |
| ASTM A 333 | : Seamless and welded steel pipe for low temperature service. |
| ASTM A 350/A 350 M | : Forgings, carbon and low alloy steel, requiring notch toughness testing for piping components. |
| ASTM A 370 | : Mechanical testing of steel products. |
| ASTM A 381 | : Metal-arc-welded steel pipe for use with high-pressure transmission systems. |
| ASTM A 420/A 420 M | : Piping fittings of wrought carbon steel and alloy steel for low temperature service. |
| ASTM A 694/A 694 M | : Forgings, carbon and alloy steel, for pipe flanges, fittings, valves, and parts for high-pressure transmission service. |
| ASTM A 707/A 707 M | : Flanges, forged, carbon and alloy steel for low temperature service. |
| ASTM E 112 | : Standard methods for determining the average grain size. |
| API 5L | : Specification for line pipe. |
| API 6D | : Specification for pipeline valves, end closures, connectors and swivels. |

- MSS SP 25 : Standard marking system for valves, fittings, flanges and unions.
- MSS SP 55 : Quality standard for steel castings for valves, flanges and fittings and other piping components (visual method).
- MSS SP 75 : Specification for high test wrought butt welding fittings.
- ASME SEC VIII : Boiler and Pressure Vessel code.
- ASME SEC IX : Welding and Brazing Qualifications.
- EN 10204 : Metallic products - Types of inspection documents.
- ISO 148 : Metallic materials — Charpy pendulum impact test.
- ISO 9001 : Quality Management Standard.

The present specification can confirm, complete or alter certain characteristics or tolerances of existing laws or specifications.

In his offer, the manufacturer shall specify all proposed modifications or alternatives to the present specification. In all cases, each modification has to be submitted to the Client / Client's Representative. All consequences after eventual order for non-respect of this obligation are at the manufacturer's charge and responsibility.

The manufacturer's specification of the steel, the manufacturing procedure itself and the laboratories in which testing takes place, shall be approved and registered by Owner /Owner's Representative.

The Owner may verify the control equipment of the manufacturer, testing equipment to be calibrated in Client's approved NABL laboratory. If during the production certain problems arise the Owner may demand supplementary tests.

At all times while work on the contract of the purchaser is being performed, the inspector representing the purchaser shall have free entry to all parts of the manufacturer's facilities and those of all subcontractors, who are involved in the manufacturing of the insulating couplings. All reasonable facilities shall be afforded to the inspector to satisfy him that the product is being furnished in accordance with these specifications. All tests and inspections called for by these specifications will be made in the manufacturer's plant prior to shipment and at the manufacturer's expense, unless otherwise, and shall be conducted as not to interfere unnecessarily with the operations of the manufacturer's plant. The manufacturer shall notify the purchaser prior to completion or shipment of all pieces requiring such inspection.

Eventual interpretations and deviations to this specification by the Manufacturer shall be requested by writing in his offer with detailed justification and approved by the Client / Client's Representative before the eventual order to the Manufacturer. The latter is responsible and shall indemnify the Owner /Owner's Representative for any damage resulting from the non-respect of this obligation.

An approval of documents can never be considered as an acceptance of deviations or relaxations to requirements. A deviation is only possible after specific request to the Owner.

A valid copy of the ISO 9001 certificate shall be included in the offer.

The manufacturer shall inform the TPIA Minimum 5 working days in advance of any control test or examination under the supervision of the TPIA required by this specification and shall send a copy (fax) of it to the Owner / Owner's Representative.

The manufacturer shall send for approval a List of Operation in Manufacturing and Control to the Client / Client's Representative, TEN (10) working days before manufacturing. This list shall be in conformity with the annex 1 of this document. Before starting any manufacturing, the manufacturer shall be in possession of this approved document, filled in with all intervention points.

2. DESIGN AND CONSTRUCTION

- 1) The pressure temperature ratings of insulating joints/couplings shall be in accordance with ANSI B16.5.
- 2) The design temperature range is from -20°C to +65°C. The design pressure is 98 bar g.

Wall thickness for parts used for the welding connection with the line pipes shall meet the following requirements:

- The maximum allowable stress in the base material and in the weld shall be equal to seventy two per cent (40%) of the minimum yield strength guaranteed by the specification of the steel used.
- The minimum wall thickness must be greater than or equal to the largest value of either the calculated minimum thickness in each zone of the coupling or of the nominal thickness of the pipe on which the coupling is welded.
- The specified pipe wall thickness and grade (with reference to the equivalent grade in API 5L and ASTM spec.) with which the coupling is intended to be used is specified in the data sheet.
- No negative tolerance is allowed for the wall thickness.
- The internal diameter of the insulating coupling shall be the same as the internal diameter of steel pipeline (see attached steel pipe data sheet).

The manufacturer shall submit for approval to the Client / Client Representative the dimensional drawings, QAP, the design calculations of the parts used for the welding connection to the pipeline and the material part lists for all the parts of the insulating coupling. All these documents must be identified with the purchaser's order number.

The design shall take into consideration performance requirements prescribed in paragraph 2.6 and 2 of ASME Section VIII DIV. I APP II.

- The design of the insulating coupling must be established, in accordance with par. 2.7 and must be established by mathematical analysis according to ASME code, section VIII DIV I.
- These calculations shall be submitted to the Client / Client's Representative before the fabrication will start.
- Insulating joint design and materials shall be capable of being vacuum tested to 1 millibar.
- Insulation material shall be minimum 20 mm thick and shall comply with Section 5, NACE RP 0286.

Hydrostatic test

- Hydrostatic tests shall be made as evidence of the adequacy to the design references. Records of design or successful proof tests shall be available at the facility for inspection.
- Unless otherwise agreed upon between manufacturer and purchaser, the only required proof test is a hydrostatic test.
- The hydrostatic test will be performed at $P = 1.5 \times \text{Design pressure}$ for min. 15 min duration, in presence of the Owner/Owner's Representative.

Air Leak Test

Air test shall be 5 Kg / cm². The duration of test shall be minimum 10 minutes. Tightness shall be checked by emersion or with frothing agent. No leakage shall be accepted

Coupling dimensions :

One of the principles of this standard is the maintenance of a fixed position for the welding ends with reference to either the centreline of the fittings or the overall dimensions, as the case may be. Dimensional standards for NPS 8 and smaller sizes may be found in the ANSI B 16.9 standard.

Coupling tolerances

❑ Tolerances for wall thickness, welding ends, out-of-roundness at the welding ends and inside diameter at the bevel for all couplings are shown hereafter. Other tolerances for NPS 8 and smaller in Table 1 and A1 of the ANSI B16.9 standard.

❑ **Welding ends :**

The welding land and bevel shall be in accordance with Figure 1 for wall thickness up to 20.0 mm ; for thicker walls, refer to Figure 2. The welding end land of the coupling shall be machined flat and shall not vary from the plane by more than 0.03 in (0.8 mm) at any point. If a coupling has a thickness unequal to the pipe with which it is intended to be used, the welding end preparation at the joint has to conform with Figure 3.

❑ **Out-of-roundness at the welding ends :**

For welded Ends, maximum out of roundness (difference between maximum and minimum internal diameter of pipe) shall be 3mm and tolerance on internal diameter at flow tee ends shall be same as diameter tolerance for the pipe ends indicated in Table -10 API 5L (latest edition).

| | Out of Roundness (mm) |
|-----------|------------------------------|
| Pipe Ends | OD > 6" - 3 mm max. |

3. MATERIALS

- 3.1 The steel used in the manufacture of insulating coupling shall be selected by the manufacturer and submitted for approval to the Client / Client’s Representative at the time of the offer. The manufacturer shall fill in the data sheet.
- 3.2 The chemical composition of the steel meets the requirements of cl. 3.10.
- 3.3 The steel used has tensile properties conforming to the requirements prescribed in Table 1 in cl. 4.4 and capable of meeting the coupling manufacturer's design conditions.
- 3.4 The ratio of yield strength to tensile strength shall not exceed 0.90.
- 3.5 The material for couplings shall consist of blooms, billets, slabs, forging quality bar, plate, seamless or fusion welded tubular products with filler metal added.
- 3.6 The steel shall be fully killed, fine grain practice.
- 3.7 The steel used shall be suitable for field welding to other fittings, pipes, flanges, or valves manufactured under ASTM specifications A 333, A350, A381, A420, A694, A707 or API standards specifications 5L,6D, 605 or MSS standards SP-44, SP-72, SP-75 and EN 10208-2 as specified in PMS.
- 3.8 If preheating of the material is required to insure proper weldability under normal field conditions, the manufacturer shall state so in the offer, specifying preheat requirements and if accepted by the purchaser this shall be permanently indicated on the insulating coupling.

3.9 The manufacturer must deliver a certificate EN 10204-3.2. stating the quality, the mechanical properties (yield strength, tensile strength, percent elongation, impact test at 0°C or material specification), the chemical analysis, the process of manufacture and the marking (for example the heat number of material) of the steel.

3.10 Chemical composition

- For each heat the manufacturer shall check a chemical analysis of the steel as per below
- The choice and use of alloying elements for couplings made from high strength low alloy steels to obtain the tensile properties prescribed in 4.4 shall be made by the manufacturer and included and reported to identify the type of steel.
- Carbon equivalent shall be computed by "check analysis", the following equation is applicable:

$$C.E. = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

and shall not exceed 0.40 % . The CE (IIW) limits shall not apply if C < 0.12%

Maximum limit of chemical elements which may be used in material under this standard.

| | % Maximum |
|----|-----------|
| C | 0.230 |
| Mn | 1.60 |
| Si | 0.50 |
| P | 0.030 |
| S | 0.025 |
| Nb | 0.080 |
| V | 0.120 |
| Mo | 0.250 |
| Nt | 0.0150 |

Alternate alloy elements may be used but they shall be discussed with the user prior to delivery of the material. This table is not intended to represent the composition of any heat of steel, but merely to record the maximum permissible amounts of one element. The combination of elements of any heat must conform to the carbon equivalent, subsection 3.10.3.

For each heat the manufacturer shall analyse the following elements:

C, Mn, Si, P, S, Nb, V, Cr, Mo, Ni and Cu.

The intentional addition of elements other than those specified is not permitted unless agreed upon by the purchaser.

In any case, for unintentional additions, the following limitations shall be respected:

Cr ≤ 0.15 % Mo ≤ 0.05 % Cu ≤ 0.20 %
 Ni ≤ 0.30 % Co ≤ 0.01 % Al ≤ 0.07 %

The content of N total (N_t) may be up to 0.0150 % and must be guaranteed by the manufacturer. If the manufacturer cannot give any guaranty of N content, he shall analyse this element.

The total content for Nb + V will be limited to 0.150 %.

In grades X42 through X70 for each reduction of 0.01 % below the maximum carbon content, an increase of 0.05% manganese above the specified maximum is permissible, up to a maximum of 1.70 %.

- 3.11 The design of insulating material shall conform to following requirements:
- The electric resistance does not decrease with time.
 - The insulating material shall not deform.
 - The insulating material shall be resistance to chemical attack by transferred fluid under design Temperature and pressure.
 - The transferred fluid does not penetrate into the structure of the insulating material under design conditions of pressure and temperature

4. FABRICATION AND TEST

Prior to manufacturing a meeting shall be organised between Client / Client's Representative, Vendor / Contractor, Client's Approved TPIA.

4.1 Welding Fabrication

- 4.1.1 All welds and repair welds shall be performed according to written procedures. The welding procedure must be submitted for approval to the Client / Client's Representative before any fabrication.
- 4.1.2 The joints shall be furnished in accordance with the requirements of Section VIII of ASME Boiler and Pressure Vessel Code (Latest Addition).
- 4.1.3 Machine welding shall be done by an electric process, preferably by submerged arc.
- 4.1.4 All butt welds shall have full penetration. Submerged arc machine welding shall be done with at least one pass from the inside, except when accessibility makes this impossible, then a manual or machine root bead may be employed provided that a visual inspection of the root bead is possible. Backing rings shall not be used. Weld design shall be such as resulting in a weld joint factor of 1.0.
- 4.1.5 Repair, chipping or grinding of welds shall be done in such a manner as not to gouge, groove, or reduce the original metal thickness below the nominal specified wall thickness.
- 4.1.6 Welded-on braces, if used, should be removed before heat treatment and the weld spot shall be repaired and ground flush and smooth. However, when braces are required for heat treatment, they shall be cut out and the surface shall be ground flush and smooth after heat treatment. Welding shall not be permitted after heat treatment. The ground areas shall be inspected by magnetic particle or liquid penetrant testing.
- 4.1.7 Weld reinforcement shall be removed upto 150 mm externally and 100 mm internally at both ends of pups.

4.2 Welding procedures

- 4.2.1 All welds, repair welds and repair by welding shall be performed according to written procedures. These welding procedures shall be qualified according to the requirements of the ASME Boiler and Pressure Vessel Code, Section IX.

The welding procedure tests are required on material which is on the high side of the chemistry specification. If existing WPS, PQR, WPT not found satisfactory then new WPS, PQR, WPT shall be establish and witness by Client.

The manufacturer shall maintain a weld record of the procedure and performance test results. The test coupons shall be submitted to the same fabrication and heat treatment as the actual couplings.

The welding procedure qualification must include an impact test set in the weld and in the HAZ with requirements of paragraph 4.4.2 and a macrographic examination described in paragraph 4.2.2. These tests shall be performed after eventual final heat treatment.

If weld thickness is higher than 25mm, additional impact test shall be performed on the test specimens taken in weld thickness layers.

- 4.2.2 Macrographic Examination: the etched surface of the macro test specimen viewed macroscopically must display the image of a well performed welded joint with sufficient penetration, free from linear defects and

important inclusions. In case of doubt, the etched surface must be examined microscopically and additional macroscopical examinations of other areas may be required.

The acceptance of inclusions can be decided upon with the NDE of the welded plates (see paragraph 4.5.).

The macro graphic examination will include hardness measurements in the welds and HAZ. The hardness shall not exceed the values measured on the parent metal by more than 80 points from the welds and 100 points for HAZ, with an absolute maximum of 350 HV10.

4.2.3 Transverse guided bend test

Test method

Transverse weld test specimens shall be subjected to face and root guided bend tests. The specimens shall be approximately 1.5 in (38 mm) wide, at least 6 in (152 mm) long with the weld at the centre, and shall be machined in accordance with Figure 4. The face bend specimen shall be bended with the inside surface of the pipe against the plunger, and the root bend specimen with the outside surface against the plunger. The dimensions of the plunger for the bending jig shall be in accordance with Figure 5 and the other dimensions shall be substantially as shown in Figure 5.

The manufacturer shall use a "jig" based on this dimension or a smaller dimension at this option.

Test specimen

The weld bend test specimens, as described here above shall be cut from the coupon. The specimens may be taken from a pipe for coupling fabrication or from sample plates as described in par. 4.4.1.

Acceptance criteria

The bend test shall be acceptable if no cracks or other defects exceeding 0.12 in (3.2 mm) in any direction are present in the weld metal or between the weld metal and the coupling metal after the bending. Cracks which originate along the edges of the specimen during testing and which are less than 0.25 in (6.4 mm) measured in any direction, shall not be considered unless obvious defects are observed.

4.2.4 Retest

If either test fails to conform to specified requirements, the manufacturer may elect to make retests on two additional specimens from the same lot*, each of which shall conform to the requirements specified here above. If any of these specimens fail to conform to the requirements, the welding procedure qualification test is not accepted.

4.3 Normalising Heat Treatment

(NOT APPLICABLE ON FINISHED COUPLING)

4.3.1 After forming and welding, all couplings shall be heat treated by normalising or any applicable and appropriate heat treatment. Normalising shall be carried out in such a way that the base material acquires a fine grained perlitic structure.

The normalising procedure requires the approval of the Client / Client's Representative. Good care shall be taken to avoid direct contact of the flames with the material to be heated.

During the normalising period, the temperature of the heat treatment lot shall be automatically recorded by a sufficient number of thermocouples attached to the material surface. The thermocouples shall be adequately protected against the influence of heat radiation. Temperature variations shall be within $\pm 20^{\circ}\text{C}$. The manufacturer shall furnish time temperature charts of each heat treatment lot. The couplings belonging to each treatment lot shall be specified on the charts. Temperature measurements by other means are permitted only if approved by the Client / Client's Representative.

4.3.2 The fine grained perlitic structure of the steel shall be verified by at least one micrographic examination per lot, according to ASTM E 112. The grain size shall be in the range of 8 to 12.

4.3.3 The manufacturer shall include in the CMTR data of this treatment.

4.3.4 A lot consists of all pieces from one heat of steel with same initial wall thickness, from the same furnace charge for final normalizing heat treatment, from the same shape and the same main pipe dimension.

4.4 Mechanical Tests

The following mechanical tests shall be performed on Insulating joint materials after final heat treatment under the supervision of the TPIA and the certificates shall be added to the CMTR.

Test specimen may only be cut after a marking transfer by the TPIA.

1) Tension test

Requirements

The material shall be in conformance with Table 1; the ratio yield/tensile strength will be ≤ 0.90 .

For pieces containing welds, the fracture must be outside of the weld. If there is a fracture in weld or HAZ, the tensile strength shall at least meet the requirements for tensile properties in Table 1.

Table – 1

TENSILE REQUIREMENTS OF THE WELDING END OF INSULATING JOINTS

| CLASS SYMBOL | YIELD STRENGTH (min.) | | TENSILE STRENGTH (min.) | | ELONG. IN 2" MIN. % |
|--------------|-----------------------|-----|-------------------------|-----|------------------------|
| | KSI | MPa | KSI | MPa | |
| X52 | 52 | 359 | 66 | 455 | As per API 5L table 3B |
| A333 Gr.6 | 35 | 240 | 60 | 415 | 22 |

Test specimen

The test specimen shall represent all forgings from the same lot. Test specimens shall be taken after final heat treatment from a piece of pipe or plate of the same nominal thickness, same heat of steel from which the coupling is made and which has been heat treated in a lot with any of the pieces it represents. For welded pipe, this coupon (piece of pipe or plate) shall contain a weld in prolongation of the weld of the pipe.

Number of tests

For couplings NPS 2 and greater the following number of test shall be performed:

- Base material : Per Size / Per Raw Material Lot / Heat Treatment Lot
- Weld : Per Size / Per Raw Material Lot / Heat Treatment Lot

Test locations and orientations

For welds, the test specimen shall be orientated transversally to the weld. For base material, test specimens shall be orientated transversally and if this orientation is not feasible, it shall be orientated longitudinally.

Test method

Testing shall be performed in accordance with ASTM A 370 standard rectangular plate type 1-1/2" wide (Fig. 4-A370) or standard round (Fig. 5 or Fig. 6-A370). Yield strength shall be determined either by the 0.2 % offset or the 0.5 % extension under load (EUL) method.

Retest

If the tension test specimen from any lot fails to conform to the requirements of the particular grade ordered, the manufacturer may elect to make retests on two additional pieces from the same lot, each of which shall conform to the requirements specified in Table 1. If one or both of the retests fail to conform to the requirements, the whole lot of that specimen will be rejected.

2) Impact test

Requirements

The Charpy V- Notch test shall be conducted as per following requirements:

| Material | Impact Test Temperature | Energy Absorption Value (Minimum) |
|-----------------------|--------------------------------|---|
| Carbon Steel Material | 0 Deg. C | <ul style="list-style-type: none"> - At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction. |

Test specimen

The test specimen shall be machined from material obtained as in paragraph Test specimen for Tension test (par. 4.5.1.).

Flattening of test specimens is not allowed.

Number of tests and orientation

Three test specimens shall constitute one test set.

For couplings NPS 2 and greater, the following number of tests shall be performed:

- Base material: 2 test sets, one set shall be orientated longitudinally and another one transversally.
- Weld: 1 test shall be orientated transversally.
- HAZ: 1 test shall be orientated transversally.

Test method

The notched bar impact test shall be made in accordance with ISO 148 - Charpy V - Notch.

If the wall thickness of the coupling or the coupon does not enable machining of full size specimens, the largest possible size must be used but not less than (10 x 5 mm). The axis of the notch shall be orientated through the wall thickness of the coupling.

3) Flattening test

Requirements

Flatten to 1/3 original O.D. without cracks or breaks in the coupling piece, continue flattening until meeting opposite walls of the coupling piece.

No evidence of lamination of burnt metal may develop during entire test.

Test specimen

The test specimen represents all the couplings from the same heat of steel of the same shape and of the same main pipe dimension of the couplings.

Number of tests

For coupling nominal size lower than 2" one flattening test shall be made per test specimen.

4) Retreatment

If the result of the mechanical tests does not conform to the requirements specified in par. 4.4, the manufacturer, with the acceptance of the Client / Client's Representative, may reheat treat the couplings as applicable and repeat all the tests specified.

4.5 Non-Destructive Examinations (NDE)

The following non-destructive examination shall be performed by the Manufacturer under the supervision of the TPIA and the certificates shall be added to the CMTR.

4.5.1 All butt welds shall be radiographed in accordance with ANSI 31.8 or ASME section V - non-destructive examination - article 2 - using fine grain film and lead screens.

4.5.2 The fillet weld shall be 100 % dye penetrant tested in accordance with ANSI 31.8.

4.5.3 U.S., magnetic, visual and dimensional examination

a) In the presence of the control authority's delegate, the manufacturer shall perform the following non-destructive examinations on all couplings according to an inspection procedure to be submitted for approval :

- ◆ For couplings with wall thickness larger than or equal to 6 mm, ultrasonic inspection on the whole surface (with angle probe and straight probe) to the maximum extent possible.
- ◆ Magnetic particle inspection on the butt welds and whole external surface and the accessible internal surface.

b) Visual examination: All Coupling shall be visually examined.

c) After machining, all the finished bevels shall be submitted to the following tests :

- ◆ Magnetic particle or liquid penetrant.
- ◆ All finished weld ends shall be 100% ultrasonically tested for lamination type defects for a distance of 50 mm from the ends. Any lamination larger than 6.35 mm shall not be acceptable.
- ◆ For coupling with wall thickness larger than or equal to 6 mm, ultrasonic inspection on 25 mm of base material.

d) Dimensional examination

All insulating couplings shall be submitted to a dimensional examination.

4.5.4 Acceptance criteria of the different NDE

a) Visual examination

The following defects are unacceptable:

- ◆ Undercuts exceeding 1 mm in depth and 25 mm in length.
- ◆ Undercuts of the outside weld which overlap undercuts of the inside weld.

- ◆ Lack of penetration.
 - ◆ Continuous occurrence of under-cutting.
- b) Magnetic particle inspection on the external surface. ASME code, section VIII, division 1, appendix VI.
- c) Ultrasonic inspection
- ◆ For the welds:
 - For longitudinal welds: ASME code section VIII, division 1, appendix 12;
 - Butt welds : (see 4.5.3 e)
 - ◆ For base material :
 - Procedure: ASME code, section V, art. 23, SA-388
 - Criteria : ASME code, section VIII, division 1, UF-55 (angle probe will be used).
- d) Radiographic examination
- ◆ For longitudinal seam welds :
 - Criteria : ASME code, section VIII, division 1, UW 51
 - ◆ For girth welds :
 - Criteria: API standards 1104, section 6.0.
- e) Magnetic particle or liquid penetrant on the finished bevel
- The following defects are unacceptable:
- ◆ Defects extending into the bevel provided the lamination is parallel to the surface and has a transverse dimension exceeding 6.35 mm.
 - ◆ All defects not parallel to the surface extending into the bevel.

4.6 Coupling Testing

4.6.1 Hydrostatic testing

Hydrostatic testing by the manufacturer is required, welding insulating couplings shall be capable to withstand a shop and field hydrostatic testing in accordance with par. 2.

The insulating coupling shall be hydrostatically tested at $P = 1.5 \times \text{Design Pressure}$ for minimum 15 min. duration, in presence of the TPIA.

4.6.2 Electrical testing

After the hydrostatic tests, the insulating coupling shall be tested with 5000V AC, 50 Hz and the holding time shall be not less than one minute. Before and after the electrical test, each insulating coupling shall be checked with an insulation check. The acceptable result is a min. value $>50 \text{ M ohm (1000V DC)}$.

4.7 WORKMANSHIP AND FINISH

4.7.1 All insulating couplings shall be free of injurious defects and shall have workman like finish.

4.7.2 Injurious defects are defined as those having a depth in excess of 6-1/2 % of specified nominal wall thickness.

4.7.3 Machining and grinding of surface defects shall be treated as follows : sharp defects such as notches,

scratches, scrabs, seams, laps, tears, or slivers not deeper than 6-1/2 % of nominal wall thickness shall be removed by grinding. Repair of injurious defects by welding shall be permitted only after agreement by the Client / Client's Representative, except that welding of injurious defects shall not be permitted when the depth of defects exceeds 33-1/3 % of the nominal wall thickness, or the length of repair exceeds 25 % of the specified diameter. Defects must be completely removed and welding performed by a welder qualified specifically for repair welding, as per par. 4.1. Such repair welding shall be ground flush with the surface and all welding shall be done before final heat treatment. Repair welding shall be done with low hydrogen electrodes in shielded metal arc welding, gas metal arc process or submerged arc process. In no case, repair welding or cracks nor repair or repairs is allowed.

- 4.7.4 Repair welding shall be done before the last heat treatment. Adjusting weld preparations, intended for field welding, by means of welding is not allowed.
- 4.7.5 Repair welding on the welds shall be 100 % radiographed and U.S. tested. Repair welding in the body shall be 100 % U.S. tested.
- 4.7.6 At the discretion of the TPIA, finished insulating couplings shall be subject to rejection if surface imperfections acceptable under par. 4.7.2. are not scattered but appear over an area in excess of what is considered as a workmanlike finish.

5. MARKING

- 5.1 All insulating couplings furnished under this specification shall be clearly identified on the O.D. with the following information marked with low stress die stamps or interrupted dot stamps except as noted :
- a) Manufacturer's name or trademark.
 - b) Heat code identity.
 - c) Marking and identification shall be done by paint/ stencilling and low stress hard punch.
 - d) Coupling number: the coupling number shall be made up of eight figures specified as follows: his tag number specified in the purchase order.
 - e) The monogram of the TPIA. This marking shall only be applied after complete approval of the Certified Material Test Report (see par. 6.4.).
- 5.2 In addition to the above, it shall also include the following information :
- Grade symbol: The grade symbol must designate the material of the coupling conforming to Table 1 or equivalent ASTM code. When couplings are produced under the Para 2., the marking will also include the grade of the material of the pipe to which the coupling shall be welded (see data sheet). For example, a coupling fabricated in a grade A333 Gr.6 designed to be welded to a main grade X60 pipe and to branch grade A333 Gr.6 pipe would contain the following marking: A333 Gr.6/X60/A333 Gr.6.
- 5.3 Marking must be done prior to final inspection.

6. INSPECTION

- 6.1 The manufacturer shall inform (by fax/Email) the Client / Client's Representative 5 working days in advance of any intervention required by this specification and shall send a copy (fax/Email) of it to the purchaser and engineer. Inspection and testing to be carried out as per client approved ITC/reverent workingprocedure and std codes.
- 6.2 Before starting any fabrication, the manufacturer shall submit for approval to Client / Client's Representative the following documents :
- Detailed fabrication drawing and calculations.

- ❑ Welding procedures (ASME, section IX, with impact at -20°C. & as per QCT).
- ❑ Fabrication and control procedure.
- ❑ List of Operations in Fabrication and Control (LOFC) in accordance with annex 1.
- ❑ Material list.
- ❑ Detailed QAP

Each company dealing in the order by fabrication and/or control shall implement a LOFC for all operations and interventions performed in its organization. They shall also be responsible for the implementation of the same by their subcontractors.

6.3 A Certified Material Test Report (CMTR) shall be furnished listing as built drawing and calculations, the LOFC (see paragraph 6.2.), the proof test certificate, the base material certificate, the chemical check analysis. The certificate of the heat treatment, the mechanical tests, electrical tests, the non-destructive examination, the mechanical properties, the quality release note (see paragraph 6.4.) and any special test required by the purchase order. The coupling individual number (see paragraph 5.3) must be indicated in the CMTR to permit the correct traceability of each coupling. The manufacturer shall furnish one copy of the CMTR to the TPIA and one original and one copy to the Client / Client's Representative.

6.4 After final approval of insulating couplings and the acceptance of the CMTR, the Owner / Owner's Representative shall furnish to the purchaser and to the manufacturer a Quality/Inspection Release Note (QRN/IRN). The manufacturer shall deliver one copy of the QRN/IRN with the insulating couplings and one copy shall be included in the CMTR (see paragraph 6.3.).

Each insulating coupling in which injurious defects are found after delivery shall be rejected. The manufacturer shall be notified. In this case, the coupling shall be replaced immediately.

7. CORROSION PROTECTION

The corrosion protection will be applied by the manufacturer after final inspection by the control authority. The nature of the product shall be specified in the offer.

The product shall meet the following criteria:

- Guarantee a corrosion protection for a storage period in open air for at least one year.
- Shall be easily removable by wire brushing or by grinding.
- It shall not produce toxic vapour or smoke when heated by blow torches or during welding.

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ANNEX 1

LOFC (LIST OF OPERATIONS OF FABRICATIONS AND CONTROLS)

Each LOFC must contain the following information as a minimum (all clearly marked and separated) :

- a) Company name and references relating to the order.
- b) All technical and other information required in order to define the items covered.

The area of application will be limited to that item or those considered as in fabrication and control.

- c) A numerical sequence of operations with description will be built-up in a logical way of work progress.
 - The first operation will be the control of the incoming material(s) and documents.
 - The last operation will be the control of the CMTR (see paragraph 6.3.).

The following operations have to be included (not limited to) :

- Each fabrication step.
 - Each step which calls for own quality control (eventually QA).
 - Each applicable examination as part of this specification.
 - Document controls - stamping and final documentation.
- d) Each operation will be followed by the applicable specification or procedure number (with the latest revision).
 - e) Columns to be provided for possible interventions of :
 - the manufacturer's fabrication control,
 - the manufacturer's quality control (eventually QA),
 - control authority,
 - the purchaser,

and place of intervention if not by the manufacturer.

The interventions will be indicated per operation with H or W and/or R.

H = hold point

No further steps may be undertaken before the intervention of the appointed responsible takes place.

W = witness point

The appointed responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not.

R = point for which a control report or a recording has to be made.

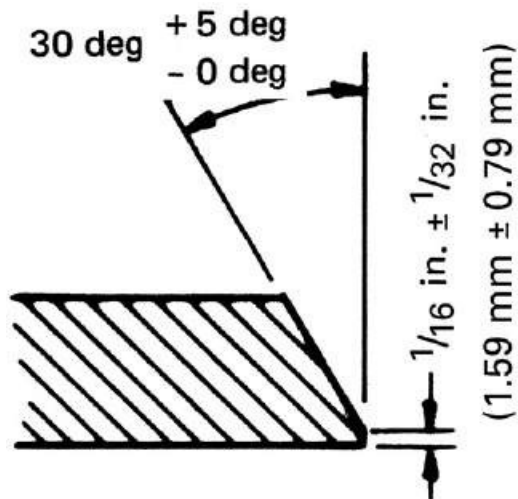
The manufacturer will fill in his own H, W and R points. The control authority and the purchaser will do the same in their designated columns, but this will not implicate a relaxation or weaving of the requirements of the manufacturer's controls.

Each intervention has to be signed and dated by the person acting as controller. Only the original documents will be presented for this purpose.

- a) One column to be provided for report or record numbers (points marked R) and one for the review of these documents by the control authority.
- b) Two extra columns may give reference to a non-conformity report if any and to the resolution given to it.

Completion of the LOFC does not automatically give rise to a release of the material or it must be stipulated otherwise in the contract.

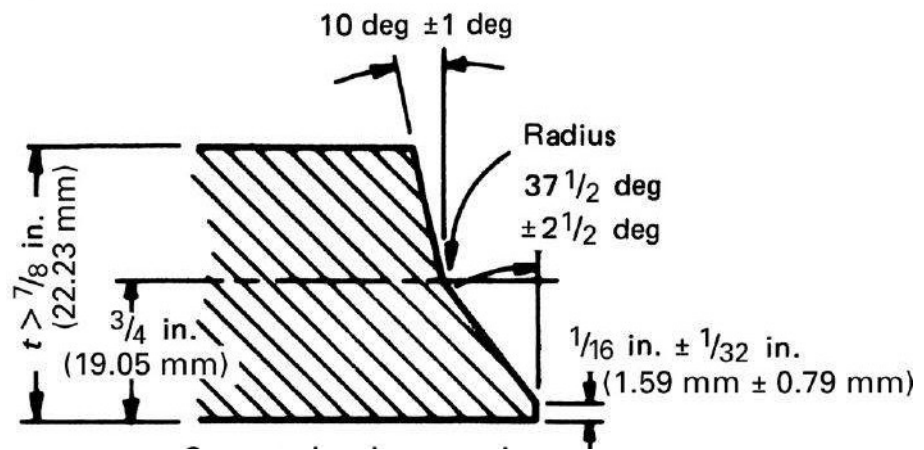
FIG. 1



Fitting size 24" and smaller may be furnished with 37° ½ level at manufacturer's option.

Recommended bevel for wall thickness (t) at end of fitting: 20 mm or less.

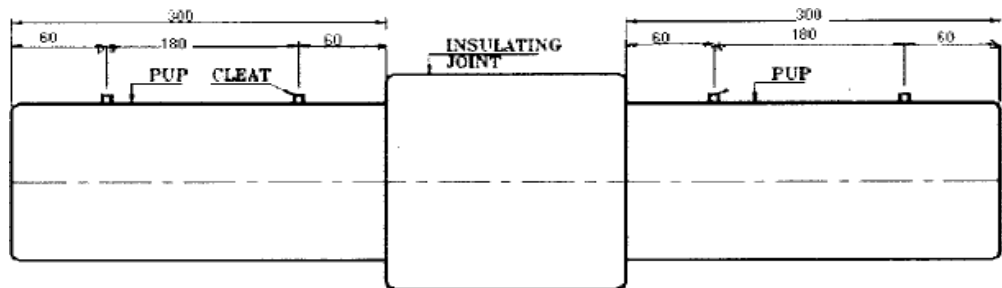
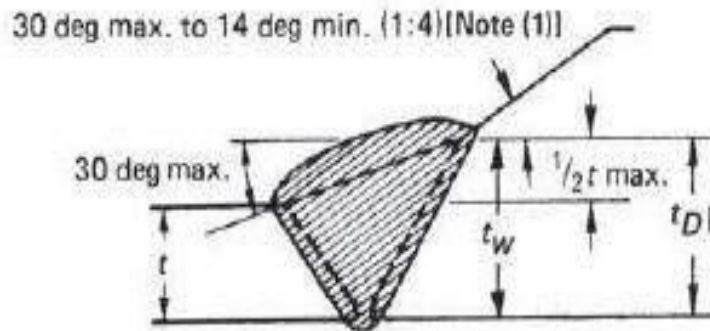
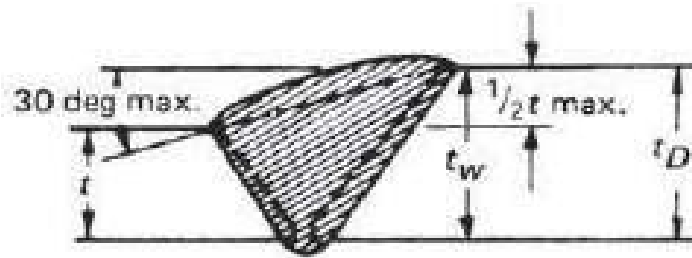
FIG. 2



Recommended bevel for wall thickness (t) at end of fitting, greater than 20 mm

ACCEPTABLE DESIGN FOR UNEQUAL WALL THICKNESS

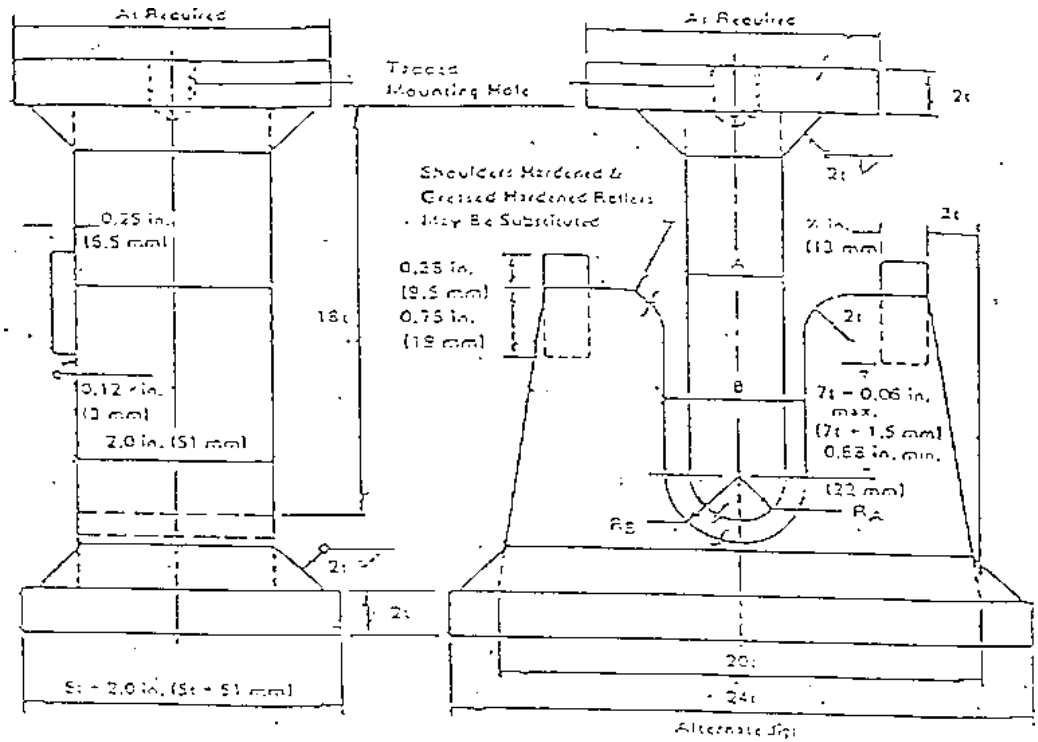
FIG. 3



FOR SIZE UPTO 8"

FIG 4

GUIDED-BEND TEST JIG DIMENSIONS



| | CLASS OF STEEL | | | |
|--|-------------------|-----------------|-----------------|-----------------|
| | X52 and low-grade | X56 | X60 | X70 |
| Radius of male member R _A | ½ A | ½ A | ½ A | ½ A |
| Radius of female member R _B | ½ B | ½ B | ½ B | ½ B |
| Width of male member A | 4 t | 5 t | 6 t | 6 t |
| Width of groove in female member B | A + 2t + 3.2 mm | A + 2t + 3.2 mm | A + 2t + 3.2 mm | A + 2t + 3.2 mm |

t = specimen thickness

The manufacturer shall use a jig based on this dimension, or a smaller dimension at his option.

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CENTRAL U.P. GAS LIMITED (CUGL)

LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS

PTS - PAINTING SYSTEM & COLOUR CODE FOR FINAL LAYER

| | | | | | |
|-------------|-------------|--------------------|--------------------|-------------------|--------------------|
| 0 | 16.04.2021 | Issued for Tender | KK | MKS | NN |
| Rev. | Date | Description | Prepared By | Checked By | Approved By |

The color codes for final layer of Station Pipe Work & Metering Shed shall be as under:

| S. No. | DESCRIPTION | FINAL LAYER COLOUR SHADE | RAL CODE |
|--------|-------------------------|--------------------------|----------|
| 1 | Pipe Work | Yellow | RAL 1004 |
| 2 | Piping Support | Grey | RAL 7043 |
| 3 | Hand Rail | Grey | RAL 7043 |
| 4 | Gas O/L Actuator | Blue | RAL 5015 |
| 5 | Valve Handle/Wheel | Black | RAL 9005 |
| 6 | All Valves | Grey | RAL 7038 |
| 7 | IJ | Grey | RAL 7038 |
| 8 | Filter | Grey | RAL 7038 |
| 9 | Pig launcher & Receiver | Grey | RAL 7038 |
| 10 | Bolts & Nuts | Grey | RAL 7038 |
| 11 | Grating | Hot Galvanized | |
| 12 | Metering Station Shed | | |
| 12.1 | Steel Frame | Beige | RAL 1018 |
| 12.2 | Roof / Vertical Shed | Grey | RAL 7030 |
| 12.3 | Control Panel | Grey | RAL 7032 |

The recommended painting system should be of Category C5 – I Very high (Industrial) as specified in the Standard ISO 12944 Part 1 to 8. The proposed Painting system shall conform to Table A 5 of ISO 12944 – 5 Standard.

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CENTRAL U.P. GAS LIMITED (CUGL)

LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS

PTS - PIPING CLASSES

| | | | | | |
|------------|-------------|--------------------|--------------------|-------------------|--------------------|
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| 0 | 16.04.2021 | Issued for Tender | KK | MKS | NN |
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| | PTS - PIPING CLASSES | |
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1. SCOPE

Piping classes are established taking into account the following criteria:

- The medium to be handled.
- The surrounding.
- The referenced codes.
- The temperature-pressure rating.

1.1. Coding of Piping Classes

Each class is named by a code consisting of four parts:

First part

A figure designating the rating and the code:

- 1 = 150 lbs ANSI
- 3 = 300 lbs ANSI
- 6 = 600 lbs ANSI
- 9 = 900 lbs ANSI

Second part

A letter designating the material:

- A = Alloy steel
- C = Carbon steel
- F = Fiberglass reinforced plastic/epoxy (FRP)
- G = Galvanized
- P = Plastic (PEHD, ...)
- S = Stainless steel
- V = PVC

Third part

A sequential number to differentiate two or more piping classes of the same rating and same material but presenting some differences related to the handled fluid.

Fourth part

A letter designating the underground:

- U = Underground

1.2. Wall Thickness

The wall thickness of pipe shall be as follows:

Wall thickness of pipe shall be calculated as specified in the applicable sections of:

- ANSI B 31.8 for classes covering the main process and auxiliary gas lines.
- ANSI B 31.3 for classes covering utilities lines.

1.3. Corrosion Allowance

The minimum corrosion allowance used to calculate wall thickness as follows:

- Carbon steel and ferritic alloys in classes calculated following ANSI B 31.8 : 1.6 mm
- Carbon steel and ferritic alloys in classes calculated following ANSI B 31.3 : 1.6 mm
- Stainless steel : 0 mm
- Plastic and FRP pipes: 0 mm.

1.4. Wall Thickness Calculation

- a) Pipes for gas application have to comply with ASME/ANSI B 31.8 code. Pipe wall thickness will be calculated as follows :

$$t = \frac{PD}{2 \times S \times F \times E \times T} + c \tag{1}$$

- t = nominal wall thickness (mm)
- P = design pressure (MPa)
- S = minimum yield strength (MPa) D = nominal outside diameter (mm)
- F = design factor = 0.4
- E = longitudinal joint factor
= 1.0 for API 5LX 52 (Seamless or HFW)
- T = temperature derating factor = 1.0
- C = corrosion allowance (mm)

- b) Pipes for utilities lines have a wall thickness complying with ASME/ANSI B 31.3 code :

$$t = \left[\frac{PD}{2 \times (SE + PY)} + c \right] \times (1 + a)$$

- t = nominal wall thickness (mm)
- S = allowable stress (MPa)
- P = design pressure (MPa)
- E = longitudinal joint factor
- Y = coefficient as per table 304.1.1
- C = corrosion allowance (mm)
- a = negative fabrication tolerance (%)

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CENTRAL U.P. GAS LIMITED (CUGL)

LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS

PTS - SHALLOW HDD

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1.0 PURPOSE

The purpose of this methodology is to lay guidelines and requirements and to establish a method for shallow HDD activity and inspection for Installation of Carrier pipe directly in bored hole at all the crossing locations and along the road.

2.0 SCOPE

This procedure covers the construction and installation of all crossing by Shallow Horizontal Directional Drilling method for the Project and along the roads to avoid manual trenching.

3.0 METHODOLOGY

3.1 ROU PREPARATION AND GRADING

The ROU at the vicinity of the entry point and exit point shall be graded as per approved grading procedure and instruction of site in-charge.

3.2 STRINGING OF LINE PIPES AND WELDING OF PIPE STRING

Carrier Pipe of approved specification shall be strung on sandbags in such a way so as to match the grade profile. The string shall end at the anticipated exit point of pilot hole drill rod. The requisite numbers of pipes shall be string as per approved stringing procedure in ROU limits and stringing report as per the said document shall be generated.

Joint welding including necessary beveling, grinding and line up etc, shall be carried out in single length according to crossing length. Pre Hydrotesting of the pipe string shall be done followed by joint coating.

3.3 DRILLING OPERATIONS

The drilling operations shall be carried out as per the following method statement.

A. Entry side Location

At the entry point, Rig shall be placed at angle of 2 degree to 5 degrees on the ground or in pre-excavated pit of 1.5 meter as per site feasibility. The Rig shall be placed approximately 15-20m away from the limit of RoW of the subject crossing. Maximum depth of profile from the entry ground level shall be 3 meters. A starter pit of 3m depth shall be excavated at the immediate edge of the crossing RoW limit and the carrier pipe shall be finally pulled up to the edge of starter pit.

B. Exit Location Site

The exit location provides adequate pipe string lay down space for the proposed crossings. Exit site shall have an excavated pipe trench of 3 m depth upto the length of carrier pipe string. Punch out of pilot drill shall be done in Exit pit itself.

C. Walkover Guidance System

The walkover system consists of three main components:

- a) Transmitter (Sonde)
- b) Receiver (The Walkover Unit)
- c) Remote (Drillers Remote)

a) Transmitter

There are different types of transmitters depending on the drilling needs, it can track up to 18 meters depth. The transmitters are placed inside the drill head assembly ahead of the lead piece or the first drill pipe. These work on remote signal principle which is picked up by the trekker carrying the receiver over the drill head position.

Normal life of the battery is 40 hours of continuous drilling or 400 hours of sleep time, which is sufficient in most cases of drilling.

b) Receiver

This is the walkover unit that picks up the signals from the drill head, boring under the road or canal. The man holding the receiver is called trekker, thus tracking the movement of the drill pipe in real time and marking on the ground. The signal gets continuously picked every two seconds, including the depth, the pitch (angle of drill head) and the roll (direction it is headed).

c) Remote

Drill remote stays on with the driller, which helps it in guiding the drill path. Remote gives the same information to the driller, as it does to trekker. Drill remote is however a passive unit, unlike the receiver, which actually locates the drill head under the earth.

The tracker shall continuously monitor the progress of the drilled hole by following the path drilled and locating the drill head assembly in real time. He shall note the depth readings on completion of every drill pipe and guide the driller if there is any deviation to the proposed drill path.

3.4 PILOT HOLE DRILLING

At cased crossing locations, the carrier Pipe string shall be installed horizontally at 90- degree angle. Radius of curvature shall not be constrained in this as pipe has to be installed in straight section only.

Minimum radius of curvature of 100-200m (according to diameter of drill pipe) shall be considered to build the curve.

In order to directionally deviate the hole, HDD operator shall deploy the use of a bent bit. When the bent bit is rotated to a particular quadrant, the pilot hole will be redirected in that direction. This process is repeated until the bit is advanced along the predetermined path and exits the exit location. A regular recording of the progression of the pilot hole drill pipes shall be maintained at site.

3.5 REAMING OPERATIONS

The reamer is then attached to the leading pipe to start ream operation.

A. Reaming

Once the lead pieces are taken off, a suitable barrel reamer will be attached to the trailing end of the drill string at the surface exit location. The reaming shall be done in multiple stages depending upon the soil strata encountered before reaching to final hole diameter of the hole i.e. diameter.

This will then be rotated by the rig and advanced in to the borehole. A section of drill pipe will then be added consecutively to the trailing end of the reamer as the reamer is being rotated and drawn along the borehole in the direction of the rig side location.

B. Swab pass

While pulling the reamer back to the entry side, if the driller feels that the hole is not conditioned or if there is a collapse of the hole, additional swab passes shall be made.

High yield bentonite with quick gelling characteristics shall be used to preserve the integrity of the borehole during the swab pass. Pulling will be done within 12 hours from swab pass.

C. Welded Pipe String Preparation

The welded carrier pipe string shall be lowered in the exit side trench and shall be placed on suitable sized rollers and the string shall be in the same line as the drilled hole from entry side to exit side.

D. Product Pipe Attachment

A pull head swivel assembly shall be pre welded to the carrier pipe string, which will be in the trench. The drill string shall be attached to the pull back assembly attached to the leading end of the carrier pipe.

E. Carrier Pipe Pull Back and Installation

Once the reaming and swab passes are completed, the pipeline shall be positioned perfectly in line with the bore hole. Once aligned, the pulling apparatus will then be attached to the leading end of the drill pipe string and the product pipes will be fed gently into the bore hole. Since the diameter of the pipe is not very large, the pipe will be slightly buoyant.

Pullback will continue until the leading end of the carrier pipe reaches the edge of the starter pit. As the pipe string is being pulled into the open borehole, drilling fluid is pumped through the rotating jet swivel. This aids in the further suspension of the drilled solids that may be in the hole. These solids are removed by the viscosity of the fluid coming out when the pipe displaces the drilling fluids in the open hole. A Regular recording of the progression of the pulling process, the pulling log shall be maintained at site.

F. Drilling Fluid and Disposal

Bentonite will be used on the all phases of the project. Bentonite used shall be of high yield and high gel strength, suitable for HDD operations. Bentonite shall be disposed of in a suitable manner as per specifications.

3.6 HYDROSTATIC TEST

Carrier Pipe shall be Pre-Hydrotested

CENTRAL U.P. GAS LIMITED (CUGL)

LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS

PTS – PIPING FABRICATION AND ERECTION

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1.0 GENERAL

This specification covers general requirements of fabrication and erection of aboveground and trench piping systems at site. The specification covers the scope of work of Contractor, basis of work to be carried out by the Contractor and standards, specifications and normal practice to be followed during fabrication and erection by the Contractor.

2.0 SCOPE

Scope of work of Contractor shall include the following:

- 2.1** Transportation of required piping materials, pipe support and all other necessary piping materials from Owner's storage point or contractor's storage point (in case of Contractor's scope of supply) to work site / shop including raising store requisitions for issue of materials in the prescribed format & maintaining an account of the materials received from Owner's stores.
- 2.1.1** Piping materials include the following but not limited to the same.
 - a. Pipes (All sizes and schedule)
 - b. Flanges (All sizes, types & Pressure ratings).
 - c. Fittings (All sizes, types and schedule)
 - d. Valves (All sizes, types and Ratings)
 - e. Gaskets (All sizes, types & Ratings)
 - f. Bolts, Nuts or M/C Bolts (All types)
 - g. Expansion Joint / Bellows (All types)
 - h. Special items like online filters, ejectors, sample coolers, steam traps, strainers, air traps etc.
 - i. Online instruments like control valve, orifice flange, rotameter, safety valves etc.
- 2.2** Shop & field fabrication and erection of piping in accordance with documents listed under Cl. 3.0 i.e 'BASIS OF WORK' including erection of all piping materials enumerated above.
- 2.3** Fabrication and erection of pipe supports like shoe, saddle, guide, stops, anchors, clips, cradles, hangers, turn buckles, supporting fixtures, bracket cantilevers, struts, tee posts including erection of spring supports and sway braces.
- 2.4** Fabrication
 - 2.4.1** Fabrication of piping materials like special radius bends, reducers, mitres etc.
 - 2.4.2** Fabrication of plain and threaded nipples from pipes as required during erection.
 - 2.4.3** Fabrication of swage nipples as and when required.
 - 2.4.4** Fabrication of odd angle elbow like 60°, 30° or any other angle from 90/45° elbows as and when required.
 - 2.4.5** Fabrication of flange, reducing flange, blind flange, spectacle blinds as and when required.
 - 2.4.6** Fabrication of stub-in connection with or without reinforcement.
 - 2.4.7** Grinding of edges of pipes, fittings, flanges etc. to match mating edges of uneven / different thickness wherever required.

- 2.5 Modifications like providing additional cleats, extension of stem of valve, locking arrangement of valves etc. as and when required.
- 2.6 Preparation of Isometrics, bill of materials, supporting details of all NON-IBR lines upto 2-1/2" within the unit battery limit and get subsequent approval from Engineer-in-Charge as and when called for.
- 2.7 Obtaining approval for drawings prepared by Contractor from statutory authority, if required.
- 2.8 Radiography, stress relieving, dye penetration, magnetic particle test etc. as required in specification.
- 2.9 Performing PMI using alloy analysers.
- 2.10 Casting of concrete pedestals and fabrication & erection of small structures for pipe supports including supply of necessary materials.
- 2.11 Providing insert plates from concrete structures and repair of platform gratings around pipe openings.
- 2.12 Making material reconciliation statement and return of Owner's supplied left-over materials to Owner's store.
- 2.13 Flushing and testing of all piping systems as per standard specification for inspection, flushing and testing of piping systems.

3.0 BASIS FOR WORK

3.1 The complete piping work shall be carried out in accordance with the following

- 3.1.1 "Approved for Construction" drawings and sketches issued by CUGL/PMC to the Contractor - Plans and/or Isometrics.
- 3.1.2 Approved Process licensor's standards and specifications.
- 3.1.3 Drawings, sketches and documents prepared by Contractor duly approved by Engineer-in- Charge/PMC (such as isometrics and offsite piping etc.)
- 3.1.4 Construction job procedures prepared by Contractor and approved by CUGL/PMC.
- 3.1.5 TEPL specifications/documents as below:
 - a. Process and Instrument Diagram.
 - b. Piping Materials Specification
 - c. Piping support standards.
 - d. Line list/ Number
 - e. Piping support index.
 - f. Standard specification of NDT Requirement of Piping
 - g. Welding specification charts for piping classes.
 - h. Standard specification for Pressure Testing of Erected Piping System.
 - i. Welding specification for fabrication of piping
 - j. Any other specifications attached with Piping Material Specification or special condition of contract.
 - k. Procedure for storage, preservation and positive identification of materials at Contractors works / stores.
- 3.1.6 Applicable codes, standards and regulations

- a. ASME B 31.3 : Process Piping

- b. ASME Sec. VIII : Rules for Construction of Pressure Vessels.
- c. IBR Regulations
- d. IS: 823 : Code for procedure for Manual Metal Arc Welding of Mild Steel (for structural steel).
: Code for Sour Services material requirements.

Note: All codes referred shall be latest edition.

3.2 Deviations

Where a deviation from the "Basis of Work" and approved job procedure described above is required or where the basis of work does not cover a particular situation, the matter shall be brought to the notice of Engineer - in - Charge and the work carried out only after obtaining written approval from Engineer – in – Charge in each case.

4.0 FABRICATION

4.1 Piping Material

Pipe, pipe fittings, flanges, valves, gaskets, studs bolts etc. used in a given piping system shall be strictly as per the "Piping Material Specification" for the "Pipe Class" specified for that system. To ensure the above requirement, all piping material supplied by the Owner / Contractor shall have proper identification marks as per relevant standards / TEPL's specifications. Contractor shall provide identification marks on left over pipe lengths wherever marked up pipe lengths have been fabricated / erected. Material traceability is to be maintained for each material for Hydrogen service and other exotic materials by way of transferring heat number, etc. (hard punching) as per approved procedure. This shall be in addition to colour coding for all piping materials to avoid mix-up.

4.2 Fabrication

- 4.2.1 All fabrication shall be carried out in accordance with piping general arrangement drawings, (prepared by CONTRACTOR and approved by (CUGL/PMC) including this specification and codes as specified in section 3.0.
- 4.2.2 CONTRACTOR shall be responsible for working to the exact dimensions as per the approved drawings.
- 4.2.3 Flange bolt holes shall generally straddle the established centre lines unless other orientation is required and as called out in approved drawings.
- 4.2.4 Threading shall be NPT as per ANSI B 1.20.1. Threading shall preferably be done after bending, forging or heat treatment operation. However, if it is not possible, precaution shall be taken to protect threading against deformation. Thread shall be clean cut with no burrs or stripping. Dies shall be new, sharp and properly designed for piping material. Ends shall be reamed to remove burrs.
- 4.2.5 All threaded joints shall be aligned properly. The pipe entering unions shall be true to centrelines so as to avoid forcing of union coupling during make up. Damaged threads shall be cut from the end of run and the pipe shall be rethreaded.
- 4.2.6 Immediately before testing the piping, all threads of pipe and fittings shall be thoroughly cleared of cuttings, fuel oil or other foreign matter. The male threads shall be sealed with thread sealant and the piping made up sufficiently for the thread to seize. Sealant shall be teflon tape.
- 4.2.7 Seal welding of threaded connections when specified shall include the first block valve, cover all threads. The joint shall be cleaned of all cutting oil and other foreign material and made up dry to full thread engagement. Instrument threaded connections which are frequently subjected to testing and maintenance shall not be seal welded.
- 4.2.8 All threaded connections shall be protected from rusting by applying greases or oil when in operating condition.

4.2.9 When socket weld fittings or valves are used, pipe shall be spaced approximately 1/16" to avoid bottoming which could result in excessive weld stress.

4.2.10 where the ends of the piping components being welded have an internal surface misalignment exceeding 1.6mm, the wall of the component extending internally shall be trimmed by machining so that the adjoining internal surface will approximately flush.

For the purpose of common understanding the construction job procedure, to be submitted by the contractor, shall include proposal for

- Maximizing prefabrication, inspection and testing at fabrication shop with minimum field joints.
- Positive material identification, handling, storage & preservation.

4.3 Dimensional Tolerances

The Contractor shall be responsible for working to the dimensions shown on the approved drawings. However, the Contractor shall bear in mind that there may be variations between the dimensions shown in the drawing and those actually existing at site due to minor variations in the location of equipments, inserts, structures etc. To take care of these variations "Field Welds" shall be provided during piping fabrication. An extra pipe length of 100 mm over and above the dimensions indicated in the drawing may be left on one side of the pipe at each of the field welds. During erection, the pipe end with extra length at each field weld, shall be cut to obtain the actual dimension occurring at site. Isometrics, if supplied may have the field welds marked on them. However, it is the responsibility of the Contractor to provide adequate number of field welds. In any case no extra claims will be entertained from the Contractor on this account. Wherever errors / omissions occur in drawings and Bills of Materials it shall be the Contractor's responsibility to notify the Engineer-in-Charge prior to fabrication or erection.

4.4 Pipe Joints

The piping class of each line specifies the type of pipe joints to be adopted. In general, joining of lines 2" and above in process and utility piping shall be accomplished by butt welds. Joining of lines 1-1/2" and below shall be by socket welding / butt welding / threaded joints as specified in "Piping Material Specifications". However, in piping 1-1/2" and below where socket welding/ threaded joints are specified butt - welds may be used with the approval of Engineer- in-Charge for pipe to pipe joining in long runs of piping.

Flange joints shall be used at connections to Vessels, Equipment's, Valves and where required for ease of erection and maintenance as indicated in drawings.

4.5 Butt Welded and Socket Welded Piping

End preparation, alignment and fit-up of pipe pieces to be welded, welding, pre-heat, post- heating and heat treatment shall be as described in the welding specification and NDT specification.

4.6 Screwed Piping

In general, Galvanized piping shall have threads as per IS: 554 or ANSI B 1.20.1 NPT as required to match threads on fittings, valves etc. All other piping shall have threads as per ANSI B 1.20.1, tapered unless specified otherwise.

Threads shall be clean cut, without any burrs or stripping and the ends shall be reamed. Threading of pipes shall be done preferably after bending, forging or heat-treating operations. If this is not possible, threads shall be gauge checked and chased after welding heat treatment etc.

During assembly of threaded joints, all threads of pipes and fittings shall be thoroughly cleaned of cuttings, dirt, oil or any other foreign matter. The male threads shall be coated with thread sealant and the joint tightened sufficiently for the threads to seize and give a leak proof joint.

Threaded joints to be seal-welded shall be cleaned of all foreign matter, including sealant and made up to full thread engagement before seal welding.

4.7 Flange Connections

All flange facings shall be true and perpendicular to the axis of pipe to which they are attached. Flanged bolt holes shall straddle the normal centrelines unless different orientation is shown in the drawing.

Wherever a spectacle blind is to be provided, drilling and tapping for the jack screws in the flange, shall be done before welding it to the pipe.

4.8 Branch Connections

Branch connections shall be as indicated in the piping material specifications. For end preparation, alignment, spacing, fit-up and welding of branch connections refer welding specifications. Templates shall be used wherever required to ensure accurate cutting and proper fit-up.

For all branch connections accomplished either by pipe to pipe connections or by using forged tees the rates quoted for piping shall be inclusive of this work.

Reinforcement pads shall be provided wherever indicated in drawings/ specifications etc.

4.9 Bending

Bending shall be as per ASME B31.3 except that corrugated or creased bends shall not be used.

Cold bends for lines 1-1/2" and below, with a bend radius of 5 times the nominal diameter shall be used as required in place of elbows wherever allowed by piping specifications. Bending of pipes 2" and above may be required in some cases.

The completed bend shall have a smooth surface, free from cracks, buckles, wrinkles, bulges, flat spots and other serious defects. They shall be true to dimensions. The flattening of a bend, as measured by the difference between the maximum and minimum diameters at any cross-section, shall not exceed 8% and 3% of the nominal outside diameter, for internal and external pressure respectively.

4.10 Forging and forming

Forging and forming of small-bore fittings, like reducing nipples for piping 1-1/2" and below, shall be as per ASME B 31.3.

Fabricated Reducers

Mitre bends not permitted

4.11 Cutting and Trimming of Standard Fittings & Pipes

Components like pipes, elbows, couplings, half-couplings etc. shall be cut / trimmed / edge prepared wherever required to meet fabrication and erection requirements, as per drawings and instructions of Engineer-in-Charge. Nipples as required shall be prepared from straight length piping.

4.12 Galvanised Piping (Not Permitted)

Galvanised carbon steel piping shall be completely cold worked, so as not to damage galvanised surfaces. This piping involves only threaded joints and additional external threading on pipes may be required to be done as per requirement.

4.13 Jacketed Piping (Not Permitted)

The Jacketing shall be done in accordance with standard specification as suggested in material specification or special condition of contract.

Pre-assembly of jacketed elements to the maximum extent possible shall be accomplished at shop by Contractor. Position of jump over and nozzles on the jacket pipes, fittings etc. shall be marked according to pipe disposition and those shall be prefabricated to avoid damaging of inner pipe and obstruction of jacket space. However, valves, flow glasses, in line instruments or even fittings shall be supplied as jacketed.

4.14 Shop Fabrication / Prefabrication

The purpose of shop fabrication or pre-fabrication is to minimise work during erection to the extent possible. Piping spool, after fabrication, shall be stacked with proper identification marks, so as facilitate their

withdrawal at any time during erection. During this period all flange (gasket contact faces) and threads shall be adequately fabricated by coating with a removable rust preventive. Care shall also be taken to avoid any physical damage to flange faces and threads.

4.15 Miscellaneous

4.15.1 Contractor shall fabricate miscellaneous elements like flash pot, seal pot, sample cooler, supporting elements like turn buckles, extension of spindles and interlocking arrangement of valves, operating platforms as required by Engineer-in-Charge.

4.15.2 Spun Concrete Lining

The work of inside spun concrete lining of pipes and specials of diameter 3" and above shall be done as per material specifications and special condition contract.

4.15.3 Fabrication of pipes from plate

Pipes shall be fabricated at site as and when required as per the specifications attached and the actual Piping Material Specification.

5.0 ERECTION

5.1 Cleaning of Piping before Erection

Before erection all pre-fabricated spool pieces, pipes, fittings etc. shall be cleaned inside and outside by suitable means. The cleaning process shall include removal of all foreign matter such as scale, sand, weld spatter chips etc. by wire brushes, cleaning tools etc. and blowing with compressed air/or flushing out with water. Special cleaning requirements for some services, if any shall be as specified in the piping material specification or isometric or line list.

5.2 Piping Routing

No deviations from the piping route indicated in drawings shall be permitted without the consent of Engineer-in-Charge.

Pipe to pipe, pipe to structure / equipments distances / clearances as shown in the drawings shall be strictly followed as these clearances may be required for the free expansion of piping / equipment. No deviations from these clearances shall be permissible without the approval of Engineer-in-Charge.

In case of fouling of a line with other piping, structure, equipment etc. the matter shall be brought to the notice of Engineer-in-Charge and corrective action shall be taken as per his instructions.

5.3 Slopes

Slopes specified for various lines in the drawings / P&ID shall be maintained by the Contractor. Corrective action shall be taken by the Contractor in consultation with Engineer-in-Charge wherever the Contractor is not able to maintain the specified slope.

5.4 Expansion Joints / Bellows

Installation of Expansion Joints/Bellows shall be as follows:

All Expansion joints / Bellows shall be installed in accordance with the specification and installation drawings, supplied to the Contractor.

Upon receipt, the Contractor shall remove the Expansion Joints/ Bellows from the case(s) and check for any damage occurred during transit.

The Contractor shall bring to the notice of the Engineer-in-Charge any damage done to the bellows / corrugations, hinges, tie-rods, flanges / weld ends etc.

Each Expansion Joint / Bellow shall be blown free of dust / foreign matter with compressed air or cleaned with a piece of cloth.

For handling and installation of Expansion Joints, great care shall be taken while aligning. An

Expansion Joints shall never be slinged from bellows corrugations / external shrouds, tie / rods, angles.

An Expansion Joints / Bellow shall preferably be slinged from the end pipes / flanges or on the middle pipe.

Expansion Joints stop blocks shall be carefully removed after hydrostatic testing.

Angles welded to the flanges or weld ends shall be trimmed by saw as per manufacturer's instructions and the flanges or weld ends shall be ground smooth.

The pipe ends in which the Expansion Joint is to be installed shall be perfectly aligned or shall have specified lateral deflection as noted on the relevant drawings.

The pipe ends / flanges shall be spaced at a distance specified in the drawings.

The Expansion Joint shall be placed between the mating pipe ends / flanges and shall be tack welded/bolted. The mating pipes shall again be checked for correct alignment.

Butt-welding shall be carried out at each end of the expansion joint. For flanged Expansion Joint, the mating flanges shall be bolted.

After the Expansion Joint is installed, the Contractor shall ensure that the mating pipes and Expansion Joints are in correct alignment and that the pipes are well supported and guided.

The Expansion Joint shall not have any lateral deflection. The Contractor shall maintain parallelism of restraining rings or bellows convolutions.

Precautions

- For carrying out welding, earthling lead shall not be attached with the Expansion Joint.
- The Expansion bellow shall be protected from arc weld spot and welding spatter.
- Hydrostatic Testing of the system having Expansion Joint shall be performed with shipping lugs in position. These lugs shall be removed after testing and certification is over.

5.5 Flange Connections

While fitting up mating flanges, care shall be exercised to properly align the pipes and to check the flanges for trueness, so that faces of the flanges can be pulled together, without inducing any stresses in the pipes and the equipment nozzles. Extra care shall be taken for flange connections to pumps, turbines, compressors, cold boxes, air coolers etc. The flange connections to these equipments shall be checked for misalignment, excessive gap etc. after the final alignment of the equipment is over. The joint shall be made up after obtaining approval of Engineer-in-Charge.

Temporary protective covers shall be retained on all flange connections of pumps, turbines, compressors and other similar equipments, until the piping is finally connected, so as to avoid any foreign material from entering these equipments.

The assembly of a flange joint shall be done in such a way that the gasket between these flange faces is uniformly compressed. To achieve these bolts shall be tightened in a proper sequence. All bolts shall extend completely through their nuts but not more than 1/4".

Steel to C.I. flange joints shall be made up with extreme care, tightening the bolts uniformly after bringing flange flush with gaskets with accurate pattern and lateral alignment.

5.6 Vents and Drains

High point vents and low point drains shall be provided as per the instructions of Engineer-in-Charge, even if these are not shown in the drawings. The details of vents and drains shall be as per piping material specifications / job standards.

5.7 Valves

Valves shall be installed with spindle / actuator orientation / position as shown in the layout drawings. In case of any difficulty in doing this or if the spindle orientation / position is not shown in the drawings, the Engineer-

in-Charge shall be consulted and work done as per his instructions. Care shall be exercised to ensure that globe valves, check valves, and other uni-directional valves are installed with the "Flow direction arrow "on the valve body pointing in the correct direction. If the direction of the arrow is not marked on such valves, this shall be done in the presence of Engineer-in-Charge before installation.

Fabrication of stem extensions, locking arrangements and interlocking arrangements of valves (if called for), shall be carried out as per drawings / instructions of Engineer-in-Charge.

5.8 Instruments

Installation of in-line instruments such as restriction orifices, control valves, safety valves, relief valves, rotameters, orifice flange assembly, venturimeters, flowmeters etc. shall form a part of piping erection work.

Fabrication and erection of piping upto first block valve / nozzle / flange for installation of offline Instruments for measurement of level, pressure, temperature, flow etc. shall also form part of piping construction work. The limits of piping and instrumentation work will be shown in drawings / standards / specifications. Orientations / locations of take-offs for temperature, pressure, flow, level connections etc. shown in drawings shall be maintained.

Flushing and testing of piping systems which include instruments mentioned above and the precautions to be taken are covered in flushing, testing and inspection of piping. Care shall be exercised and adequate precautions taken to avoid damage and entry foreign matter into instruments during transportation, installation, testing etc.

5.9 Line Mounted Equipments / Items

Installation of line mounted items like filters, strainers, steam traps, air traps, desuperheaters, ejectors, samples coolers, mixers, flame arrestors, sight glasses etc. including their supporting arrangements shall form part of piping erection work.

5.10 Bolts and Nuts

The Contractor shall apply molycoat grease mixed with graphite powder (unless otherwise specified in piping classes) to all bolts and nuts during storage, after erection and wherever flange connections are broken and made-up for any purpose whatsoever. The grease and graphite powder shall be supplied by the Contractor within the rates for piping work.

5.11 Pipe Supports

Pipe supports are designed and located to effectively sustain the weight and thermal effects of the piping system and to prevent its vibrations. Location and design pipe supports will be shown in drawing for lines 2" NB. However, any extra supports desired by Engineer-in-Charge shall also be installed.

No pipe shoe / cradle shall be offset unless specifically shown in the drawings.

Hanger rods shall be installed inclined in a direction opposite to the direction in which the pipe moves during expansion.

Preset pins of all spring supports shall be removed only after hydrostatic testing and insulation is over. Springs shall be checked for the range of movement and adjusted if necessary to obtain the correct positioning in cold condition. These shall be subsequently adjusted to hot setting in operating condition. The following points shall be checked after installation, with the Engineer-in-Charge and necessary confirmation in writing obtained certifying that :

- All restraints have been installed correctly.
- Clearances have been maintained as per support Drawings.
- Insulation does not restrict thermal expansion.
- All temporary tack welds provided during erection have been fully removed.
- All welded supports have been fully welded.

6.0 WELDING

Welding of pipelines shall be done as per applicable codes and **Annexure-1**

7.0 ERECTION

7.1 Pre-fabrication and Field Assembly

Extent of pre-fabrication shall be purely at the discretion of CONTRACTOR keeping in view the following:-

7.1.1 Field joint shall be decided by CONTRACTOR keeping in view the transportation of pre-fabricated pieces to site.

7.1.2 There can be some variations in the dimensions and level appearing in the arrangement drawings and those actually occurring at site due to minor variations in the location of equipments, structures, cut out etc. Adequate field joints shall be provided, permitting assembly and erection of pipe work without major modification.

7.2 Supporting

Location and design of pipe supports shown in approved drawings and support drawings shall be strictly followed.

7.2.1 Supports shall be installed in such a way that they do not contribute to over stressing of a line.

7.2.2 Fabrication and erection of additional supporting elements and structural fixtures which in COMPANY'S view are required for proper supporting of the system, shall be carried out by CONTRACTOR at no extra cost.

7.2.3 All temporary supports, elements required for alignment, erection and assembly shall be removed after completion of work.

7.3 Equipment hook-up

7.3.1 Prior to hook-up, the alignment and trueness of flange faces shall be checked to ensure that no undue stresses shall be induced in the system while hooking up.

8.0 INSPECTION

8.1 CONTRACTOR shall provide all facilities/ assistance to CUGL for proper execution of their inspection without any extra charge.

8.2 All piping work shall be subjected to inspection by CUGL/PMC at any time during fabrication. CONTRACTOR shall furnish to TNGCL detailed work programme sufficiently in advance, in order to enable CUGL to arrange for inspection.

9.0 PROTECTIVE COATING

9.1 All above ground piping system shall be applied with protective coating in accordance with specification for shop & field painting.

9.2 All underground portion of piping system shall be coated with three-layer polyethylene coating. CONTRACTOR shall prepare procedure for epoxy painting of buried pipeline for approval of COMPANY. Procedure shall include surface preparation, brand and type of coating to be adopted. Coating of pipes shall not commence without approval of coating procedure. Total dry film thickness to be achieved shall not be less than 300 microns. Compatible primer and finish coat as recommended by coating manufacturer shall only be applied. Coating integrity shall be checked by "Holiday detector" over full length of coated pipe work. Coating to be supplied by CONTRACTOR shall be suitable for design temperature.

9.3 Once the Coating has been accepted by CUGL/PMC, backfilling operation can be started. In order to protect coated pipe from damage, the excavated trench shall be examined for stone, rock and any other hard substance detrimental to coating. All such substances shall be removed before lowering the pipe in the trench. COMPANY may ask for a 100mm padding of clear sand under and above pipeline in rocky or

otherwise hard soil area. No additional payment on account of padding shall however be admissible.

10.0 FLUSHING

Completed piping systems shall be flushed by CONTRACTOR with fresh water, to clean the pipe of all dirt, debris, and foreign material. CONTRACTOR shall prepare a procedure for flushing of the system for approval of TNGCL/PMC. Flushing shall not be commenced without approval of flushing procedure.

10.1 CONTRACTOR shall perform all activities like dismantling and reinstalling of all strainers, in line instruments etc. before and after completion of flushing.

10.2 Flushing shall be considered as complete only after inspection and approval by COMPANY.

10.3 Disposal of muck and flushing media shall be arranged by CONTRACTOR as directed by CUGL/PMC, in such a manner that it does not spoil the adjacent installation. CONTRACTOR shall obtain CUGL/PMC approval regarding the place and method to be adopted for disposal of debris.

10.4 Record of flushing giving following details shall be submitted by CONTRACTOR to CUGL/PMC for its approval and records:

- a) Date of Flushing
- b) Identification of line: flushed-line Number

11.0 HYDROSTATIC TESTING

- 11.1** Completed piping system as approved by Owner/PMC shall be hydrostatically tested in the presence of Owner/PMC. The general requirements of hydrostatic testing shall be in accordance with codes specified in section 2.0.
- 11.2** CONTRACTOR shall prepare hydrostatic test procedure based on specified codes. The hydrostatic test shall commence only after approval of procedure by CUGL/PMC.
- 11.3** Piping system shall be hydrostatically tested to a pressure corresponding to 1.4 times the design pressure.
- 11.4** Fresh water shall be used as test media. CONTRACTOR shall locate the source of water supply and arrange for transportation of water to test site. CONTRACTOR shall arrange at his own cost the water analysis and confirm that water is suitable for testing. In case any corrosion inhibitor is added, the same shall be done after approval of CUGL/PMC.
- 11.5** Lines repaired subsequent to hydrostatic test shall be retested using the same procedure as originally adopted. However CUGL/PMC may waive such retest in case of minor repairs by taking precautionary measures to ensure sound construction.
- 11.6** All equipment and instruments used for hydrostatic test shall be approved by CUGL/PMC before start of tests.
- 11.7** Pressure gauges shall be installed on line to measure test pressures. In case of longer lines two or more pressure gauges shall be installed as directed by COMPANY. One gauge shall be installed at the discharge of the pressurising pump. Pressure gauge used for hydrostatic testing shall be calibrated with dead weight tester in the presence of Engineer-in-charge. Range of pressure gauge shall generally be 1.5 times the test pressure.
- 11.8** Orifice plates and restriction orifices shall not be installed until hydrostatic testing is completed. Temporary gaskets shall be used during testing.
- 11.9** First block valve of pressure instruments shall be half open & plugged at the time of hydrostatic testing. Temperature connections shall be blanked off during testing.
- 11.10** All equipments, in line instruments, relief valves shall be disconnected from piping system by means of blinds during testing. Control valves shall be replaced by spool pieces during testing.
- 11.11** High point vents and low point drain required for testing in addition to those marked in the drawings shall be provided by CONTRACTOR at his own cost.
- 11.12** All welded and screwed joints shall be kept clean for detecting leaks during testing.
- 11.13** Test pressure shall be maintained long enough to facilitate complete inspection of the system. Minimum duration of test shall be 6 hours unless otherwise specified. Pressurising equipment shall be isolated immediately after test pressure is attained.
- 11.14** After successful completion of hydrostatic testing, the piping system shall be dewatered. All lines shall be completely dried using compressed air. CONTRACTOR shall make his own arrangement for supply of compressed air. Drying of lines shall be considered complete on approval CUGL/PMC.
- 11.15** Test Records

11.16 The records in duplicate shall be prepared and submitted by CONTRACTOR as below:

- a) Date of test
- b) Identification of pipe tested - line number
- c) Test pressure
- d) Test results
- e) Signature of CONTRACTOR
- f) Approval signature by CUGL/PMC.

CENTRAL U.P. GAS LIMITED (CUGL)

**LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN
BAREILLY, KANPUR & UNNAO AND JHANSI GAS**

PTS – CIVIL CONSTRUCTION

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1.0 CIVIL, STRUCTURAL AND ARCHITECTURAL WORKS

1.1 GENERAL

DEFINITIONS AND INTERPRETATION

1.2 PTS shall be read in conjunction with the General Conditions of Contract (GCC) ,Special Conditions of Contract(SCC), General Technical Specifications (GTS) of work, drawings, Schedule of rates(SOR), Instruction to Bidders (ITB) and other documents forming part of the tender wherever the context so requires.

1.3 Where any portion of the GTS is repugnant or variance with any provisions of the PTS, unless a different intention appears, the provision(s) of PTS shall be deemed to govern the provision(s) of GTS of contract. If there is no variance or repugnance between GTS and PTS, both clauses shall be applicable.

1.4 In case of conflict between the requirements of this specification and that of the referred codes, standards and specifications, the requirements of this **specification shall govern.**

Definitions

The terms used in the technical document must be understood as follows:

| | |
|------------------------|---|
| AGREEMENT | Designates the agreement concluded between the OWNER and the CONTRACTOR, under which the latter undertakes to the former the GOODS and/or SERVICES according to the stipulations which are agreed and specified in the form of an order. |
| OWNER | Designates the purchaser of the GOODS and/or SERVICES which are the subject of the AGREEMENT. |
| CODE | Designates a set of systems and Indian rules or international standardization documents for design, materials, tests, etc. |
| CONTRACTOR | Designates the individual or legal entity with whom the order has been concluded by the OWNER.The term "CONTRACTOR" may be used indifferently for a supplier, a manufacturer, an erection CONTRACTOR, etc. |
| DAYS - WEEKS - MONTHS | Specify the number of calendar days, weeks or months and not of working days, weeks or months. |
| OWNER'S REPRESENTATIVE | Designates the individual or legal entity to which the OWNER has entrusted various tasks in relation with the carrying out of his PROJECT. |
| GOODS and/or SERVICES | Designate, depending on the case, all or part of the drawings or documents, substances, materials, material, equipment, structures, plant, tools, machinery,... to be studied, designed, manufactured, supplied, erected, built, assembled, adapted, arranged or put into service by the CONTRACTOR under the AGREEMENT, including all the studies, tasks, works and services specified by the order. The terms GOODS or SERVICES may be indifferently used one for the other as required by the context. |
| PROJECT | Designates the aggregate of GOODS and/or SERVICES to be provided by one or more CONTRACTORS. |
| STANDARD | Designates a set of models or references, corresponding to common practice and generally used by the OWNER'S REPRESENTATIVE. This can be typical standard drawings or documents. |

SPECIFICATION

Designates a document describing in some details general or particular requirements for specific type of works.

LAWS –CODES –RULES & STANDARDS

General

Basically, the following are applicable:

Basic Laws – Codes – Rules & Standards, mandatory by law in State of Bihar of India.

The complete set of which are part of the present technical volume.

Particular Codes & Standards as per Section 2.2.

The “Rules of Art” and “Sound Practices” of the engineering.

In case of contradiction, the above shall prevail in descending order of precedence.

Particular Codes & Standards (Latest editions)

| | | |
|----|----------------------------|--|
| 1 | IS:875 (Part I to V) | Code of Practice for design loads (other than earthquake) for building and structures. |
| 2 | IS:1893 | Criteria for Earthquake resistant design of structures. |
| 3 | IS:2911 | Code of Practice for design and construction of pile foundation. |
| 4 | IS:456 | Code of practice of Plain and Reinforced Concrete. |
| 5 | IS:1786 | Code of practice of specifications for high strength deformed steel bars and wires for concrete reinforcement. |
| 6 | IS:1566 | Code of Practice of hard-drawn steel wire fabric for concrete reinforcement. |
| 7 | IS:432 | Code of Practice of specifications for mild steel and medium tensile steel bars and hard-drawn steel wires for concrete reinforcement. |
| 8 | IS:13920 | Code of practice for ductile detailing of reinforced concrete structures subjected to seismic forces. |
| 9 | IS: 800 | Code of practice for general construction in steel. |
| 10 | IS: 806 | Code of practice for use of steel tubes in general building construction |
| 11 | IS: 2062 | Code of practice for Steel for general structural purposes |
| 12 | IS: 3502 | Code of practice for Steel chequered plates. |
| 13 | IS: 1363 | Code of practice for Hexagonal head bolts, screws and nuts of product grade C. |
| 14 | IS: 1367 | Code of practice for Technical supply conditions for threaded steel fasteners |
| 15 | IS: 5624 | Code of practice for Specification for foundation bolts. |
| 16 | IS: 2016 | Code of practice for Plain washers |
| 17 | IS: 277 | Code of practice for Galvanized steel sheet (Plain and corrugated) |
| 18 | IS: 1230 | Code of practice for Cast Iron rain water pipes and fittings |
| 19 | IS: 1728 | Code of practice for Specification for sheet metal rain water pipes, normal size gutters, fittings and accessories |

The scope of work to be performed under this contract shall include complete civil, architectural and steel structural works as per plans, equipment layout, drawings & technical specifications for the ‘CGD work for Bareilly, Kanpur & Unnao and Jhansi GAs.

1.5 SCOPE OF SUPPLY

Contractor shall procure & supply to site all the materials including cement, reinforcing steel, steel sections, plates, pipes, MS Angle Posts, Concertina coil, RBT fencing wire, Chain link fencing, chequered plate, Colour coated steel sheets, False ceiling, mesh and other accessories, other masonry materials, bitumen/asphalt, admixtures & bonding agents, sealants, kerb stones, paver block, sand, boulder, etc., and any other construction material / item required to complete the civil & structural works.

All costs towards testing/inspection of materials/goods shall be the Contractor.

1.6 SITE WORK

Construction work including supply of labour, construction materials, construction equipment, survey, tools & tackles, dismantling & modification / strengthening, supervision, testing etc. required to complete all the structures, foundations, roads, drains, pavements, finishes, supply, fabrication, erection of steel structures, LCV Platform, cat ladder, CHAIN LINK fencing and gates etc, painting, including site grading/earthwork in cutting & filling etc. as specified and required to complete the civil & road works in all respect.

All enabling works e.g. construction water tank, casting/fabrication yard, electricity, site stores & office, safety and security measures, coordination with other contractors working at site etc. shall be Contractor's responsibility.

Special permits such as 'Hot Permit', "Fire Safety Permit", "permissions for controlled blasting of rock from concerned authorities" etc to work at terminals shall be contractor's responsibility.

2.0 SCOPE OF WORK

The scope of work shall be broadly, but not limited to, the following.

- a) Site grading of the plot by removing 150 mm top soil, , stacking it properly and reusing it for planting purpose, including plot development by filling good quality earth as required.
- b) Earth filling in embankments for external roads wherever required with providing of RCC Culverts/ Pipe Culvert.
- c) Clearing the site, removal of bushes and trees etc as per site requirement.
- d) Construction of a 3 m high boundary wall with brick masonry, PCC Coping, MS Y Angle Posts and Concertina coil with RBT fencing etc as per drawing.
- e) RCC cable trenches: complete civil works for cable trench including providing inserts plates , conduits (GI, PVC or HDPE etc.) And PVC coated MS Chequered cover plate / Pre cast concrete covers as per requirement.
- f) Construction of Single and double SS Tube Trench as per drawing.
- g) Construction of compressor foundation as per drawing.
- l) Construction of Dispenser foundation, canopy foundation, and other associated work as per relevant drawings.
- j) Construction of fore court, approach roads etc. as per drawing.
- k) Construction of cable pit, drain pits etc as per requirement.
- l) Construction of Septic Tank along with Soak Pit and connections.
- m) Storm water drainage system in RCC / Brick drains with complete civil works as per requirement
- n) Laying of Hume pipes for drainage as per drawing and requirement of site.
- o) Construction of Utility / office building - control room, office room, store room, UPS and battery room, electrical room, ATM room etc as per relevant architectural drawings.

- p) Construction of B o r e w e l l as per supplier specification and direction of Engineer in charge.
- q) 80 mm thick PCC paver block M- 40 over sand cushion over ground/on a PCC base (Grade M- 10) at locations as specified.
- r) Laying PCC kerb stones M30 grade 125mm x 300 mm over 75 thk PCC base (Grade M- 10) as specified.
- s) Grouting of all base plates/frames of equipment foundations and structural bases.
- t) Providing of all inserts, conduits, pre-cast covers, fixing of free issue items into permanent works etc.
- u) Providing of approved quality sand for back filling as per requirement.
- v) Clearing all construction debris and handing over completed work site.
- w) Any other work not specifically mentioned but required to make the station functional.
- x) Making as-built details/drawings on one set of construction drawings and return to owner.

3.0 PREMEABLE TO SCHEDULE OF RATES

The Preamble to Schedule of Items is an integral part of the schedule of quantities and rates and this is to be considered incorporated into the description of items themselves. The Contractor's rate for any item of work in the schedule of item shall, unless stated otherwise be held to include the cost of all materials including wastage, conveyance and delivery, unloading, storing, fabrication, all consumable materials, like MS bolts, washer, electrodes, putty, gases, splices paints, tools and plants, power fuel, consumables, all taxes, royalties, other revenue expenses, temporary facilities like roads etc

The item shall include all the safety provisions listed below:

- i) The site should be cordoned off on all sides by way of 3 Mt. High corrugated GI sheet fixed on metal pipes/angles, leaving space for only a Gate. This fencing should be fixed such that it is not possible for anyone to enter the site from any other location other than the Gate.
- ii) The gate should be made in metal with metal sheet cladding. A guard restricting entry of all unauthorized person/material on site should man the gate. The guard shall also maintain a register of all persons visiting site.
- iii) All persons including all labor, supervisors, visitors etc. on site must wear hand gloves, helmet and safety shoes. The responsibility of this shall rest with the main contractor.
- iv) All workmen while working on height shall have PPE's like safety belt, safety helmets etc .
 - a) All w o r k m e n such as welders/ fitters etc. shall wear protective gloves, protective glasses etc. and as per the requirement and demands ofthe trade.
- v) All excavated pits/holes shall be cordoned off with red tape with warning notice.
- vi) All inflammable material shall be kept in non-inflammable containers that are fixed with screwed on caps at all times. The containers should be marked with danger sign and the name of the material shall be marked on the outside. There should be at least one person who should be responsible for the safe custody of these materials.
- vii) All areas of work shall have appropriate safety signage depending on the nature of work, prominently displayed to prevent any mishap, particularly signs in fluorescent paint for night vision. These signs should be visible from a reasonable distance for a vehicular traffic at designated speed limits for a given road/ location. All necessary city traffic rules and signage specifications shall be observed with strict adherence.
- viii) All gadgets must have required safety devices in working conditions as per the manufacturers' recommendations and the law of the country.

- ix) All the persons on site must be insured against injury and death due to accidents.
- x) The contractor shall not use the site for any activity other than what it is authorised for.
- xi) Children below the age of 16 shall not be allowed to work on site. The contractor shall prepare a secured crèche adjacent to the site, for the children of labor working on site and there shall be at least one person dedicated to look after the safety and other needs of these children at all time.

4.0 GENERAL REQUIREMENT

4.1 SITE CLEARANCE

Complete works for the site clearing so that the site is suitable for construction activity. Brief description of major items shall be as follows:

- a) Dismantling of all existing structures in brick masonry/stone masonry/RCC/PCC, road, fence, sheds, cladding, sheets etc. so that the site becomes suitable for construction activity.
- b) Disposal of all material to be cleared from the site to any authorised disposal site/ storage yard.
- c) Removal of trees up to and above 30cm girth as per respective SOR items.
- d) Provide all assistance/co-ordination/liaison between any and all government/semi government agencies connected with the scope mentioned and also with the body owning/maintaining the access road to the site.

4.2 EARTHWORK IN SITE GRADING, EXCAVATION & BACKFILLING FOR PLOT DEVELOPMENT, ETC.

Brief description of major items shall be as follows

- a) Taking pre-work and finished levels.
- b) Stripping and grubbing the top soil of 150 mm and preparation of sub-grade.
- c) Excavating excess soil and soft rock if any to develop the plot.
- d) Dewatering of excessive water.
- e) Backfilling with serviceable earth in layers of 150 mm thickness in controlled way
- f) Watering and compaction up to '95% or as per direction of Engineer in charge of its MDD with mechanical means.
- g) Disposal of unserviceable and surplus earth/rock to a suitable dumping ground to any lead.
- h) Actual work shall be carried out as per certified construction drawings to be issued to successful tenderer

Note:

- i) For all these items only net excavated quantity in Cum shall be measured for payment.
- ii) No separate payment for excavation for foundation / sewerage / forecourt or roadwork/other items where earthwork is included (since cost of earthwork is included in respective items).
- iii) Measurement for rock breaking shall be done by stacking. 35% of stack measurement shall be deducted as voids.

Earthwork shall be done as per approved detailed construction drawings to be issued to the successful bidder. Offer to be prepared by the tenderer based on the enclosed drawings and on lump sum unit rate (per M3).

4.3 EARTH WORK IN FILLING

Complete earthwork in filling with borrowed earth is included in the scope. Brief description of major items shall be as follows.

- a) Taking pre-work and finished levels.
- b) De-watering of excessive water.
- c) Strutting and shoring to retain the earth.
- d) Borrowing of approved quality good earth from any lead.
- e) Filling in layers of 150 mm.
- f) Watering and compaction up to '95% or as per direction of Engineer in charge of its MDD with mechanical means.

Note:

Payment for item earthwork in filling shall be paid for compacted net volume of filling after deductions of foundations, culverts, etc

4.4 SAND FILLING AND STONE SOLING

Complete works in filling is included in the scope. Brief description of major items shall be as follows

- a) Taking pre-work and finished levels
- b) Borrowing of approved quality sand/stone from any lead.
- c) Filling in layers of 150 mm
- d) Providing and laying stone ballast 40-63 mm size in layers of 150 mm with spreading blinding material like murum, bajri, stone grit and compaction with road roller etc. complete the surface as per specifications including cost of material.
- e) Watering and compaction by 10 T rollers.

Note:

- i) Payments to be done on completed work profiles by considering the plan dimensions only.

Sand filling and Stone soling shall be done as per approved detailed construction drawings to be issued to the successful bidder. Offer to be prepared by the bidder based on the enclosed drawings and on lump sum unit rate (per M3).

4.5 REINFORCED CEMENT CONCRETE – SUB STRUCTURE

Brief description of major items shall be as follows

- a) Earth Work in excavation including back filling using serviceable surplus/ borrow material, disposal of surplus earth (wherever required), including bailing out water (where ever required), shoring / strutting etc.
- b) 100 mm thk. PCC M-10 in mud mat.
- c) Providing shuttering and strutting of all types.
- d) RCC M25 as per drawing. & specification including supply of cement, coarse aggregate, fine aggregate and placement of concrete at all levels and depths, all inclusive & testing of concrete and other materials.
- e) Providing and fixing of all anchor bolt and nuts into permanent works etc.
- f) Providing and fixing of all inserts, conduits, precast covers into permanent works etc.
- g) Provision of chequered plates, gratings into permanent works as per SOR item of Structural works.
- h) Grouting of all base plates/frames of equipment foundations as per requirement.

- i) Application of two coats of hot bitumen on surfaces in contact with soil.

Note:

- i) For all these items only net RCC quantity in M3 shall be measured for payment.
- ii) Earth work with borrowed earth shall be paid vide respective SOR item.
- iii) Anchor bolts and nuts shall be paid vide respective SOR item.
- iv) Grouting with non shrinkable compound shall be paid vide respective SOR item.

4.6 REINFORCED CEMENT CONCRETE – SUPER STRUCTURE

Brief description of major items shall be as follows.

- a) Providing shuttering and strutting of all types
- b) RCC M25 as per drawing. & specification including supply of cement, coarse aggregate, fine aggregate and placement of concrete at all levels, all inclusive & testing of concrete and other materials.
- c) Grouting of all base plates/frames of equipment foundations and structural bases as per requirement.
- d) Providing and fixing of all anchor bolt and nuts into permanent works etc.
- e) Providing and fixing of all inserts, conduits, precast covers into permanent works etc.
- f) Provision of chequered plates, gratings into permanent works as per SOR item of Structural works.

Note:

- i) For all these items only net RCC quantity in M3 shall be measured for payment.
- ii) Anchor bolts and nuts shall be paid vide respective SOR item.
- iii) Grouting with non shrinkable compound shall be paid vide respective SOR item

4.7 REINFORCEMENT STEEL

- a) Supplying, Fabricating and Fixing in position HYSD Steel Reinforcements/ TMT Grade Fe-500 conforming to IS1786-1985 at all levels and positions
- b) Straightening, Cutting, Bending, Cranking, Binding, Welding, Provision of necessary Chairs and Spacers for reinforcement bars as per drawing and construction requirements.
- c) Preparation of bar bending schedule Drawings and getting the same approved by Site Engineers as directed by EIC

Note:

- i) Rate to include cost of all labour, tools, tackles, equipment, hire charges, supply of all materials such as steel Reinforcement, binding wire and other minor construction materials, testing etc. all bye works and sundry works complete in all respects.
- ii) Chairs, laps, spacers, wastage etc. shall be to contractor's account.
- iii) Only net Reinforcement bars as per approved BBS / as laid at site shall be considered for payment.

4.8 BRICK WORK IN SUB STRUCTURE

Complete works in brick masonry sub structure is included in the scope

Brief description of major civil items shall be as follows

- a) Earth Work in Excavation including back filling using serviceable surplus material or approved borrow material and transportation of excess earth beyond plot limits. Preparation of sub-base including dewatering and compaction.

- b) Brick work in sub structure with not less than M-7.5 grade bricks in 1:4 cement sand mortar (in coarse sand).
- c) 150 mm thk PCC1:4:8 (M-10) in leveling course.
- d) DPC 40 mm with cement concrete M-15 (1:2:4) as per requirement with water proofing compound and application of bituminous paint
- e) 18 mm thk plastering in CM (1:4) (in coarse sand) on exposed brick surfaces.
- f) Application of two coats of hot bitumen on surfaces in contact with soil.
- g) Applying Cement based paint / Weather proof paint /washable distemper on plastered faces in sub structure as specified in drawings.
- h) Making weep holes with 75mm dia. PVC pipe stone filter pack at 1.0 m intervals in both the directions.

Note:

- i) Only net brick masonry quantity excluding plaster thickness shall be measured in M3 for payment purpose.
- ii) Earth work in backfilling with borrowed earth shall be paid vide respective SOR item.

The construction of brick work shall be done as per detailed construction drawings to be issued to the successful tenderer. Offer to be prepared by the tenderer based on work described above.

4.9 BRICK WORK IN SUPER STRUCTURE

Complete works in brick masonry super structure is included in the scope.

Brief description of major civil items shall be as follows:

- a) Brick work in super structure in Control building with fly ash bricks with not less than M-7.5 grade bricks in 1:4 cement sand mortar (in coarse sand) and for other building with clay bricks with not less than M-7.5 grade bricks in 1:4 cement sand mortar (in coarse sand)
- b) 18 mm thk plastering in CM (1:4) (in coarse sand) on exposed brick surfaces.
- c) All niches, offsets, pockets etc shall be considered part of the work.
- d) Providing shuttering / supports etc. as per requirement
- e) Applying Cement based paint / Weather proof paint / oil bound distemper/Acrylic paint on plastered faces in super structure as specified in drawings

Note:

- i) Only net brick masonry quantity excluding plaster thickness shall be measured for payment purpose.

The construction of brick work shall be done as per detailed construction drawings to be issued to the successful tenderer. Offer to be prepared by the tenderer based on work described above and payment will be made on rate (per M) of brickwork done.

4.10 PAVER BLOCK (80 MM THK) PAVEMENTS IN SPECIFIED AREAS

Brief description of major works to be considered in this item is as follows.

- a) Earthwork in excavation including back filling up to required level (including using borrow earth and disposal of surplus earth).
- b) Filling in layers of 150 mm thickness in controlled way.
- c) Watering and compaction up to 95% of modified dry proctor density of soil with mechanical means.

- d) Providing and laying / fixing 80 mm thick M-40 Paver Blocks over 75 mm thk. sand cushion over well compacted sub grade / PCC as specified.
- e) Filling joints between the blocks with fine River sand.
- f) Making slopes, finishing edges, leaving pockets for pedestals & sleepers
- g) Actual work shall be carried out as per certified construction drawings to be issued to successful tenderer.

Note:

- i) Complete civil works for Paver Block Pavement including, earth work in excavation, preparation of base i.e., compacted sub grade, 100mm thk. sand filling and compaction, PCC etc. are included in the works & payment shall be made under Paver Block Pavement item. Only net laid quantity shall be considered for payment purpose.

4.11 RCC KERB STONE IN SPECIFIED AREAS

Brief description of major works to be considered in this item is as follows.

- a) Earth Work in excavation including back filling up to required level (including using borrow earth and disposal of surplus earth).
- b) Supplying and fixing M-30 Kerb Stone Blocks 125 mm x 300 mm over 75 mm thk PCC – M 10 grade.
- c) Filling joints between the blocks with cement mortar (1:3) (in coarse sand).
- d) Actual work shall be carried out as per certified construction drawings to be issued to successful tenderer.

Note:

Complete civil works for Kerb Stone including, earth work in excavation, preparation of base i.e., compacted sub grade, 75 mm thk. PCC, etc. are included in the works & payment shall be made in RM. under Kerb Stone item.

4.12 RCC GRADE SLAB IN FORECOURT

Complete civil works and other finishes in the fore court are included in the scope.

Brief description of major civil items shall be as follows.

- a) Stone soling (150 mm thick) compacted with road roller and river sand filling in voids.
- b) 100 mm thick PCC M-10 (1:3:6).
- c) Laying of all required conduit, cables, pipes etc. and fixing them securely to the reinforcement bars (payable under separate item).
- d) RCC M25 (to be procured from batching plant/site prepared mix) 150 mm thick laid to slope including reinforcement and inserts, PVC sleeves, expansion joints and brush finish.
- e) Providing & laying 50 mm thick M25 screed over RCC floor with 4 mm dia and 75 X75 mm wire mesh (payable under separate item).
- f) Applications of non-metallic compounds, as per manufacturer's specifications to make the surface hard enough to bear abrasion, improve impermeability & resist weathering. The compound to be used shall be non-metallic hardener of Roff/ Fosroc/ STP/ CICO or equivalent (payable under separate item).
- g) Providing non-deteriorating board in expansion joints with polysulphide sealant (payable under separate item).
- h) Making of cable and steel tube trench with SFRC precast covers with lifting arrangement (payable under separate item but area of trench will be deducted from forecourt).

- i) Making dispenser islands including Granite/Vitrified tile top fixing and all its finishes (payable under separate item).
- j) Concrete paver blocks laid over PCC (payable under separate item).
- k) Fixing of concrete kerb stone blocks. Kerb stone blocks shall have niche with reflective material fixed in it (payable under separate item).
- l) Manhole, gully trap including SFRC covers.

Note:

Only area of completed forecourt shall be measured for payment.

The construction of fore court shall be done as per approved detailed construction drawings to be issued to the successful tenderer. Offer to be prepared by the tenderer based on the enclosed architectural drawings and on lump sum unit rate (per Sq.M) for complete work.

4.13 ROADWORK

Complete works in making of road over well-compacted sub grade (CBR 4.0 – 5.0 in soaked condition) is included in the scope.

Brief description of major items shall be as follows.

- a) Preparation of sub grade including dressing to camber, making good all undulations, re-rolling with power road roller of 8 to 12 tons capacity etc.
- b) Supply and laying river sand of 200mm thick over compacted soil.
- c) Providing and laying 100 mm thick cement concrete of 1:3:6 over sand.
- d) Providing and laying 200mm thick RCC of Grade M25 over PCC.
- e) Providing & laying 25 mm dowel bars with metal cap @200 mm c/c across the full road width at expansion joint location as per drawing.
- f) Providing and laying cap cell of Supreme make board of or equivalent sealing in expansion joints at all locations, including sand fill, edge preparation, cleaning, drying complete in all respects.

Road making shall be done as per approved detailed construction drawings to be issued to the successful tenderer. Offer to be prepared by the tenderer based on the enclosed drawings and on lump sum unit rate (per SqM) of premix carpet surface laid.

4.14 SFRC PRE-CAST SLAB

Brief description of main items shall be as follows:

Heavy duty 600mmx550mmx70mm thick precast SFRC Slab in trenches of approved make shall be provided and fixed as per instruction of Engineer-in-charge.

4.15 PROVIDING AND LAYING FLOOR HARDENER

Heavy duty non-metallic hardener compound of STP, Roff, Fosroc, CICO of approved manufacture or equivalent laid in panels at all locations over well compacted concrete bed complete with all works, with minimum coverage as per manufacturers' specifications, drawings and as directed by EIC shall be provided and laid. All preparation and laying to be done under specialist supervision and a performance guarantee be furnished for a long term service life.

4.16 GROUTING WITH NON-SHRINKABLE COMPOUND

Brief description of major items shall be as follows

Ready mix non-shrink cementitious grout of compressive strength 30N/mm² / 45

N/mm² as per SOR shall be provided and laid manually or by pumping at all positions. This shall include shuttering, compacting, edging, repairing, sealing and curing for shutdown repairs, base

grouting of rotating equipment and other installation complete. This shall be as per specifications, site sketches/ drawings and direction of the EIC.

Minimum coverage as per manufacturers' recommendations shall be applied in absence of actual field consumption data.

4.17 PROVIDING AND LAYING CAP CELL BOARD

CAPCELL board sealing in expansion joints of 12 mm/25 mm thickness and required depth shall be provided and laid. All preparation, protection, sealing and sand bed separation will be part of the work.

4.18 PLANTING AND LAWN DEVELOPMENT

Complete works of Planting and Lawn development is included in the scope

Brief discretion of major items is as follows

- a) Soft Landscape
- b) Soil preparation including manure, pesticides, sweet soil etc.
- c) Top soil shall be protected to the possible extent during construction and reused.
- d) Making plant pits/surfaces.
- e) Planting of plant material and watering etc.
- f) Maintaining plants till growth (6 months).
- g) Landscaping shall be protected during construction. Trees cut during construction shall be compensated by planting new trees in the ratio of 1:4 on available space.

Note: Payment of Lawn work for Soft Landscape shall be done as per actual area developed. Lawn development work shall be done as per approved detailed construction drawings to be issued to the successful tenderer.

4.19 SIGNAGE WORKS

- a) Building Fascia, as per drg. on top of building faces in elevation

4mm thick ACM (of approved make) cladding in a combination of corporate colours with the use of Retro Reflective Sheeting Type XI DG3 Microprismatic as per ASTM D 4956-09 duly pasted on ACM in required size & shape (colour scheme to be approved) on mild steel framework. Structural frame to be fasteners/ Nut Bolted to the building walls with dash fasteners and leveling 'arrangement. Building fascia to be made in maximum length of straight panels (with minimum no. of joints) straight panels factory plan/processed at converters factory and assembled/installed at site. Corner piece (1metre both sides) on both sides, also to be factory plan/processed/assembled and installed at site. Only bottom trim and top flashing is to be Plan/processed and installed at site. All work to be done in line, level and plumb, all complete with by works, as approved.

- b) Direction sign

4mm thick. ACM (Aluminum Composite Material) cladding on steel framework with the use of 3M (or approved equivalent make) Retro Reflective Sheeting Type XI DG3 Microprismatic as per ASTM D 4956-09 duly pasted on ACM in require size & shap & back-lit panels in 10 mm thick Acrylic/ PC duly CNC Routed in require shape & Size as per direction of concerned engineer or 3 mm thick, thermoformed PET-G (Spectra Copolymer/ Relstar) on both sides. Front face of PET-G panels to have acrylic of appropriate colour with cutout for arrow sign as indicated in drawings and the sides to be white. The sign frame to be fixed securely to CC foundation as shown in drawings. The CC foundation shall have 8mm thick polished black granite tiles cladding on top and all exposed side surfaces. Sufficient no. of LED/ T5 (14 W) tube lights with electronic chokes fixed with plastic holders and electric connections. Multi- strand copper conductors with PVC insulation to be used. All work to be done in line, level and plumb, all complete with by works, as approved.

- c) Supply Fabrication and Erection of Steel Structure

This Specification shall apply to supply, fabrication and erection of steel structures in CNG Station and general structural work.

The steel structures shall consist of but not limited to columns, column bracing, portals, LCV Stand, loading unloading platforms, walkways, stairs, ladders, handrails, chequered Plate, Grating for platforms, welded mesh fencing and fencing gate, colour coated steel, steel false ceiling gutter, down take pipes, hoarding, etc.

This Specification covers the structural steel work mainly mentioned below. The structural work shall not be limited to the following description but shall be guided by technical/ technological aspects for the total scope of work.

Any other work not specifically mentioned but required to make the station functional. Making as-built details/drawings on one set of construction drawings and return to owner

4.19.1 Supply, Fabrication and Erection of Chain link wire mesh fencing and Gates

Brief description of major items shall be as follows.

- a) Supply, Fabrication and erection of mild steel welded wire mesh fencing and gates fabricated from MS Pipes, welded mesh, plates etc with all fixtures like MS Pivot, locking arrangement, ms tower bolts, hinges, and any other fixture to complete the work as per tender drawing.
- b) Painting of MS Gate as per specification and drawings
- c) Fencing and Gates shall be fabricated and erected as per detailed construction drawing to be issued to the successful tenderer.

4.19.2 Supply, Fabrication and Erection of Miscellaneous steel structural works.

Brief description of major items shall be as follows

- a) Supply, Fabrication and erection of Loading unloading platform, LCV Stand, Hoarding, cat ladder for approach on building, safety guard for dispenser, pipe supports, chequered plate cover, Grating, etc. shall be fabricated from rolled Steel section and built up section conforming to IS:2062 Grade-A and pipes conforming to IS:1161, as per requirement.
- b) Painting of steel structure as per specification and drawing.
- c) All steel structure shall be fabricated and erected as per detailed construction drawing to be issued to the successful tenderer.

Note : All works shall be considered for payment on MT basis

The cost of MS bolts (permanent and service), washers, electrodes, putty, gases, cost of straightening the raw materials, cutting of flats from plates and providing splices, paints, tools, plants, electric power, water. Other consumables, as required for the work shall be deemed to be included in the quoted rates.

All handling and transport charges of raw materials and fabricated structures including double handling, as required, for completion of work in accordance with time schedule, are deemed to be included in the quoted rates.

List of Approved Manufacturers of Architectural / Building Products

| Sl. No. | Item/ Name of Manufacturer | Plac | Brand Name |
|------------|--|-----------|-----------------|
| 1.0 | Floor Finishing | | |
| 1.1 | Terrazzo Tiles | | |
| A | Nitco | Del | NITCO |
| B | Hindustan Tiles | Del | Hindustan Tiles |
| 1.2 | Ceramic Tiles | | |
| A | Regency Ceramics Ltd. | Hyderabad | Regency |
| B | Kajaria Ceramics Ltd. | Del | Kajaria |
| C | Orient Ceramics & Industries Ltd. | Del | Orient |
| D | Bell Ceramics | Vadodara | BELL |
| E | SPL Ltd. | Del | Somany |
| F | H & R Johnson (I) Ltd. | Mumb | Johnson |
| G | Spartek Ceramics | Chenna | Spartek |
| H | Murudeshwar Ceramics Ltd. | Hub | Naveen |
| 1.3 | Vitrified Tiles | | |
| A | Regency Ceramics Ltd. | Hyderabad | Regency |
| B | Orient Ceramics & Industries Ltd. | Del | Orient |
| C | SPL Ltd. | Del | Somany |
| D | H & R Johnson (I) Ltd. | Mumb | Johnson |
| E | Murudeshwar Ceramics Ltd. | Chenna | Spartek |
| F | Kajaria Ceramics Ltd. | Hub | |
| 1.4 | Acid Resistant Tiles | | |
| A | Regency Ceramics Ltd. | Hyderabad | Regency |
| B | H & R Johnson (I) Ltd. | Mumb | Endura |
| 1.5 | PVC Tiles/ Rolls | | |
| A | All Manufacturers Listed (Having Operative and Valid License) by HIS AI BIS Web Site http://www.bis.org.in | | |
| B | Armstrong World Insutries | Mumb | Excelln |
| C | Bhor Industries | Del | MARBLFX |
| D | Shyam Vinyl | Chenna | Shyam Vinyles |
| 1.6 | PVC Tiles/ Rools / Anti-Static) | | |
| A | Armstrong World Insutries | Mumb | Solid LG1 |
| B | Premier Poly Film Ltd. | Del | ANSTAT |
| 1.7 | Epoxy Coating | | |
| A | Fosroc Chemical (I) Pvt. Ltd. | Bangalore | Nitofloor SL |
| B | Sika | Kolkat | Sika Floor |
| C | Buildtech Products (I) Pvt. Ltd. | Del | Buildpoxy-SL |
| D | Anupam Industries | Kolkat | - |
| E | STP | Del | |
| 1.8 | Floor Hardener | | |
| A | Cico Technologies Limited | Del | CICO |
| B | Samcock Chemicals (P) Ltd. | Ahmedabad | Samhard STD |
| C | PCC CSS Profcssor and Traders | Kolkat | Doronite |
| 1.9 | Designer Paver Tiles/ Interlocking Tiles ISI Marked/ Grass-Jointed Tiles (1st Quality Only) | | |
| A | Pavit, Ultra, Hindustan, Eurocon, Vyara, National Tiles, Gem, Unistone, Konkrete | | |
| B | Rammica Industries | Del | Rammica |
| C | The Bombay Burmah Trading Corpn. | Del | Formica |
| 2.0 | Wood Work | | |
| 2.1 | Block Board/ Flush Door | | |

| Sl. No. | Item/ Name of Manufacturer | Plac | Brand Name |
|---------|--|------|------------|
| A | All Manufacturers Listed (Having Operative and Valid License) by HIS AI BIS Web Site http://www.bis.org.in | | |

| Sl. No. | Item/ Name of Manufacturer | Place | Brand Name |
|-------------|---|--|-------------|
| 2.1 | Plywood | | |
| A | All Manufacturers Listed (Having Operative and Valid License) by HIS AI BIS Web Site http://www.bis.org.in | | |
| 2.2 | Laminates | | |
| A | All Manufacturers Listed (Having Operative and Valid License) by HIS AI BIS Web Site http://www.bis.org.in | | |
| 2.3 | MDF Boards | | |
| A | Nuchem Limited | Faridabad | NULAM/NVWUD |
| B | Mangalam Timber Products Limited | Delh | Nuwud |
| C | Western Bio Systems Ltd. | PUNF | Ecoboard |
| D | Bajaj Eco-Tech Products Limited | Noida | Bajaj |
| 2.4 | Particle Board (Plain/ Veneered/ Pre-Laminated) | | |
| A | All Manufactureres Listed by BIS Under is 3097 (Having Operative and Valid License) at BIS Web Site http://www.bis.org.in/ | | |
| 2.5 | Pressed Steel Door Frames/ Cupboard and Window Frames (Fabricators) | | |
| | M/s SAIL | | |
| | M/s TATA | | |
| 3.0 | Steel/ Aluminium/ Fire Rated Doors, Windows, Ventilators | | |
| 3.1 | Pressed Steel Doors/ Windows | | |
| A | SKS Steel Ind. | Delh | - |
| B | Dhiman Steel | Delh | - |
| C | Supper Steel Windows Co. | Delh | - |
| D | RDG Engineering | Mumbai | - |
| E | Anand Industries | Delh | - |
| F | Raymus Engineering | Gurgaon | - |
| G | M/s Loyal Safe Works Mayapur | New Delhi | |
| H | M/s Multiwyn Industrial Corpn. Clacutta | Kolkata | |
| I | M/s Metal Window Corpn. | New Delhi | |
| J | M/s Chhabra Steel Udyog | 260 Sadar Bazar, Meerut Cantt | |
| K | M/s Delite Safe Works, | Rani Jhansi Road, New Delh | |
| L | M/s Ishwar Industries, | 175/A Bomay Bazar, Meerut Cantt | |
| M | M/s Chandni Industries | J-142, Patel nagar 1 st , Ghaziabad | |
| 3.2A | Aluminium/ Doors/ Windows Sections | | |
| A | Jindal Aluminium Limited | Bangalore | |
| B | Hindalco | Mumbai | |
| 3.2B | Alluminuml Door/ Windows/ Glazing Fabricator and Anodized | | |
| A | M/s Alumilite Pvt. Ltd., C. AHLCON | New Delhi | |
| B | M/s Ajit India Pvt. Ltd. | Mumbai | |
| 3.3 | Fire Proof Doors | | |
| A | Navair International | Delh | Viper |
| B | RDG Engineering | Bombay | Radiant |

| Sl. No. | Item/ Name of Manufacturer | Place | Brand Name |
|------------|---|-----------|------------|
| 3.4 | Steel Windows, Ventilators (as per IS-1038 of 1983) & frames pressed steel dorr/ window) | | |
| A | M/s Multiwyn Industrial Corpn Calcutta | Kolkata | |
| B | M/s Metal Window Corp N/Delhi | New Delhi | |
| C | M/s Govind Enterprises, Delhi | Delhi | |
| D | M/s Chhabra Steel Udyog 260, Sadar Bazar, Meerut Cantt, Agent Steel MFG Pvt. Ltd. Ahmedabad, Godrej. | | |
| E | M/s Chandni Industries, J-142, Patel Nagar Ist, Ghaziabad | Ghaziabad | |
| 3.5 | Rolling Shutters (ISI marked) | | |
| A | Swastic | Mumbai | |
| B | Hercules | Bangalore | |
| C | Shubdwar | | |
| D | M/s Bharat Rolling Shuters Industries Agra Rama Rolling Shutter Works | | |
| E | Gandhi Entrance Automations Private Limited | | |
| 4 | Door/ Windows Fittings | | |
| 4.1 | Mortice Locks with Handles | | |
| A | Godrej & Boyce | Mumbai | Godrej |
| B | Everite Agencies (P) Ltd. | Delhi | Everite |
| C | Golden Industries | Delhi | Golden |
| 4.2 | Hydraulic Door Closer (Overhead/ Floor Mounted) | | |
| A | All Manufactureres Listed by BIS Under is 3087 (Having Operative and Valid License) at BIS Web Site http://www.bis.org.in/ | | |
| B | Doorking Industries | Delhi | Doorking |
| 4.3 | Misc. Door Fittings e.g. Hingee, Tower Bots, Latches, Stoppers etc. | | |
| A | All Manufacturers Listed by BIS under IS:3087 (Having operative and valid license) at BIS Web Site http://ww.bis.org.in/ | | |
| B | Everite Agencies (P) Ltd. | Delhi | Everite |
| C | EBCO Industries | Delhi | EBCO |
| D | ECIE (P) Ltd. | Mumbai | ECIE |
| D | Hardwyn Traders | Mumbai | Hardwyn |
| | Aluminium/ Doors/ Windows Fittings | | |
| | M/s Wlite Enterprises C/6 Shalimar Hardware 133, Jarg Mahal, Dhobitalao Mumbai 400002 | | |
| | M/s Mohan Metal Industries 178/2-A, Bhole Nath Nagar, Shahadara, Delhi 110032 | | |
| | Mepro, Argent New Delhi, Classic, New Delhi | | |
| | Argent New Delhi, | | |
| | Golden Industries Pvt. Ltd. | Delhi | |
| 4.4 | Automatic Glass Door | | |
| A | Ditec (Gandhi) | Mumbai | |
| 4.5 | Aluminium Grill | | |
| A | Alu Grill, Arihant Aluminium Corporation, Decogrille | Bangalore | Decogrille |
| 4.6 | Builders Hardware | | |
| A | M/s Golden Industries Pvt.Ltd. Everite, Solo | delhi | |

| Sl. No. | Item/ Name of Manufacturer | Place | Brand |
|------------|--|-------------------|-------------------------|
| 5.0 | Roof Treatment (Water - Proofing) | | |
| 5.1 | P.U. Based Waterproofing (One Component) | | |
| A | Llyod Insulations (I) Ltd. | Delhi | Isothane Ema |
| B | Cico Technologies Ltd. | Delhi | Corchem 2061 |
| C | Fosroc Chemical (I) Pvt. Ltd. | Bangalore | Nitoproof |
| 5.2 | P.U. Based Waterproofing (Two Component) | | |
| A | Shivalik Agro Poly Products Pvt. Ltd. | Delhi | Shivabond 903 |
| B | Industrial Product Manufacturing Company | Pune | EZECOAT |
| C | Fosroc Chemical (I) Pvt. Ltd. | Bangalore | Brushbond |
| D | Sika | Kolkata | Sikalastic |
| E | Sip Industries Limited | Chennai | Sipguard |
| 5.3 | Approved Membrane | | |
| A | Llyod Insulations (I) Ltd. | Delhi | Lloyd Plastolan |
| B | Buildtech Products Pvt. (I) Ltd. | Delhi | Buil Dwrap P |
| C | Cico Technologies Ltd. | Delhi | CICO Shield |
| D | Fosroc Chemical (I) Pvt. Ltd. | Bangalore | Proofex |
| F | Sika | Kolkata | Sika WP Shield |
| G | STP Ltd | Kolkata | Super Thermolay |
| H | IWL India Ltd. | Chennai | Hyperplas |
| I | Pure Leathers Pvt. Ltd. | Delhi | Roofseai |
| 6.0 | Painting Works | | |
| | Plastic/ Acrylic Emulsion Paint | Jodhpur | |
| 6.1 | (Internal and External, Distemper/ Acrylic Distemper) | | |
| A | ICI Paints/ ICI India Ltd. | Kolkata | |
| B | Berger Paints | Kolkata | Lewis Berger |
| C | Asian Paints | Mumbai | Asian Paint |
| D | Shalimar Paints | Mumbai | Color Space |
| E | Nerolac Paints | Mumbai | |
| F | Acropaints/ Imited | Delhi | |
| G | Godavari Paints Pvt. Ltd. | Mumbai | |
| H | N E Paint Udyog | Sivasagar (Assam) | |
| 6.2 | Synthetic Enamel Paint (for Building Works) | | |
| A | ICI Paints/ ICI India Ltd. | Kolkata | |
| B | Berger Paints | Kolkata | |
| C | Asian Paints | Mumbai | |
| D | Shalimar Paints | Mumbai | |
| E | Nerolac Paints | Mumbai | |
| F | Godavari Paints Pvt. Ltd. | Mumbai | |
| G | N E Paint Udyog | Sivasagar (Assam) | |
| 6.3 | Waterproof Cement Paint | | |
| A | Killick Nixon Ltd. | Mumbai | Snowcem |
| B | Godavari Paints Pvt. Ltd. | Mumbai | Superemcem |
| C | Acropaints/ Imited | Delhi | Acrocfm |
| D | Snow White Industrial Corpn | Chennai | Superclm |
| E | Rajdoot Paints | Delhi | Xlracem 78 Super Cement |

| Sl. No. | Item/ Name of Manufacturer | Place | Brand |
|-------------|--|--|--------------|
| 6.4 | Decorative Textured Coating | | |
| A | Luxture Surface Coatings Pvt. Ltd. | Ajmer | Luxture |
| B | Bakelite Hylam Ltd. | Secundrabad | Heritage |
| C | NCL Alltek and Seccolor Ltd. | Hyderabad | Alltek |
| D | Acro paints Ltd. | Delhi | Acrotextures |
| E | Unitile | Delhi | Unitile |
| F | Spectrum Paint | Delhi | Spectrum |
| 6.5 | Plushing (for Woodwork) | | |
| A | Asian Paints | Mumbai | Asian Paint |
| B | Shalimar Paints | Mumbai | Mellac |
| 7.0 | Roofing Sheets & Accessories | | |
| 7.1 | Precoated Profiled G.I./ Galvalume/ Zinalume Sheets | | |
| A | Llyod Insulations (I) Ltd. | Delhi | Lloydeck |
| B | Interarch Building Products (P) Ltd. | Noida | Tracdek |
| C | Multi Colour Steel (I) Pvt. Ltd. | Delhi | Multi |
| D | Hardcastele & Waud Mfg. Co. Ltd. | Mumbai | Fero Colour |
| E | Japan Metal Building Systems Pvt. Ltd. | Bangalore | JMBS |
| F | TATA Bluescope Steel Limited | Pune | Trimdf CK |
| G | Era Building Systems Limited | Delhi | ERA |
| H | Shree Precoated Steels Limited | Mumbai | Metacolour |
| 7.2 | C.G.I. Sheet | | |
| A | ISPAT Industries Ltd. | Delhi | Everest |
| B | Steel Authority of India Ltd. | - | SAIL |
| C | TATA Steel | - | TISCO |
| 7.3 | Aluminium Sheet | | |
| A | Jindal Aluminium Limited | Bangalore | |
| B | Hindalco | Mumbai | |
| 7.4 | Fiber Glass Sheet & Panels | | |
| A | Simba Frp (P) Ltd. | Delhi | |
| 8.0 | Sanitary, Plumbing Fittings & Fixtures | | |
| 8.1 | Sanitary Fittings | | |
| A | All Manufacturers Listed by BIS under IS:3087 (Having operative and valid license) at BIS Web Site http://www.bis.org.in/ | | |
| 8.2 | Plumbing Fittings and Fixtures | | |
| A | Jupiter Aqua Lines Ltd. | Mohali | Jupitor |
| B | Othello Faucets Pvt. Ltd. | Delhi | Mayur |
| C | Orient Ceramics | Delhi | Orient |
| D | Gem International | Faridabad | Gem |
| E | Parkash Brassware Industres | Delhi | Parko |
| F | Jaquar & Company Ltd. | Delhi | Jaquar |
| G | Plastocraft Sanitary India Pvt. Ltd./ HSW | Delhi | Kingston |
| 8.2H | Cast Iron Pipes and Fittings Hinddustan Engineermg Products Company | Calcutta | |
| 8.2I | RCC Pipes | | |
| A | Indian Hume Pipe Company | Delhi/ Allahabad/ Chandigarh/ Lucknow | |
| B | Hindustan Pressure Pipes | Kolhapur | |
| C | Dhere Concrete Products Pune | Pune | |

PTS – CIVIL CONSTRUCTION

| Sl. No. | Item/ Name of Manufacturer | Place | Brand Name |
|-------------|--|-----------------|------------|
| 8.2J | GI Pipes | | |
| A | Indian Tube Company | Calcutta | |
| B | Kalinga Tubes Limited | Cuttack Gujarat | |
| C | Steel Tube | | |
| D | Zenith Tube Co. | Kolaba | |
| E | Bharat Steel Tube | New Delhi | |
| F | Jindal | | |
| G | Shivmoni Steel Tubes Limited | Bangalore | |
| H | Sekhar Iron Works | Calcutta | |
| I | Jain Tubes, | Ghaziabad | |
| J | Khandelwal Tubes | Nagpur | |
| 8.2K | G.I. Fittings | | |
| A | International Pipe Works | Calcutta | |
| B | R.M. Engineering Works | Jalandhar | |
| C | Bombay Metal Company | Bombay | |
| D | Tarapada Das & Sons | Howrah | |
| E | Annapurna Metal Works | Calcutta | |
| 8.2L | Gun Metal Valves and Copper Alloy Valve | | |
| A | Leader Engineering Wroks | Jalandhar | |
| B | Neta Engineering Works | Jalandhar | |
| C | Lakshmi Metal Works | Jalandhar | |
| D | Bombay Metal & AlloysCompany | Bombay | |
| E | Luster Sanitary Fittings | Jalandhar | |
| F | Annapurna Metal Works | Calcutta | |
| 8.2M | Sluice Valves, Check Valves etc. | | |
| A | Shiva Durga Iron Works, | Howrah | |
| B | Leader Engineering Wroks | Jalandhar | |
| C | Kirloskar Bros Limited | Pun | |
| D | Indian Valve | Calcutta | |
| E | Geeta Iron & Brass Works | Baroda | |
| 8.2N | Brass Fittings | | |
| A | Leader Engineering Wroks | Jalandhar | |
| B | L & K Mathura | | |
| C | Luster Sanitary Fittings | Jalandhar | |
| D | Annapurna Metal Works | Calcutta | |
| E | Neta Engineering Works | Jalandhar | |
| F | Honey Industril Corporation | Bombay | |
| 8.2O | C.P. Fittings | | |
| A | Ego Metal Works | Ballabhgarh | |
| B | Jaquar & Company Ltd. | Delh | |
| C | Soma Plumbing Fixtures Limited | Calcutta | |
| D | Gem Sanitary Appliances Pvt. Ltd. | Delh | |
| E | Essco Sanitations | Delh | |
| F | Bilmet | Bombay | |
| 8.2P | Hydrants | | |
| A | Brady's | Bombay | |
| B | Firex | Bombay | |
| C | Upadhya Valves | Calcutta | |
| D | Eddy Foundry | Calcutta | |

| | | | |
|---|---------|------|--|
| E | Minimax | Delh | |
|---|---------|------|--|

| Sl. No. | Item/ Name of Manufacturer | Place | Brand Name |
|-------------|--|-------------|----------------------|
| 8.2Q | Stone Ware (Salt - Glazed) Pipes | | |
| A | Hind Ceramics Limited | Orissa | |
| B | Ceramic Industries Limited | Sambalpur | |
| C | Shrikamakshi Agencies | Madras | |
| D | Binary Udyog Pvt. Limited | Howrah | |
| E | Tirumati Moulds Limited | Nagpur | |
| F | Kiran Potteries | Hyderabad | |
| G | Perfect Sanitary Pipes | Bharatpur | |
| 8.3 | Mirror/ Glass | | |
| A | Atul Glass | Delhi | Atul |
| B | Gujarat Guardian Ltd./ Modi / Saint Govin | Delhi | Modiguard |
| C | Triveni Glass | Kolkata | Triveni |
| D | Continental Float Glass | Delhi | Continental |
| E | Hindustan Safety Glass | Kolkata | Hindustan |
| 9.0 | False Ceiling | | |
| 9.1 | Aluminium Strip/ Tray Type | | |
| A | Interarch Building Products (P) Ltd. | Noida | Trac |
| B | Hunter Douglas | Delhi | Luxalon |
| C | Mascot Oversfas | Delhi | Mctacie/ Trulon |
| D | Llyod Insulations (I) Ltd. | Delhi | Lloyd Lineal Celings |
| 9.2 | Gypsum Board | | |
| A | Saint-Gobain Guproc India Ltd., LA, IP Board | Mumbai | Gypboard |
| 9.3 | False Ceiling (POP/ Gypsum Board) | | |
| A | Armstrong, Daiken, Luxalon, Llyods | | |
| 10.0 | False Flooring | | |
| A | United Insulation | Mumbai | |
| B | Llyod Insulations (I) Ltd. | Delhi | |
| C | Muti Floors | Delhi | |
| D | A.R & Brothers | Chennai | |
| E | Bestlock System & Concepts, Goderej | Mumbai | |
| 11.0 | Insulation | | |
| 11.1 | Underdeck Insulation | | |
| A | Bakelite Hylam Ltd. | Secundrabad | Phenotherm |
| B | Llyod Insulations (I) Ltd. | Delhi | Isolloyd |
| C | UP Twiga Fibre Glass Limited | Delhi | TWIGA |
| 11.2 | Overdeck Insulation | | |
| A | Llyod Insulations (I) Ltd. | Delhi | Lloyad Spray Foam |
| B | Best Plastronics Ltd. | Delhi | Best Plastronics |
| 12.0 | Miscellaneous Items | | |
| 12.1 | Water Proofing Compound in Plaster | | |
| A | Cico Technologies Ltd. | Delhi | CICO No.1 |
| B | Pidilite Industries | Mumbai | Pidiproof LA |
| C | Amit Chemicals (P) Ltd. | Delhi | CRETO ADMIX |
| 12.2 | CPRX Bituman Mastic | | |
| A | Shai Imar Tar Products | Delhi | Shalimar Tar |

| Sl. No. | Item/ Name of Manufacturer | Place | Brand Name |
|-------------|--|-----------|---|
| 13.0 | Concrete Admixtures | | |
| 13.1 | Water Proofing Compound | | |
| A | Cico Technologies Ltd. | New Delhi | CICO No.1 |
| | | | CICO Super |
| | | | CICO Acry |
| B | Kryton Buildmat Co Pvt. Ltd. | Delhi | KIM |
| C | Sika India Pvt. Ltd. | Kolkata | Plastocrete Plus |
| | | | Noleek |
| 13.2 | Water Reducing Compounds | | |
| A | CICO Technologies Ltd. | Delhi | CICOPLAST Super |
| B | Fairmatf Chemicals Pvt. Ltd. | Vadodara | Faircrete N Fairflo |
| | | | Fairf LO S |
| C | Sika India Pvt. Ltd. | Kolkata | Plastiment BV Plastiment 81 Plastiment 70 Sikament FF Sikament NN Sikament NN (BWS) Sikament NNSP1 Skamen 1 Sikarapid 1 Sikaviscoerl : L 20HE Sikaviscoere TE R550 (I) Sika AER |
| 14.0 | Construction Chemicals | | |
| 14.1 | Polysulphide Sealant | | |
| A | Cnowksfy Chemicals Pvt. Ltd. | Mumbai | Techseal |
| B | Cico Technologies Ltd. | Delhi | CICOSEALANI T580 |
| C | Fosroc Chemical | Delhi | Thioflex 660 |
| D | Pidilite Industries | Mumbai | Pidiseal PS42P |
| E | Sika India Pvt. Ltd. | Kolkata | SIKA Polysul PH:DE (Sika AST:C) Construction |
| 14.2 | Silicon Sealants | | |
| A | Pidilite Industries Ltd. | Mumbai | Dr. Fixit Silicon Sealant |
| 15.0 | Anchor Fasteners | | |
| 15.1 | Mechanical Anchor Fasteners | | |
| A | Hilti India Pvt. Ltd. | Delhi | |
| B | Fischer Fixing Systems (MICO) Ltd. | Bangalore | |
| 15.2 | Chemical Anchor Fasteners | | |
| A | Hilti India Pvt. Ltd. | Delhi | |
| B | Fischer Fixing Systems (MICO) Ltd. | Bangalore | |
| 16.0 | Electro-Forged Gratings | | |
| A | Greatweld Steel Gratings Pvt. Ltd. | Pune | |
| B | Indiana Gratings Pvt. Ltd. | Mumbai | |
| 17 | Modular Partitions/ Furniture | | |
| A | Godrej, Blowplast, Featherlire, Duriar | | |

| Sl. No. | Item/ Name of Manufacturer | Place | Brand |
|-------------|--|-----------|-------|
| 18.0 | Wall Care Putty for Base Preparation (1st Quality Only) | | |
| A | Birla Wall Care Putty | | |
| B | M/s Sahlimar Hardware | | |
| C | Berger | delhi | |
| D | Jenson & Nichoison | Gurgaon | |
| E | JK White | Udaipur | |
| 19.0 | White Cement (1st Quality Only) | | |
| A | Birla, JK | | |
| 20.0 | Sheet Glass/ Structural Glazing | | |
| A | Hindustan Pilkington Glass Works | Chennai | |
| B | Saint Gobain | Chennai | |
| C | Modi Float | Delhi | |
| D | Triveni Float Glass | Allahabad | |
| F | ASI | | |
| G | Fresca | | |
| H | Emirates | | |
| 21.0 | Polycarbonate Sheet | | |
| A | GE Plastic, Everest | | |
| 22.0 | Multitell/ Multiwall Polycarbonate Panel | | |
| A | M/s Coxwell Domes Engineering, Delhi | Delhi | |
| B | M/s Lexan, M/s Galina India Pvt. Ltd. | New Delhi | |
| C | M/s Vijaynath Interiors & Exteriors Products | Mumbai | |
| 23.0 | Stainless Steel Railing | | |
| A | Jindal | | |
| 24.0 | Punch Tape Concetina Coil | | |
| A | Global Technocrat, S.G. Engineers | Delhi | |
| 25.0 | Punch Tape In Plastic Spool | | |
| A | Global Technocrat, S.G. Engineers | Delhi | |
| 26.0 | Stainless Steel Railing | | |
| A | Jindal | New Delhi | |
| 27.0 | SGSW Pipes (IS-651) ISI marked | | |
| A | Perfect Agra, Devraj Ind. Gaziabad, Buran, RK, Prince, Supreme Pipe and Fittings | | |
| 28.0 | CI (Centrifugally Cast) Pipes for Sewage Disposal ISI Marked | | |
| A | NICCO, SRIF, A-1 Singhal Casting Co Agra, Jindal Saw, Kesoram | | |
| 29.0 | PVC Rain Water/ Sewage Pipes (IS-4985) | | |
| A | Reliance, Finolex, Supreme, Kisan, Prince | | |
| 30.0 | HDPE Water / Sewage Pipes (Rotational Moulded) | | |
| A | Sintex, Swift, Nutech, Sheetal | | |
| 31.0 | Asbestos Cement Pipes and Fittings | | |
| A | Ganga Asbestos Limited | U.P | |
| B | Hyderabad Asbestos Cement Products Limited | | |
| C | J.K. Super Pipes Industries | Nanded | |
| D | Konark Cement and Asbestos Limited | Orissa | |
| E | Maharashtra Asbestos Limited | Bombay | |
| F | Poddar Industrial Corporation | Patna | |
| G | Sarbamangala Mfg. Company | Calcutta | |

| Sl. No. | Item/ Name of Manufacturer | Place | Brand |
|-------------|--|------------|-------|
| 32.0 | Wind Driyen Air Ventilators | | |
| A | Multi Colour | | |
| | Anchit Ispat Pvt. Ltd. | Faridabad | |
| | Apurva Enterprises | Mumbai | |
| | SVS Wind Driven Turbo Ventilator | Ahmadnagar | |
| | Real Green Engineers Pvt. Ltd. Bagalores | Bangalore | |
| | Sun Green Ventilation System Pvt. Ltd | Mylapore | |



DATA SHEET-PRESSURE GAUGE

P.014714 G
11087 M001

UNITS: Flow<-> Liquid- m³/hr Gas- Sm³/hr Steam- kg/hr Pressure-> kg/cm² G Temperature<-> °C Level/Length<-> mm

| | | | |
|----------------------|--|------------------------------------|----------------------|
| 1 Type:- | Direct | 15 Diaphragm Seal:- | -- |
| 2 Mounting:- | Local | Type:- | -- |
| 3 Dial Size:- | 150 mm | Wetted Parts Material:- | -- |
| | Colour:- White with black inscriptions | Others Material:- | -- |
| 4 Case Material:- | SS316 | Process Connection: Size & Rating | -- |
| 5 Bezel Ring:- | Bayonet type SS316/Screwed | Facing & Finish:- | -- |
| 6 Window Material:- | Shatterproof glass | Capillary Material:- | -- |
| 7 Enclosure:- | WP to IP 65 as per IEC 60529 / IS 2147 | Armour - Flexible Material:- | -- |
| 8 Pressure Element:- | Bourdon | Capillary Length:- | -- |
| 9 Element Material:- | SS316 | Flushing/Filling connection with:- | -- |
| 10 Socket Material | SS316 | 16 Over Range Protection:- | 130% of FSD |
| 11 Accuracy:- | +/-1% of FSD | 17 Blow Out Protection:- | Yes |
| 12 Zero adjustment:- | Micropointer | 18 Options :- | a) Snubber |
| 13 Connection:- | 1/2" NPT(M) | b) Syphon | c) Gauge Saver |
| | Connection Location:- Bottom | d) Liquid Filled casing | e) Vacuum Protection |
| 14 Movement:- | SS316 | f) Solid front | |
| | | g) Two valve manifold | Yes |
| | | 19 Quantity :- | * |

| SL. NO. | TAG NO. | RANGE | PRESSURE kg/cm ² | | | TEMPERATURE °c | | | SERVICE | OPTIONS |
|---------|---------|-------|-----------------------------|------|------|----------------|------|------|-------------|---------|
| | | | OP. | MAX. | DES. | MIN | MAX. | DES. | | |
| | * | * | 0-40 | - | 49 | - | 65 | - | Natural Gas | e,f,g |
| | | | | | | | | | | |

NOTES:

*: Vendor to furnish

- Since the natural gas is saturated with water and has corrosive constituents CO₂-2.08%, the wetted parts of the instruments shall be suitable for that accordingly.
- Vendor shall furnish Make and Model No. with product catalogues along with the offer.
- Above data-sheet is typical for all Pressure Gauges used in the respective P&ID.Vendor shall submit the individual data sheet of each pressure gauge .
- Make of the PG shall be Warea / A N Instruments / General Instruments.

DEVIATION

NO DEVIATION

VENDOR'S SIGNATURE WITH SEAL

| | | | | | | | |
|------------------|----------|---|------------|------|------|------|------|
| Sheet No. 1 of 1 | CLIENT: | CUGL | | | | | |
| | PROJECT: | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS | | | | | |
| | VENDOR: | | 10.07.2023 | | | | |
| | | | REV. | DATE | PREP | CHKD | APPD |


| | | |
|---|----------------------|-----------------------|
| CENTRAL U.P. GAS LIMITED LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI Gas | MANUAL BALL VALVES | DATA SHEET No. |
| | ABOVEGROUND SERVICES | P.014714 G 11087 M002 |
| | SIZE - 2" TO 12" | (VBA-3C1) |
| | DATA SHEET | Page 1 of 2 |

I. PROCESS DATA :

- PIPE CLASS : 3C1 - CORROSION ALLOWANCE : 1.6 mm
- FLUID : Natural Gas
- FLUID SYMBOL : NG
- OPERATING CONDITION
 - TEMPERATURE (°C) : 10 - 50
 - PRESSURE (Barg) : 19 - 35
- DESIGN CONDITION
 - TEMPERATURE (°C) : 0 - 60
 - PRESSURE (Barg) : 49


II. VALVE DATA :

- APPLICABLE SPECIFICATION : PTS - Pipeline valves
- CONSTRUCTION DESIGN : API 6D
- PIPE CLASS : 3C1
- RATING : 300#
- VALVE BORE : AS per M.R.
- TYPE : TRUNNION MOUNTED - DOUBLE BLOCK AND BLEED - FULLY WELDED / BOLTED CONSTRUCTION
- END CONNECTION : AS PER M.R.
- BODY MATERIAL : ASTM A 216 GR. WCB / ASTM A 234 GR. WPB
- BALL MATERIAL : (ASTM A 216 GR. WCB / ASTM A 234 GR. WPB) + MINIMUM 75 MICRONS ENP
- BODY SEAT RINGS : AISI 4140 + MINIMUM 75 MICRONS ENP COATING / AISI 410
- SEAT SEAL : VITON / DEVLON
- STEM : AISI 4140 + MINIMUM 75 MICRONS ENP COATING / AISI 410
- STEM SEALS : VITON / PTFE
- STUD BOLTS/NUTS : ASTM A 193 Gr. B7 / ASTM A 194 GR. 2H
- PRIMARY SEAT : METAL TO METAL
- SECONDARY SEAT : DEVLON / RPTFE or Equivalent
- FIRE SAFE : YES (Bidder to submit documentary proof)
- ANTISTATIC : YES
- ANTI-BLOW OUT : YES
- EXTENSION STEM : NO
- PUPS (Applicable only for BW end)
- LENGTH : 2" Valve - 150mm, 4" Valve - 200mm, 6" Valve- 250mm, Above 6"- 300mm
- MATERIAL OF CONSTRUCTION : for 2" TO 8" size - API 5L X-52
- THICKNESS : Refer MR
- **PAINTING (Refer Annexure II of PTS)**
 - Surface preparation : SA 2.5
 - Primer : Type of Paint, Total DFT shall be as per paint system no. chosen from Table 5, ISO 12944-5 for highly corrosive environment, Final Shade shall be as per Painting Specification no. P.014714 G11087 M002
 - Finish : Specification no. P.014714 G11087 M002
 - Final Paint DFT : 300 µm (min.)
- **INSULATION** : NO

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| 10.07.2023 | | | | | Issued for Procurement |  <small>CUGL Central U.P. Gas Limited</small> |
| DATE | REV | PREP | CHK | APP | DESCRIPTION | |

| | | |
|---|--|--|
| CENTRAL U.P. GAS LIMITED LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS | MANUAL BALL VALVES ABOVEGROUND SERVICES SIZE - 2" TO 10" DATA SHEET | DATA SHEET No. |
| | | P.014714 G 11087 M002 (VBA-3C1) |
| | | Page 2 of 2 |

| | | | | | | | |
|--|---------------|---|---------------------|---------------|---------|----------|--|
| - Operator | : | <table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">Wrench Operated</td> <td style="width: 50%;">Gear Operated</td> </tr> <tr> <td>Upto 2"</td> <td>Above 2"</td> </tr> </table> | Wrench Operated | Gear Operated | Upto 2" | Above 2" | |
| Wrench Operated | Gear Operated | | | | | | |
| Upto 2" | Above 2" | | | | | | |
| III TEST | | | | | | | |
| - HYDROSTATIC SHELL TEST : | | | | | | | |
| Test pressure | : | 1.5 x Design Pressure | Test Medium : Water | | | | |
| Test Duration | : | 15 mins. | | | | | |
| - HYDROSTATIC SEAT TEST : | | | | | | | |
| Test pressure | : | 1.1 x Design Pressure | Test Medium : Water | | | | |
| Test Duration | : | 5 mins. | | | | | |
| - PNEUMATIC SEAT TEST : | | | | | | | |
| Test pressure | : | 6 barg | Test Medium : Air | | | | |
| Test Duration | : | 5 mins. | | | | | |
| - FUNCTIONAL TEST : | : | 3 Opening / Closing | | | | | |
| Test pressure | : | Atmospheric & Maximum differential pressure | | | | | |
| - HELIUM LEAK TEST : | : | 25% OF Rated Pressure (As Per ASME Sec V, Subsection A, Article 10, Appendix IV) | | | | | |
| Test Duration | : | 30 Min | | | | | |
| - EXTERNAL LEAK TEST | : | at inner pressure of 6 barg with soap suds to check external leak of Body, Stem and all external taps. | | | | | |
| - HELIUM LEAK TEST : | : | 25% OF Rated Pressure (As Per ASME Sec V, Subsection A, Article 10, Appendix IV) | | | | | |
| Test Duration | : | 30 Min | | | | | |
| - DOUBLE BLOCK & BLEED TEST | : | Yes | | | | | |
| - TORQUE TEST | : | Yes | | | | | |
| - ANTISTATIC TEST | : | BS 5146 | | | | | |
| - VISUAL AND DIMENSIONAL EXAMINATION TEST: | : | MSS-SP-55 / API 1104 | | | | | |
| - FIRE TEST | : | API 6FA | | | | | |
| IV QUALITY CONTROL | : | See quality control table for valves | | | | | |
| - MATERIAL CERTIFICATES | : | ALL PRESSURE RETAINING AND PRESSURE CONTROLLING PARTS OF VALVES SHALL BE SUPPLIED WITH EN 10204 - 3.2 CERTIFICATES. | | | | | |
| - ALL TEST CERTIFICATES | : | TEST CERTIFICATES INCLUDING, FIRE SAFE, ANTISTATIC, PHYSICAL IMPACT, CHEMICAL, PAINTING ETC. | | | | | |
| NOTES:- | | | | | | | |
| 1 Unless otherwise stated, all tests will be witnessed by the purchaser/control authority. | | | | | | | |

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|-------------|------------|-------------|------------|------------|------------------------|--|
| | | | | | |  CUGL Central U.P. Gas Limited |
| 10.07.2023 | 0 | | | | Issued for Procurement | |
| DATE | REV | PREP | CHK | APP | DESCRIPTION | |
| | | | | | | |

I. PROCESS DATA :

- **PIPE CLASS** : 3C1U - **CORROSION ALLOWANCE** : 1.6 mm
- **FLUID** : Natural Gas
- **FLUID SYMBOL** : NG
- **OPERATING CONDITION** :
 - TEMPERATURE (°C) : 10 - 50
 - PRESSURE (Barg) : 15 - 35
- **DESIGN CONDITION** :
 - TEMPERATURE (°C) : 0 - 60
 - PRESSURE (Barg) : 49

II. VALVE DATA :

- **APPLICABLE SPECIFICATION** : PTS - Pipeline valves
- **CONSTRUCTION DESIGN** : API 6D Latest Editio
- **PIPE CLASS** : 3C1U
- **RATING** : 300#
- **TYPE** : TRUNNION MOUNTED - DOUBLE BLOCK AND BLEED - FULLY WELDED BODY
- **VALVE BORE** : As per M.R.
- **END CONNECTIONS** : As per M.R.
- **END to END** : ASME B16.25
- **BODY MATERIAL** : ASTM A 216 GR. WCB / ASTM A 234 GR. WPB
- **BALL MATERIAL** : (ASTM A 216 GR. WCB / ASTM A 234 GR. WPB) + MINIMUM 75 MICRONS ENP COATING
- **BODY SEAT RINGS** : AISI 4140 + MINIMUM 75 MICRONS ENP COATING / AISI 410
- **SEAT SEAL** : VITON / DEVLON
- **STEM** : AISI 4140 + MINIMUM 75 MICRONS ENP COATING / AISI 410
- **STEM SEALS** : VITON / PTFE
- **STUD BOLTS / NUTS** : ASTM A 193 Gr. B7 / ASTM A 194 GR. 2H
- **PRIMARY SEAT** : METAL TO METAL
- **SECONDARY SEAT** : DEVLON / RPTFE or Equivalent
- **FIRE SAFE** : YES (Bidder to submit documentry proof)
- **ANTISTATIC** : YES
- **ANTI-BLOW OUT** : YES
- **STEM EXTENSION** : No
- **PUPS (Applicable only for BW end)** :
 - LENGTH : 2" Valve - 150mm, 4" Valve - 200mm, 6" Valve- 250mm, Above 6" - 300mm
 - MATERIAL OF CONSTRUCTION : for 2" TO 8" size - API 5L GR.-X52 PSL2
 - THICKNESS : Refer MR
- **PAINTING (Refer Annexure II of PTS)** :
 - Surface preparation** : SA 2.5
 - Primer :
 - Finish : Final Shade/Color code of valve shall be as per attached painting specification (P.014714 G 11077 M012). Final Paint DFT - 1000 Microns minimum for PUR / 500 Microns Minimum for High Build Epoxy Resin (DIN 30677/2).
- **INSULATION** : NO

| | | | | | |
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| 10.07.2023 | 0 | | | | ISSUED FOR APPROVAL |
| DATE | REV | PREP | CHK | APP | DESCRIPTION |



| | | |
|---------------------|-----------------|---------------|
| - Operator : | Wrench Operated | Gear Operated |
| | Upto 2" | Above 2" |

III TEST (Valves)

- **HYDROSTATIC SHELL TEST :**
 Test pressure : 1.5 x Design Pressure Test Medium : Water
 Test Duration : 15 mins.
- **HYDROSTATIC SEAT TEST :**
 Test pressure : 1.1 x Design Pressure Test Medium : Water
 Test Duration : 5 mins.
- **AIR SEAT TEST :**
 Test pressure : 6 barg Test Medium : Air
 Test Duration : 5 mins.
- **FUNCTIONAL TEST :** 3 Opening / Closing
 Test pressure : Atmospheric & Maximum differential pressure
- **EXTERNAL LEAK TEST :** at inner pressure of 6 barg with soap suds to check external leak of Body, Stem and all external taps.
- **DOUBLE BLOCK & BLEED TEST :** Yes
- **TORQUE TEST :** Yes (API 6D)
- **ANTISTATIC TEST :** BS 5146
- **VISUAL AND DIMENSIONAL EXAMINATION TEST :** MSS-SP-55 / API 1104
- **FIRE TEST :** API 6FA

- IV QUALITY CONTROL :** See quality control table for Valves
- **MATERIAL CERTIFICATES :** ALL PRESSURE RETAINING AND PRESSURE CONTROLLING PARTS OF VALVES SHALL BE SUPPLIED WITH EN 10204 - 3.2 CERTIFICATES.
- **ALL TEST CERTIFICATES :** TEST CERTIFICATES INCLUDING, FIRE SAFE, ANTISTATIC, IMPACT, CHEMICAL, PAINTING ETC.

NOTES:-

- 1 Unless otherwise stated, all tests will be witnessed by the purchaser/control authority.
- 2 Provision shall be provided to future conversion of Manual valve to Actuator operated valve.

| | | | | | |
|------------|-----|------|-----|-----|-------------------|
| | | | | | |
| | | | | | |
| 10.07.2023 | 0 | | | | ISSUED FOR TENDER |
| DATE | REV | PREP | CHK | APP | DESCRIPTION |



I. PROCESS DATA

- PIPE CLASS : 3C1 - CORROSION ALLOWANCE : 1.6 mm
- FLUID : Natural Gas
- Fluid Symbol : NG
- OPERATING CONDITIONS
 - Pressure (barg) : 15-35
 - Temperature (°C) : 10 - 50
- DESIGN CONDITIONS
 - Pressure (barg) : 49
 - Temperature (°C) : 0 to 60

II. VALVE DATA

- CONSTRUCTION DESIGN : BS 1873
- TYPE : HIGH RESISTANCE TO VIBRATIONS AND HIGH DIFFERENTIAL PRESSURE
 - : BILINEAR OR EQUAL %
 - : PARABOLIC DISC/BI-DIRECTIONAL
 - : GLAND TYPE-BOLTED BONNET-NON ROTATING STEM
- PATTERN : STRAIGHT THROUGH GLOBE
- END CONNECTION : Refer MR
- FACE TO FACE : ANSI B16.10
- BODY MATERIAL : ASTM A 216 GR. WCB / ASTM A 234 GR. WPB
- DISC MATERIAL : (ASTM A 216 GR. WCB / ASTM A 234 GR. WPB) +STELLITED
- SEAT : (ASTM A 216 GR. WCB / ASTM A 234 GR. WPB) +STELLITED
- TRIM : ASTM A182 F6
- STEM : ASTM A182 F6
- GASKET : GRAPHITE
- PACKING : GRAPHITE
- OPERATOR : HANDWHEEL OPERATED
- PAINTING
 - Surface preparation : SA 2.5
 - Primer : Type of Paint, Total DFT shall be as per paint system no. chosen from Table 5, ISO 12944-5 for highly corrosive
 - Finish : environment, Final Shade shall be as per Painting Specification no. P.014714 G 11087 M003
 - Final Paint DFT : 300 µm (min.)
- INSULATION : No

| | | | | | | |
|------------|-----|-------------|------------|-------------|------------------------|---|
| | | | | | |  |
| | | | | | | |
| 10.07.2023 | 0 | | | | Issued for Procurement | |
| DATE | REV | PREPARED BY | CHECKED BY | APPROVED BY | DESCRIPTION | |
| | | | | | | |

| | | |
|--|--|------------------------------|
| CENTRAL U.P. GAS LIMITED LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS | MANUAL GLOBE VALVES ABOVEGROUND SERVICE SIZE UPTO 6" DATA SHEET | DATA SHEET NO. |
| | | P.014714 G 11087 M003 |
| | | (VGA-3C1) |
| | | Page 2 of 2 |

III. VALVE INSPECTION AND TESTING


- SHELL TEST : SEE API 598 / BS 6755
- BACKSEAT TEST : SEE API 598 / BS 6755
- LOW -PRESSURE CLOSURE TEST : SEE API 598 / BS 6755
- HELIUM LEAK TEST : 25% OF Rated Pressure (As Per ASME Sec V, Subsection A, Article 10, Appendix IV)
- Test Duration : 30 Min
- HIGH-PRESSURE CLOSURE TEST : SEE API 598 / BS 6755
- VISUAL EXAMINATION OF CASTINGS : SEE API 598 / BS 6755
- HIGH-PRESSURE PNEUMATIC SHELL TEST : SEE API 598 / BS 6755

NOTE : Unless otherwise stated, all tests will be witnessed by the purchaser.

IV. QUALITY CONTROL

(See Quality Control Table for CS valves)

- MATERIAL CERTIFICATES ALL PRESSURE RETAINING AND PRESSURE CONTROLLING PARTS OF VALVES SHALL BE SUPPLIED WITH EN 10204 - 3.2 CERTIFICATES.
- ALL NECESSARY CERTIFICATES TEST CERTIFICATES INCLUDING, FIRE SAFE, ANTISTATIC, PHYSICAL IMPACT, CHEMICAL, PAINTING ETC.

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I. PROCESS DATA

| | | | |
|-------------------------------|---------------|-----------------------|----------|
| - PIPE CLASS | : 3C1U | - CORROSION ALLOWANCE | : 1.6 mm |
| - FLUID | : Natural Gas | | |
| - Fluid Symbol | : NG | | |
| - OPERATING CONDITIONS | | | |
| Pressure (barg) | : 15-35 | | |
| Temperature (°C) | : 10 - 50 | | |
| - DESIGN CONDITIONS | | | |
| Pressure (barg) | : 49 | | |
| Temperature (°C) | : 0 to 60 | | |

II. VALVE DATA

| | |
|-----------------------|---|
| - CONSTRUCTION DESIGN | : BS 1873 |
| - TYPE | : HIGH RESISTANCE TO VIBRATIONS AND HIGH DIFFERENTIAL PRESSURE |
| | : BILINEAR OR EQUAL % |
| | : Uni-Directional |
| | : GLAND TYPE-BOLTED BONNET-NON ROTATING STEM |
| PATTERN | : STRAIGHT THROUGH GLOBE |
| - END CONNECTION | : Refer MR |
| - END-TO-END | : ANSI B16.10 |
| - BODY MATERIAL | : ASTM A 216 GR. WCB / ASTM A 234 GR. WPB |
| - DISC MATERIAL | : (ASTM A 216 GR. WCB / ASTM A 234 GR. WPB) +STELLITED |
| - SEAT | : (ASTM A 216 GR. WCB / ASTM A 234 GR. WPB) +STELLITED |
| - TRIM | : ASTM A182 F6 |
| - STEM | : ASTM A182 F6 |
| - GASKET | : GRAPHITE |
| - PACKING | : GRAPHITE |
| - OPERATOR | : HANDWHEEL OPERATED |
| - PAINTING | |
| Surface preparation | : SA 2.5 |
| Primer | : Type of Paint, Total DFT shall be as per paint system no. chosen from Table 5, ISO 12944-5 for highly corrosive |
| Finish | : environment, Final Shade shall be as per Painting Specification no. P.014714 G 11077 M012 |
| Final Paint DFT | : 300 µm (min.) |
| - INSULATION | : No |

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III. VALVE INSPECTION AND TESTING


- SHELL TEST : SEE API 598 / BS 6755
- BACKSEAT TEST : SEE API 598 / BS 6755
- LOW -PRESSURE CLOSURE TEST : SEE API 598 / BS 6755
- HELIUM LEAK TEST : 25% OF Rated Pressure (As Per ASME Sec V, Subsection A, Article 10, Appendix IV)
 Test Duration : 30 Min
- HIGH-PRESSURE CLOSURE TEST : SEE API 598 / BS 6755
- VISUAL EXAMINATION OF CASTINGS : SEE API 598 / BS 6755
- HIGH-PRESSURE PNEUMATIC SHELL TEST : SEE API 598 / BS 6755

NOTE : Unless otherwise stated, all tests will be witnessed by the purchaser.

IV. QUALITY CONTROL (See Quality Control Table for CS valves)

- MATERIAL CERTIFICATES ALL PRESSURE RETAINING AND PRESSURE CONTROLLING PARTS OF VALVES SHALL BE SUPPLIED WITH EN 10204 - 3.2 CERTIFICATES.

- ALL NECESSARY CERTIFICATES TEST CERTIFICATES INCLUDING, FIRE SAFE, ANTISTATIC, PHYSICAL IMPACT, CHEMICAL, PAINTING ETC.

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| DATE | REV | PREPARED BY | CHECKED BY | APPROVED BY | DESCRIPTION | |
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CENTRAL U.P. GAS LIMITED

DATA SHEET

DATA SHEET No

LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI Gas

MONOLITHIC INSULATING JOINT

P.014714 G 11087 M004

SIZE UPTO 16"

IJ-3C1

I PROCESS DATA

- PIPE CLASS : 3C1
- FLUID : Natural Gas Fluid Symbol NG
- OPERATING CONDITIONS :
 - Pressure (barg) : Min 19 / Max 35
 - Temperature (°C) : 10 to 50
- DESIGN CONDITIONS :
 - Pressure (barg) : 49
 - Temperature (°C) : 10 to 50

I CONSTRUCTION DATA :

- DESIGN AND CONSTRUCTION CODE : ASME VIII, DIV. 1 APP.2, ASME IX & ANSI B31.8
- ALLOWABLE STRESS VALUE : 50 % SMYS (Design factor : 0.50)
- CORROSION ALLOWANCE : 1.6 MM
- CONSTRUCTION MATERIAL
 - CONNECTING PIPE : API 5L X52
 - PIPE PUPS (SHOP WELD) : API 5L X52
 - INSULATING JOINTS : ASTM A694 F52 (Carbon steel, fully killed, fine grain) (**)
 - SEALING GASKET : (*)
 - SPACING RING : (*)
 - FILLING MATERIAL : (*)
 - EXTERNAL COATING : Epoxy Resin (*) [Refer Painting System Specification]
- TESTING INSPECTION AND CERTIFICATES : Refer to QCT attached with tender
- NDE (Non Destructive) : Refer specification and Approved QCT
 - Radiography Test (RT) : Refer Specification / as per API 1104
 - Magnetic Particles Inspection (MPI)/ Dye Penetrate Inspection (DPI) : Refer Specification
- HYDROTEST : 1.5 X Design pressure for 15 minutes hold period
- AIR LEAK TEST : 5 Kg/cm² for Minimum 10 Minutes. No Leakage shall be observed
- INSTALLATION : Aboveground
- ELECTRICAL TEST :
 - Dielectric Strength : 5000 VAC, 50 Hz Holding time for at least one minute (After & before hydrotest)
 - Resistance check : > 50 Mohm (1000VDC)
- DIMENSIONAL STANDARD : standard of manufacturer of insulating joint
- CONNECTING PIPE THICKNESS : Refer PMS (3C1)
- PUP THICKNESS : Refer PMS (3C1)
- END CONNECTION : ASME B16.25 (Butt weld at both ends)
- MARKING : Manufacture name, Heat Number, TAG Number, Grade symbol

NOTE -

- 1 (*) To be Indicated by vendor in his bid and submitted for approval.
- 2 For welded Ends, maximum out of roundness (difference between maximum and minimum internal diameter of pipe) shall be 3mm and tolerance on internal diameter at tee ends shall be same as diameter tolerance for the pipe ends indicated in ASTM A106 (latest edition).
- 3 Manufacturer to ensure that wall thickness of all parts shall be adequate to sustain design pressure. Selected thickness shall be suitable for welding to connecting pipe.

| DATE | REV | PREP | CHK | APP | DESCRIPTION |
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| 10.07.2023 | 0 | | | | Issued for Tender |
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QUALITY ASSURANCE PLAN

FITTINGS

QAP No. : P.014714 G 11013 M001 Rev. 0

Date: 10.07.2023

| | | | |
|-------------|---|-----------|--|
| Prepared by | | Checked : | |
| Approved by | | | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS | | |
| Client | CUGL | | |
| Consultant | | | |

| S NO. | ACTIVITY | PTS | Frequency | Applicable standard & Procedure | Acceptance criteria | Document type | Scope of Inspection | | |
|----------|--|-----------------|----------------------|---------------------------------|-------------------------------|---------------|---------------------|-------------------------------------|---------------------|
| | | Clause No. | | | | | Manufacturer | TPIA | Client / Consultant |
| 0 | CONTROL BEFORE MANUFACTURING | | | | | | | | |
| | - list of operation in manufacturing and control | 9.1 | | | specification | | Perform | review point | review point |
| | - Fabrication and Control procedure | 9.1 | | | specification | | Perform | review point | review point |
| | - Design Proof test | 2.7 | | | specification | | Perform | review point | review point |
| | - material part list | 9.1; 2 and 3 | | | specification | | Perform | review point | review point |
| | - dimensional drawings | 9.2 ; 2 | | | specification | | Perform | review point | review point |
| | - heat treatment procedure | 2, 4, 5, 6 & 7 | | | specification | | Perform | review point | review point |
| | - non destructive testing procedures | 6 | | | specification | | Perform | review point | review point |
| | - painting procedure | As per Appl PTS | | | specification | | Perform | review point | review point |
| 1 | BASE MATERIAL | | | | | | | | |
| 1.1 | MATERIALS | | | | | | | | |
| | Tensile tests (YS, UTS, YS/UTS, %EL, RA, Bend etc. as applicable) (remark : marking transfer by TPIA) | 5.1.1 | 1 per heat | | PTS | certif. 3.2 | Perform | hold point | review report |
| | Charpy-test at as per Mat. Spec. (Impact Energy & Shear Area) (remark : marking transfer by TPIA) | 5.1.2 | 1 per heat | | Mat. Spec. | certif. 3.2 | Perform | hold point | review report |
| 1.2 | CHEMICAL COMPOSITION | | | | | | | | review report |
| | Check chemical analysis & Carbon Equivalent | 3.10 | 1 per heat | | PTS-Table1+ ASTM & Mat. Spec. | Lab certif. | Perform | review report | review report |
| 2 | FABRICATION & TESTS | 4 | | | | | | | |
| 2.1 | Welding | 4.1 & 4.2 | | | | | | | |
| | - Review of WPS (If New WPS has established, same to be witnessed by TPIA) | | | ASME SEC IX | PTS & ASME Sec-IX | report | Perform | hold point | review report |
| | - Review of welders records | | | | | report | Perform | hold point | review report |
| | - Consumable Verification | | | ASME SEC IX / SEC IIC | PTS & ASME Sec-IX & Sec-II | report | Perform | review point | |
| 2.2 | Heat treatment (Loading & Unloading shall be witnessed by TPIA, Power failure log shall be maintained) | 4.3 | all fittings | T/T Graph | PTS | certif. 3.2 | Perform | Witness Point (Loading & Unloading) | review report |
| | - time temperature chart | 4.3.1 | 1 per furnace charge | | | report | Perform | review report | review report |
| | - micrographic examination | 4.3.2 | 1 per lot* | ASTM E 112 | Grain size : range 8 to 12 | certif. 3.2 | Perform | hold point | review report |



QUALITY ASSURANCE PLAN

FITTINGS

QAP No. : P.014714 G 11013 M001 Rev. 0

Date: 10.07.2023

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| Prepared by | | Checked : | |
| Approved by | | | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS | | |
| Client | CUGL | | |
| Consultant | | | |

| S NO. | ACTIVITY | PTS | Frequency | Applicable standard & Procedure | Acceptance criteria | Document type | Scope of Inspection | | |
|-------|---|-------------------------------------|---|---------------------------------|---|---------------|---------------------|---------------|---------------------|
| | | Clause No. | | | | | Manufacturer | TPIA | Client / Consultant |
| 2.3 | Mechanical testing (remark : marking transfer by TPIA) | | | | | | | | |
| | - Tension test for fitting ≥ 2" (YS, UTS, YS/UTS, %EL, RA, Bend etc. as applicable) | 4.2.4 & 5.1.1 | | ASTM A 370 | PTS + E/R ≤ 0.85 & Mat. Spec. | certif. 3.2 | Perform | hold point | review report |
| | - base material | | 1 per lot | | PTS & Mat. Spec. | | | | |
| | - weld | 1 per lot | | | | | | | |
| | - Impact test for fitting ≥ 2" | 4.2.4 & 5.1.2 | | ISO 148 - Charpy V - Notch | - At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction. | | | | |
| | - base material (Longitudinal & Transverse) | | 2 sets of 3 specimens per lot | | | | | | |
| | - weld (Transverse) | | 1 sets of 3 specimens per lot | | | | | | |
| | - HAZ (Transverse) | 1 sets of 3 specimens per lot | | | | | | | |
| | - Flattening test for fitting < 2" | 5.1.3 | 1 per group (*) | PTS | PTS & Mat. Spec. | | | | |
| 2.4 | Chemical analysis & Carbon Equivalent | 5.2 | For each lot | ASTM & PTS CI 3.10.1 & 3.10. 2 | PTS & Mat. Spec. | certif. 3.2 | Perform | review report | review report |
| 3 | NON DESTRUCTIVE EXAMINATIONS (NDE) | 5.3 | | | | | | | |
| 3.1 | Radiographic examination | 6.1.1 and 6.1.3.4 | All butt welds | ASME section V | Longitudinal welds : ASME section VIII division 1 UW 51 | certif. 3.2 | Perform | witness point | review report |
| | | | | | Girth welds : API 1104 section 6.0 | | | | |
| 3.2 | Ultrasonic inspection | | | | | | | | |
| | - base material thickness ≥ 6 mm | 6.1.2.1, 6.1.2.2, 6.1.2.4 , 6.1.3.3 | 100% | ASME section V art 23, SA-388 | ASME section VIII division1 UF-55 | certif. 3.2 | Perform | witness point | review report |
| | - weld | 6.1.2.1, , 6.1.2.2, 6.1.3.3, | 100% | ASME V | ASME section VIII division1, appendix 12 | | | | |
| 3.3 | - Magnetic particle inspection | 6.1.2.1, 6.1.2.4, 6.1.3.2, 6.1.3.5, | 100% | ASME V | ASME section VIII division1, appendix 6 | certif. 3.2 | Perform | witness point | review report |
| 3.4 | - After machining | | | | | | | | |
| | - Magnetic particle or liquid penetrant of the bevels | 6.1.2.4, 6.1.3.5, | wall thickness ≥ 6 mm all finished bevels | ASME V | PTS & Mat. Spec. | certif. 3.2 | Perform | witness point | review report |
| | - Ultrasonic inspection of 25 mm of base material (if t ≥ 6 mm) | 6.1.2.1, 6.1.2.2, 6.1.2.4 , 6.1.3.3 | All finished bevels | ASME V | PTS & Mat. Spec. | | | | |
| 3.5 | - Visual examination | 6.1.2.3 & 6.1.3.1 | 100% | | PTS & Mat. Spec. | certif. 3.2 | Perform | hold point | review report |
| 3.6 | - Dimensional examination | 6.1.2.5 | 10% NPS ≤ 6" | Page 281 of 803 | PTS & Mat. Spec. | certif. 3.2 | Perform | witness point | review report |
| | | | 100% NPS > 6" | | | | | | |



QUALITY ASSURANCE PLAN

FITTINGS

QAP No. : P.014714 G 11013 M001 Rev. 0

Date: 10.07.2023

Prepared by _____ Checked : _____

Approved by _____

Project LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS

Client CUGL

Consultant _____

| S NO. | ACTIVITY | PTS | | Frequency | Applicable standard & Procedure | Acceptance criteria | Document type | Scope of Inspection | | |
|----------------|---|----------------------------|---------------------------------------|--|---------------------------------|---------------------|---------------|---------------------|---------------|---------------------|
| | | Clause No. | | | | | | Manufacturer | TPIA | Client / Consultant |
| 4 | FINAL INSPECTION TEST | | | | | | | | | |
| 4.1 | Marking | 8 | | all | | | certif. 3.2 | Perform | witness point | review report |
| 4.2 | Inspector's stamp | 8.1.1 | | all | | | certif. 3.2 | Perform | witness point | review report |
| 4.3 | Documentation | 9 | | - | PTS & P.O. | PTS & P.O. | certif. 3.2 | Perform | hold point | review report |
| | (*) Fittings from the same heat of steel of the same shape and the same main pipe/plate dimension of the fittings | | | | | | | | | |
| | LOT - A lot consists of all fittings from one heat of steel with same initial wall thickness, from the same furnace charge for final heat treatment, from the same shape and the same main pipe/plate dimension. | | | | | | | | | |
| LEGEND: | | | | | | | | | | |
| | RT : Radiographic test | PT : Liquid penetrant test | MT : Magnetic particle test | HT : Heat treatment | VT : Visual test | P : Performed | | | | |
| | R : Review | W : Witness | TPIA : Third Party Inspection Agency; | SMYS : Specified Minimum Yield Strength; | | | | | | |
| | Hold point = No further steps may be undertaken before the intervention of the appointed responsible takes place. | | | | | | | | | |
| | Witness point = The appointed responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not. | | | | | | | | | |
| Note: | 1 The Above Testing and acceptance criteria are minimum requirements. However, equipment supplier shall ensure that the product also comply to the additional requirements as per Technical specifications and data sheets. | | | | | | | | | |
| | 2 The supplier shall submit their own detailed QAP prepared on the basis of the above for approval of Owner/Owner's representative and TPIA for each sizes. | | | | | | | | | |
| | 3 Supplier shall submit Calibration certificates of all Instruments/Equipment to be used for Inspection and Testing to TPIA with relevant procedures and updated standards for TPIA review/Approval. | | | | | | | | | |
| | 4 TPIA will have Right to Inspect minimum 10% of all manufacturing activities on each day or as specified above. | | | | | | | | | |
| | 5 TPIA along with Owner/Owner representative shall review/approve all the documents related to QAP/Quality manuals/Drawings etc. submitted by supplier. | | | | | | | | | |
| | 6 Manufacturer shall in coordination with Sub vendor shall issue detailed Production and Inspection schedule indicating the dates and the locations to facilitate Owner/Owner's representative and TPIA to organize Inspection. | | | | | | | | | |
| | 7 Certification requirements shall comply with European Standard EN 10204 (latest edition)- 3.2 Type. | | | | | | | | | |
| | 8 Heat treatment start and stop temperature chart shall be witnessed & signed by TPIA. Power failure log book / sheet shall be maintained | | | | | | | | | |
| | 9 For All Forging Materials, The Specimen Shall Be Taken From The Integral Part Of The Forging. | | | | | | | | | |
| | 10 In case of conflict between purchase specification, contract documents and QAP, more stringent conditions shall be applicable. | | | | | | | | | |



QUALITY ASSURANCE PLAN
BALL VALVES

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| Date | 10.07.2023 |
| Prepared by | Checked : |
| Approved by | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS |
| Client | CUGL |
| Consultant | |

| Sl. Nos. | ACTIVITY | GTS / PTS | Applied standard e/o Procedure | Acceptance criteria | Document type | Scope of Inspection | | |
|--|--|----------------|--------------------------------|---|---------------|---------------------|-------------------------------------|-------------------|
| | | chap. | | | | Manufacturer | TPIA (By Manufacturer / Contractor) | Control Authority |
| CONTROL BEFORE MANUFACTURING | | | | | | | | |
| 1 | - list of operation in manufacturing and control | 3 | | specification | | Perform | review point | review point |
| | - material part list | 6.1. | | specification | | Perform | review point | review point |
| | - dimensional drawings | 6.1. | | specification | | Perform | review point | review point |
| | - calculation butt welding ends | 6.1. / 6.2.2. | | specification | | Perform | hold point | hold point |
| | - calculation of body bolting, Bonnet, Cover (For Pressure Retaining Parts) | 6.2.8. | ASME B16.34 | specification, | | Perform | hold point | hold point |
| | - Fixation of Operation Methodology | 6.3 | | specification, Data Sheet | | Perform | review point | review point |
| | - qualified welding procedures/welders performances qualification record | 8.1, 8.2, 10.2 | | specification | | Perform | review point | review point |
| | - heat treatment procedure | 8.3 | | specification | | Perform | review point | review point |
| | - non destructive testing procedures | 8.5 | | specification | | Perform | review point | review point |
| | - pressure test procedure | 8.6.6 | | specification | | Perform | review point | review point |
| - painting procedure | 11 | | specification | | Perform | review point | review point | |
| 2 CONTROL ON RECEIPT OF MATERIAL | | | | | | | | |
| 2A | Valve BODY: | | | | | | | |
| | Chemical Testing, Carbon Equivalent | | | GTS / PTS | certif. 3.2 | Perform | hold point | review point |
| | Mechanical tests (YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness etc.) (Remark : marking transfer by TPIA) | | | GTS / PTS | certif. 3.2 | Perform | hold point | review point |
| | Charpy-test at 0°C and as per Material requirement 2 test sets (1 long./1 trans) (Remark : marking transfer by TPIA) | 7 | | - At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction. | certif. 3.2 | Perform | hold point | review point |
| | UT of Forging Body (100%) | - | ASME B 16.34, App IV | ASME B 16.34, App IV | certif. 3.2 | Perform | witness point | review point |
| | Radiography Test of Casting Body (100%) | - | ASME B 16.34 | ASME B 16.34 | certif. 3.2 | Perform | review point | review point |
| Wet magnetic Particle Examination (100% External & accessible Internal) | - | ASME B 16.34 | ASME B 16.34 | certif. 3.2 | Perform | witness point | review point | |
| FLANGES: | | | | | | | | |
| Chemical Testing, Carbon Equivalent | | | | GTS / PTS | certif. 3.2 | Perform | hold point | review point |
| Mechanical tests (YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness etc.) (Remark : marking transfer by TPIA) | | | | GTS / PTS | certif. 3.2 | Perform | hold point | review point |



QUALITY ASSURANCE PLAN
BALL VALVES

| | |
|-------------|---|
| Date | 10.07.2023 |
| Prepared by | Checked : |
| Approved by | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS |
| Client | CUGL |
| Consultant | |

| Sl. Nos. | ACTIVITY | GTS / PTS chap. | Applied standard e/o Procedure | Acceptance criteria | Document type | Scope of Inspection | | |
|------------------------------|---|----------------------|--------------------------------|---|---------------|---------------------|--|-------------------|
| | | | | | | Manufacturer | TPIA (By Manufacturer / Contractor) | Control Authority |
| 2B | Charpy-test at 0°C and as per Material requirement 2 test sets (1 long./1 trans.) (Remark : marking transfer by TPIA) | - | | - At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction. | certif. 3.2 | Perform | hold point | review point |
| | UT of Forging Body (100%) | - | ASME B 16.34, App IV | ASME B 16.34, App IV | certif. 3.2 | Perform | witness point | review point |
| | Radiography Test of Casting Body (100%) | - | ASME B 16.34 | ASME B 16.34 | certif. 3.2 | Perform | review point | review point |
| | Wet magnetic Particle Examination (100% External & accessible Internal) | | ASME B 16.34 | ASME B 16.34 | certif. 3.2 | Perform | witness point | review point |
| 2C | LATERAL CONNECTIONS: | | | | | | | |
| | Chemical Testing, Carbon Equivalent | | | GTS / PTS | certif. 3.2 | Perform | hold point | review point |
| | Mechanical tests (YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness etc.) (Remark : marking transfer by TPIA) | | | GTS / PTS | certif. 3.2 | Perform | hold point | review point |
| | Charpy-test at 0°C and as per Material requirement 2 test sets (1 long./1 trans.) (Remark : marking transfer by TPIA) | 7 | | - At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction. | certif. 3.2 | Perform | hold point | review point |
| | UT of Forging Body (100%) | - | ASME B 16.34, App IV | ASME B 16.34, App IV | certif. 3.2 | Perform | witness point | review point |
| | Radiography Test of Casting Body (100%) | - | ASME B 16.34 | ASME B 16.34 | certif. 3.2 | Perform | review point | review point |
| | Wet magnetic Particle Examination (100% External & accessible Internal) | - | ASME B 16.34 | ASME B 16.34 | certif. 3.2 | Perform | witness point | review point |
| 2D | EXTENSION PIPE PIECES AS PER DATA SHEET | | | | | | | |
| | Chemical Test, Carbon Equivalent | | | GTS / PTS | certif. 3.2 | Perform | hold point | review point |
| | Mechanical tests (Remark : marking transfer by TPIA) | | | | | | | |
| 2E | Charpy-test at 0°C and as per Material requirement 2 test sets (1 long./1 trans.) (Remark : marking transfer by TPIA) | 7 | | - at 0°C, for Base - 40J/cm²(Avg.), 32J/cm²(Ind.), - at 0°C, for Weld/HAZ - 27J/cm²(Avg.), 22J/cm²(Ind.) | certif. 3.2 | Perform | hold point | review point |
| | BALL / OBTURATOR (Note-7): | | | | | | | |
| | Chemical Testing, Carbon Equivalent | | | GTS / PTS | certif. 3.2 | Perform | hold point | RW |
| | - Mechanical tests (YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness etc.) (Remark : marking transfer by TPIA) | | | GTS / PTS | certif. 3.2 | Perform | hold point | RW |
| UT of Forging Body (100%) OR | | ASME B 16.34, App IV | ASME B 16.34, App IV | certif. 3.2 | Perform | witness point | review point | |



QUALITY ASSURANCE PLAN
BALL VALVES

| | |
|-------------|---|
| Date | 10.07.2023 |
| Prepared by | Checked : |
| Approved by | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS |
| Client | CUGL |
| Consultant | |

| Sl. Nos. | ACTIVITY | GTS / PTS | Applied standard e/o Procedure | Acceptance criteria | Document type | Scope of Inspection | | |
|----------|--|-----------|--------------------------------|----------------------|----------------------|---------------------|--------------------------------------|-------------------|
| | | chap. | | | | Manufacturer | TPIA (By Manufacturer / Contractor) | Control Authority |
| | Radiography Test of Casting Body (100%) | | ASME B 16.34 | ASME B 16.34 | certif. 3.2 | Perform | review point | review point |
| 2F | SEAT: - Mechanical tests (YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness etc.) (Remark : marking transfer by TPIA), - Chemical tests, Carbon equivalent | 7 | | GTS / PTS | certif. 3.1 | Perform | hold point (Mech.) review(Others) | review point |
| | | | GTS / PTS | | | | | |
| | Wet magnetic Particle Examination (All accessible area) | - | ASME B 16.34 | ASME B 16.34 | certif. 3.2 | Perform | witness point | review point |
| 2G | STEM: -Chemical Testing, Carbon equivalent | 7 | | GTS / PTS | certif. 3.1 | Perform | review point | review point |
| | -Mechanical tests (YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness etc.) (Remark : marking transfer by TPIA) | | | GTS / PTS | certif. 3.1 | Perform | hold point | review point |
| | UT of Forging Body (100%) | | - | ASME B 16.34, App IV | ASME B 16.34, App IV | certif. 3.2 | Perform | witness point |
| | Wet magnetic Particle Examination (All accessible area) | - | ASME B 16.34 | ASME B 16.34 | certif. 3.2 | Perform | witness point | review point |
| 2H | STUDS/NUTS (With Xylan Coating) -Chemical Testing, Carbon Equivalent | 7 | | GTS / PTS | certif. 3.1 | Perform | review point | review point |
| | - Mechanical tests (YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness etc.) (Remark : marking transfer by TPIA) | | | GTS / PTS | | | | |
| | | | | GTS / PTS | | | | |
| 2I | VENT/BLEED PLUG: - Chemical test, Mechanical tests | 7 | | GTS / PTS | certif. 3.1 | Perform | hold point (Mech.) review(Others) | review point |
| | | | GTS / PTS | | | | | |
| 2J | DRAIN: OPEN BLOCK VALVE AT DRAIN TAP: - Chemical test, mechanical tests | 7 | | GTS / PTS | certif. 3.1 | Perform | review point | review point |
| | | | GTS / PTS | | | | | |
| 2K | DRAIN: UPPER BALL VALVE & NEEDLE VALVE: - Chemical Test, Mechanical tests | 7 | | GTS / PTS | certif. 3.1 | Perform | hold point (Mech.) review(Others) | review point |
| | | | | GTS / PTS | | | | |
| 2L | STEM & SEAT SEALING CONNECTION : - Chemical Test, Mechanical tests | 7 | | GTS / PTS | certif. 3.1 | Perform | hold point (Mech.) review(Others) | review point |
| | | | | GTS / PTS | | | | |
| 2M | OTHER VALVE PARTS INCLUDING PIPE PUP PIECE - Mechanical and Chemical tests | 7 | | GTS / PTS | certif. 3.1 | Perform | hold point (Mech.) review(Others) | review point |
| | | | | GTS / PTS | | | | |
| | | | | GTS / PTS | | | | |
| 3 | FABRICATION AND TESTS | | | | | | | |



QUALITY ASSURANCE PLAN
BALL VALVES

| | |
|-------------|---|
| Date | 10.07.2023 |
| Prepared by | Checked : |
| Approved by | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS |
| Client | CUGL |
| Consultant | |

| Sl. Nos. | ACTIVITY | GTS / PTS chap. | Applied standard e/o Procedure | Acceptance criteria | Document type | Scope of Inspection | | |
|----------|--|--------------------|--|---|---------------------------------------|---------------------|--|-------------------------|
| | | | | | | Manufacturer | TPIA (By Manufacturer / Contractor) | Control Authority |
| 3.1 | Welds and repair welds shall be performed according to written qualified procedures | 8.1 - 8.2 | ASME IX + spec. | ASME IX + spec. | Welding Procedure Specification (WPS) | Perform | hold point | review & approval point |
| 3.2 | Heat treatment fully welded valve and test pieces | 8.3 | ASME VIII Div.1 | ASME VIII Div.1 | review CTT/TT curves | Perform | review report | review report |
| 3.3 | Mechanical tests (Remark : marking transfer by TPIA) | 8.4.1 | ASTM A370 | GTS / PTS | certif. 3.2 | Perform | hold point | review point |
| 3.4 | Charpy-test at 0°C and as per Material requirement 2 test sets (1 long./1 trans.) (Remark : marking transfer by TPIA) | 8.4.2 | ISO 148 or ASTM A370 | - At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction. | certif. 3.2 | Perform | hold point | review point |
| 3.5 | (if feasible) RT on butt welds | 8.5.1 | ASME SECT V art. 2 | ASME SECT. VIII, div.1, UW 51. | (RT-Test report) | Perform | witness point | review point |
| | (if not feasible & thk. > 15mm) UT on butt welds | 8.5.1 | ASME SECT V art. 5 | ASME SECT. VIII, div.1, App.12 | UT-Test report | Perform | witness point | review point |
| 3.6 | Butt welding ends on cast bodies shall be examined before fabrication welding end by radiography (Over a width of 70 mm)(not applicable for forged bodies) | 8.5.1 | | MSS-SP-54 | (RT-Test report) | Perform | witness point | review point |
| 3.7 | UT on 25 mm of base mat. (at each side) and each weld(100%) | 8.5.1 | ASME SECT V art. 5 | ASME SECT. VIII, dic.1, App.12 | UT-Test report | Perform | witness point | review point |
| 3.8 | Magnetic Particle Examination on valve body 10 % valves < 6" 100% valves ≥ 6" | 8.5.1 | ASME SECT V art. 7 | ASME SECT. VIII App.6 | MPE-Test report | Perform | witness point | review point |
| 3.9 | Visual examination | 8.5.1 | Sec 8 proc.7 | MSS-SP-55 | report | Perform | hold point | review point |
| 3.10 | Dimensional examination | 8.5.1 | Sec 8 proc.24 | DWG ** | report | Perform | witness point | review point |
| 4 | Finished bevel end pipe used for field welding : | | | | | | | |
| 4.1 | Magnetic Particle Examination / Liquid Penetrant Examination | 8.5.1 | ASME SECT V art. 7 ASME SECT V art. 6 | unacceptable defects : defects not parallel to the surface extending into the bevel + defect extending into the bevel provided the lamination is parallel to the surface and has a transverse dimension exceeding 6.35 mm | MPE/ LPE-Test report | Perform | witness point | review point |
| 4.2 | UT inspection on 25 mm of base material | 8.5.1 | ASME SECT V art. 5 | ASME SECT. VIII, div.1, App.12 | UT-Test report | Perform | witness point | review point |
| 4.3 | RT examination on 25 mm of base material | 8.5.1 | ASME SECT V art. 2 | ASME SECT. VIII, div.1, UW 51. | RT-Film & report | Perform | witness point | review point |
| 4.4 | Visual and dimensional examination | 8.5.1 | Sec 8 proc.7 | MSS-SP-55 +DWG** | report | Perform | witness point | review point |
| 5 | FINAL INSPECTION TEST | | | | | | | |
| 5.1 | Hydrostatic Shell Test | 8.6.2 | API 6D + GTS / PTS | @ 1.5 x Design Pr., 30 Min(NPS>18") / 15 Min(NPS<16"). | certif. 3.2 | Perform | witness point | hold point |
| 5.2 | Hydrostatic Seat Test | 8.6.3 | API 6D + GTS / PTS | @ 1.1 x Design Pr., 5 Min. | certif. 3.2 | Perform | witness point | hold point |
| 5.3 | Pneumatic Test (with nitrogen) (Shell & Seat) | 8.6.5 | GTS / PTS | @ 95 barg for 5 min. | certif. 3.2 | Perform | witness point | hold point |



QUALITY ASSURANCE PLAN
BALL VALVES

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| Client | CUGL |
| Consultant | |

| Sl. Nos. | ACTIVITY | GTS / PTS chap. | Applied standard e/o Procedure | Acceptance criteria | Document type | Scope of Inspection | | |
|----------|--|--------------------|---|--------------------------------------|---------------|---------------------|--|-------------------|
| | | | | | | Manufacturer | TPIA (By Manufacturer / Contractor) | Control Authority |
| 5.4 | External leak testing (with Soup suds) | 8.6.4 | GTS / PTS | @ 6 bar | certif. 3.2 | Perform | witness point | hold point |
| 5.5 | Air seat test | 8.6.5 | GTS / PTS | @ 7 bar, 5 Min. | certif. 3.2 | Perform | hold point | hold point |
| 5.6 | Helium Leak Test | 8.6.5 | ASME Sec. V, Subsection A, Art.10, Appendix IV. | @ 25% of Rated Pressure for 30 mins. | certif. 3.2 | Perform | hold point | hold point |
| 5.7 | Double Block and Bleed Test | x | API 6D/API 598 + GTS / PTS | API 6D/ API 598 | certif. 3.2 | Perform | hold point | hold point |
| 5.8 | Functional Test (10 Opening / Closing with Operator mounted on the valve at 95 barg) | x | API 6D/API 598 + GTS / PTS | API 6D/ API 599 | certif. 3.3 | Perform | hold point | hold point |
| 5.9 | Antistatic Test | x | BS 5351 + GTS / PTS | BS 5351 + specification | certif. 3.2 | Perform | hold point | hold point |
| 5.10 | Operational torque Test | 8.7 | API 6D | | report | Perform | witness point | hold point |
| 5.11 | Fire Safe Test | 8.8 | API 6FA | API6FA | report | Perform | review report | review report |
| 5.12 | Visual examination | 8.10 | Sec 8 proc.7 | MSS-SP-55 / GTS / PTS | report | Perform | hold point | review report |
| 5.13 | Dimensional examination | 8.10 | Sec 8 proc.24 | DWG ** | report | Perform | witness point | review report |
| 6 | Marking | 9 | section 9 of specification | section 9 specification | X | Perform | witness point | review report |
| 6.1 | Inspector's stamp | 9.1.2 | section 9 of specification | section 9 specification | X | X | X | X |
| 7 | Painting And Coating | 11 | SIS055900 | SA2.5, CL11 of Specification | report | Perform | witness point | review report |
| 8 | Control of all certificates & Final Certificate | 10 | section 10 of specification | section 10 of specification | certif. 3.2 | Perform | hold point | review report |

LEGENDS:

| | | | | |
|-----------------------|---------------------------|----------------------------|--|---|
| RT: Radiographic test | PT: Liquid penetrant test | MT: Magnetic particle test | TPIA: Third Party Inspection Agency; . | Control Authority : Owner / Owner's representatives |
| P: Performed | R:Review | W: Witness | RW: Random Witness | |

Hold point = No further steps may be undertaken before the intervention of the appointed responsible takes place.

Witness point = The appointed responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not.

- Note:**
- The above testing and acceptance criteria are minimum requirements, however, equipment supplier shall ensure that the product also comply to the additional requirements as per Technical specifications and data sheets.
 - The supplier shall submit their own detailed QAP prepared on the basis of the above for approval of Owner/Owner's representative and TPIA.
 - Supplier shall submit Calibration certificates of all Instruments/Equipment to be used for Inspection and Testing to TPIA with relevant procedures and updated standards for TPIA review/Approval.
 - TPIA will have Right to Inspect minimum 10% of all manufacturing activities on each day or as specified above.
 - TPIA along with Owner/Owner representative shall review/approve all the documents related to QAP/Quality manuals/Drawings etc. submitted by supplier.
 - TPIA shall also Review the Test certificates submitted by the Actuator manufacturer.
 - For All Forging Materials, The Specimen Shall Be Taken From The Integral Part of The Forging.
 - The hold points in this QAP pertains to mechanical tests and hydro test. These tests on all the components can be clubbed together to be performed during a single visit of TPIA
 - Heat treatment start and stop temperature chart shall be witnessed & signed by TPIA. Power failure log book / sheet shall be maintained
 - TPIA shall ensure that Ball and Stem are Electroless Nickel Plated (ENP) with minimum thickness of 75 microns as per data sheet requirement.
 - Contractor in coordination with Supplier/Sub vendor shall issue detailed Production and Inspection schedule indicating the dates and the locations to facilitate Owner/Owner's representative and TPIA to organize Inspection.
 - Certification requirements shall comply with European Standard EN 10204 (latest edition)
 - In case of conflict between purchase specification, contract documents and QAP, more stringent conditions shall be applicable.



QUALITY ASSURANCE PLAN
FLANGES

| | | |
|-------------|---|-----------|
| QAP No | P.014714 G 11013 M003 Rev. 0 | |
| Date | 10.07.2023 | |
| Prepared by | | Checked : |
| Approved by | | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAs | |
| Client | CUGL | |
| Consultant | | |

| Sl. No. | ACTIVITY | PTS chap. | Frequency | Applied standard e/o Procedure | Acceptance criteria | Document type | Scope of Inspection | | |
|----------|--|----------------|--|--------------------------------|----------------------------|---------------|---------------------|-------------------------------------|---------------------|
| | | | | | | | Manufacturer | TPIA | Client / Consultant |
| 0 | CONTROL BEFORE MANUFACTURING | | | | | | | | |
| | - list of operation in manufacturing and control | 9.1 | 1 per purchase order | | specification | | Perform | review point | review point |
| | - Fabrication and Control procedure | 9.1 | | | specification | | Perform | review point | review point |
| | - material part list | 9.1; 2 and 3 | | | specification | | Perform | review point | review point |
| | - dimensional drawings | 9.2 ; 2 | | | specification | | Perform | review point | review point |
| | - heat treatment procedure | 2, 4, 5, 6 & 7 | | | specification | | Perform | review point | review point |
| | - non destructive testing procedures | 6 | | | specification | | Perform | review point | review point |
| | - painting procedure | As per PTS | | | specification | | Perform | review point | review point |
| 1 | BASE MATERIAL | | | | | | | | |
| 1.1 | Mechanical tests (remark : marking transfer by TPIA) | | | | | | | | |
| | Tensile tests (YS, UTS, YS/UTS, %EL, RA, Bend etc. as applicable) | 5.1.1 | 1 per lot* | | PTS / Mat. Spec. | certif. 3.2 | Perform | hold point | review report |
| | Charpy Impact test at temp. as per Mat. Spec. | 5.1.2 | 1 per lot* (1 set of 3 specimen per temp. range) | | PTS / Mat. Spec. | certif. 3.2 | Perform | hold point | review report |
| 1.2 | CHEMICAL COMPOSITION | | | | | | | | |
| | Check chemical analysis | 3.10 | 1 per heat | | PTS-Table1 | | Perform | review report | review report |
| 2 | FABRICATION AND TESTS | | | | | | | | |
| 2.1. | Heat treatment (Loading & Unloading shall be witnessed by TPIA, Power failure log shall be maintained) | 4.3 | all fittings | T/T Graph | PTS | certif. 3.2 | Perform | Witness Point (Loading & Unloading) | review report |
| | - time temperature chart | 4.3.1 | 1 per furnace charge | | | report | Perform | review report | review report |
| | - micrographic examination | 4.3.2 | 1 per lot* | ASTM E 112 | Grain size : range 8 to 12 | certif. 3.2 | Perform | hold point | review report |
| 2.2. | Mechanical tests (remark : marking transfer by TPIA) | | | | | certif. 3.2 | Perform | hold point | review report |



QUALITY ASSURANCE PLAN
FLANGES

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| Sl. No. | ACTIVITY | PTS chap. | Frequency | Applied standard e/o Procedure | Acceptance criteria | Document type | Scope of Inspection | | |
|----------|--|-------------------------------------|---|---------------------------------------|---|---------------|---------------------|---------------|---------------------|
| | | | | | | | Manufacturer | TPIA | Client / Consultant |
| 2.2.1 | - Tension test for flanges (YS, UTS, YS/UTS, %EL, RA, Bend etc. as applicable) | 4.2.4 & 5.1.1 | 1 sample per lot of HT per Raw material Heat | ASTM A 350 § 6.1.3 + E/R ≤ 0.85 / PTS | PTS & Mat. Spec. | certif. 3.2 | Perform | hold point | review report |
| 2.2.2 | - Charpy Impact test for flanges (Longitudinal & Transverse) | 4.2.4 & 5.1.2 | 2 sets of 3 specimens per lot of HT per RM Heat | ISO 148 - Charpy V-Notch | - At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction. | certif. 3.2 | Perform | hold point | review report |
| 3 | NON DESTRUCTIVE EXAMINATIONS (NDE) | | | | | | | | |
| 3.1 | Radiographic examination | 6.1.1 and 6.1.3.4 | All butt welds | ASME Section-V | Girth welds : API 1104 section 6.0 | certif. 3.2 | Perform | witness point | review report |
| 3.2 | Ultrasonic inspection | 6.1.2.1, 6.1.2.2, 6.1.2.4 , 6.1.3.3 | 100% | ASME Section-V, Art-23, SA-388 | ASME section VIII division1 UF-55 | certif. 3.2 | Perform | witness point | review report |
| 3.3 | Magnetic particle inspection | 6.1.2.1, 6.1.2.4, 6.1.3.2, 6.1.3.5, | 100% | ASME Section-V | ASME section VIII division1 appendix 6 | certif. 3.2 | Perform | witness point | review report |
| 3.4 | After machining | | | | | | | | |
| | - Magnetic particle or liquid penetrant of the bevels | 6.1.2.4, 6.1.3.5, | all finished bevels | ASME Section-V | PTS § 5.3.3.5. | certif. 3.2 | Perform | witness point | review report |
| | - Ultrasonic inspection of 25 mm of base material | 6.1.2.1, 6.1.2.2, 6.1.2.4 , 6.1.3.3 | wall thickness ≥ 6 mm all finished bevels | ASME Section-V | PTS § 5.3.3.5. | certif. 3.2 | Perform | witness point | review report |
| 3.5 | Visual examination | 6.1.2.3 & 6.1.3.1 | 100% | | PTS | certif. 3.2 | Perform | hold point | review report |
| 3.6 | Dimensional examination | 6.1.2.5 | 10% NPS ≤ 6" 100% NPS > 6" | | PTS | certif. 3.2 | Perform | witness point | review report |



QUALITY ASSURANCE PLAN
FLANGES

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| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAs | |
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| Sl. No. | ACTIVITY | PTS chap. | Frequency | Applied standard e/o Procedure | Acceptance criteria | Document type | Scope of Inspection | | |
|---------|-----------------------|-----------|-----------|--------------------------------|---------------------|---------------|---------------------|---------------|---------------------|
| | | | | | | | Manufacturer | TPIA | Client / Consultant |
| 4 | FINAL INSPECTION TEST | | | | | | | | |
| 4.1 | Marking | 8 | all | | | | Perform | witness point | review report |
| 4.2 | Inspector's stamp | 8.1.1 | all | | | certif. 3.2 | Perform | hold point | review report |
| 4.3 | Documentation | 9 | - | PTS & P.O. | PTS & P.O. | certif. 3.2 | Perform | hold point | review report |

* LOT - A lot consists of all fittings from one heat of steel with same initial wall thickness, from the same furnace charge for final normalizing heat treatment, from the same shape and the same main pipe dimension.

LEGEND:

RT : Radiographic test PT : Liquid penetrant test MT : Magnetic particle test HT : Heat treatment VT : Visual test RM : Raw Material
 R : Review W : Witness P : Performed TPIA : Third Party Inspection Agency; SMYS : Specified Minimum Yield Strength;

Hold point = No further steps may be undertaken before the intervention of the appointed responsible takes place.

Witness point = The appointed responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not.

- Note:**
- 1 The Above Testing and acceptance criteria are minimum requirements, however, equipment supplier shall ensure that the product also comply to the additional requirements as per Technical specifications and data sheets.
 - 2 The supplier shall submit their own detailed QAP prepared on the basis of the above for approval of Owner/Owner's representative and TPIA, for each size. Impact test at -20 deg C shall be conducted in addition to respective material requirement.
 - 3 Supplier shall submit Calibration certificates of all Instruments/Equipment to be used for Inspection and Testing to TPIA with relevant procedures and updated standards for TPIA review/Approval.
 - 4 TPIA will have Right to Inspect minimum 10% of all manufacturing activities on each day or as specified above. Owner reserves the right to inspect any quantity of item at any time during execution.
 - 5 TPIA along with Owner/Owner representative shall review/approve all the documents related to QAP/Quality manuals/Drawings etc. submitted by supplier.
 - 6 Manufacturer shall in coordination with Sub vendor shall issue detailed Production and Inspection schedule indicating the dates and the locations to facilitate Owner/Owner's representative and TPIA to organize Inspection.
 - 7 Certification requirements shall comply with European Standard EN 10204 (latest edition)-3.2 issued by TPIA and Vendor.
 - 8 Heat treatment start and stop temperature chart shall be witnessed & signed by TPIA. Power failure log book / sheet shall be maintained
 - 9 For All Forging Materials, The Specimen Shall Be Taken From The Integral Part of The Forging.
 - 10 Certification requirements shall comply with European Standard EN 10204 (latest edition)
 - 11 In case of conflict between purchase specification, contract documents and QAP, more stringent conditions shall be applicable.



**QUALITY ASSURANCE PLAN
GLOBE & CHECK VALVES**

| | | |
|-------------|---|-----------|
| QAP No | P.014714 G 11013 M004 Rev.0 | |
| Date | 10.07.2023 | |
| Prepared by | | Checked : |
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| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS | |
| Client | CUGL | |
| Consultant | | |

| Sl. Nos. | ACTIVITY | Applied standard e/o Procedure | Acceptance criteria | Document type | Scope of Inspection | | |
|-------------------------------------|---|---|---|---------------|---------------------|--|----------------------|
| | | | | | Manufacturer | TPIA (By Manufacturer / Contractor) | Control Authority |
| CONTROL BEFORE MANUFACTURING | | | | | | | |
| 1 | - list of operation in manufacturing and control | As per tender specification / data Sheet / Ref Std. | As per tender specification / data Sheet / Ref Std. | | Perform | review point | review point |
| | - material part list | | | | Perform | review point | review point |
| | - dimensional drawings | | | | Perform | review point | review point |
| | - calculation butt welding ends | | | | Perform | hold point | hold point |
| | - calculation of body bolting, Bonnet, Cover (For Pressure Retaining Parts) | ASME B16.34 | specification, | | Perform | hold point | hold point |
| | - Fixation of Operation Methodology | | specification, Data Sheet | | Perform | review point | review point |
| | - qualified welding procedures/welders performances qualification record | | specification | | Perform | review point | review point |
| | - heat treatment procedure | | specification | | Perform | review point | review point |
| | - non destructive testing procedures | | specification | | Perform | review point | review point |
| | - pressure test procedure | | specification | | Perform | review point | review point |
| - painting procedure | specification | | | Perform | review point | review point | |
| 2 | CONTROL ON RECEIPT OF MATERIAL | | | | | | |
| 2.1 | Casts | | | | | | |
| 2.1.1 | Non Destructive Testing | | | | | | |
| | Radiography Testing - 100%: each type / size / rating | ASME V, Art. 2 | ASME VIII-1, App. 7 ASME B31.3(Latest), Table 341.3.2A, Severe Cyclic cond. | certif. 3.2 | Perform | review point | review point |
| | Penetrant Testing - 100%: each type / size / rating | ASME V, Art. 6 - ASTM E-165 | ASME VIII-1, App. 7 & 8 | certif. 3.2 | Perform | Witness point | review point |
| | Magnetic Particle Testing - (alternative for PT) | ASME V, Art. 7 | ASME VIII-1, App. 6 & 7 | certif. 3.2 | Perform | Witness point | review point |
| 2.1.2 | Chemical analysis, Carbon Equivalent (each heat and product) | Referred API/ ASTM | Referred API/ ASTM | certif. 3.2 | Perform | Witness point | review point |
| 2.1.3 | Mechanical tests (YS, UTS, YS/UTS, %EL, RA, Bend, Micro / macro, hardness etc. as applicable) - on samples taken from mill. (Remark : marking transfer by TPIA) | Referred API/ ASTM | Referred API/ ASTM | certif. 3.2 | Perform | Witness point | Random Witness point |



QUALITY ASSURANCE PLAN
GLOBE & CHECK VALVES

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| Prepared by | | Checked : |
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| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS | |
| Client | CUGL | |
| Consultant | | |

| Sl. Nos. | ACTIVITY | Applied standard e/o Procedure | Acceptance criteria | Document type | Scope of Inspection | | |
|----------|---|--|--|---------------|---------------------|--|----------------------|
| | | | | | Manufacturer | TPIA (By Manufacturer / Contractor) | Control Authority |
| 2.1.4 | Charpy Impact test - 2 test sets (1 Longitudinal & 1 Transverse) (Remark : marking transfer by TPIA) | ASTM A-370 | - For CS at -20°C Energy is 35J/cm ² (Avg.), 28J/cm ² (Ind.) - For LTCS at -20°C Energy is 35J/cm ² (Avg.), 28J/cm ² (Ind.) and Material Standard's impact test temperature requirements or -45°C, Whichever is lower. | certif. 3.2 | Perform | Witness point | Random Witness point |
| 2.2 | Forgings | | | | | | |
| 2.2.1 | Non Destructive Testing | | | | | | |
| | Penetrant Testing - 10%: on Disc / Wedge & Stem after final machining | ASME V, Art. 6 | ASME VIII-1, App. 8 | certif. 3.2 | Perform | review point | review point |
| | Ultrasonic Testing - 100%: on Body & Bonnet | ASME B 16.34, App. IV / ASME Sec V Art 5 | ASME B 16.34, App. IV / ASME Sec V Div. 1 UF 55 | certif. 3.2 | Perform | review point | review point |
| | Magnetic Particle Testing - 100% on pressure retaining parts | ASME V, Art. 7 | ASME VIII-1, App. 6 | certif. 3.2 | Perform | Witness point | review point |
| 2.2.2 | Chemical analysis, Carbon Equivalent (each heat and product) | Referred API / ASTM | Referred API / ASTM | certif. 3.2 | Perform | Witness point | review point |
| 2.2.3 | Mechanical tests (YS, UTS, YS/UTS, %EL, RA, Bend etc. as applicable) - on samples taken from mill. (Remark : marking transfer by TPIA) | Referred API / ASTM | Referred API / ASTM | certif. 3.2 | Perform | Witness point | Random Witness point |
| 2.2.4 | Charpy Impact test - 2 test sets (1 Longitudinal & 1 Transverse) (Remark : marking transfer by TPIA) | ASTM A-370 | - At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction. | certif. 3.2 | Perform | Witness point | Random Witness point |
| 2.3 | Plate: Cover, Disc, Seat Ring Flap, Arm (Chemical & Mechanical Properties) | As per Approved Procedure / Purchase Specification | As per Approved Procedure / Purchase Specification | certif. 3.2 | Perform | Witness point | review point |



QUALITY ASSURANCE PLAN
GLOBE & CHECK VALVES

| | | |
|-------------|---|--------------|
| QAP No | P.014714 G 11013 M004 Rev.0 | |
| Date | 17.04.2021 | |
| Prepared by | KK | Checked :MKS |
| Approved by | NN | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS | |
| Client | CUGL | |
| Consultant | TEPL | |

| Sl. Nos. | ACTIVITY | Applied standard e/o Procedure | Acceptance criteria | Document type | Scope of Inspection | | |
|------------|---|---|---|---------------|---------------------|--|----------------------|
| | | | | | Manufacturer | TPIA (By Manufacturer / Contractor) | Control Authority |
| 2.4 | Bolting/ Fasteners | | | | | | |
| 2.4.1 | Penetrant Testing (on each batch after final machining) | ASME V, Art. 6 | ASME VIII-1, App. 8 | certif. 3.2 | Perform | review point | review point |
| 2.4.2 | Heat Treatment (on each Heat Treatment batch) | Referred ASTM | Referred ASTM | certif. 3.2 | Perform | Witness point | review point |
| 2.4.3 | Chemical analysis, Carbon Equivalent (each heat and product) | Referred API / ASTM | Referred API / ASTM | certif. 3.2 | Perform | Witness point | review point |
| 2.4.4 | Mechanical tests (YS, UTS, YS/UTS, %EL, RA, Bend etc. as applicable) - on samples taken from mill. (Remark : marking transfer by TPIA) | Referred API / ASTM | Referred API / ASTM | certif. 3.2 | Perform | Witness point | Random Witness point |
| 2.4.5 | Charpy Impact test as per Material specification requirement 2 test sets (1 long./1 trans.) (Remark : marking transfer by TPIA) | ASTM A-370 | As per material specification | certif. 3.2 | Perform | Witness point | Random Witness point |
| 2.5 | Actuators (If Applicable) | Compliance to purchase order | Purchase Specification | report | Perform | review point | review point |
| 2.6 | BW ends - each piece. | 100 % RT ASME V, Art. 2 | ASME B31.3(1990), Table 341.3.2A, severe cyclic cond. | report | Perform | Witness point | review point |
| 2.7 | Welds & weld repairs - each piece | 100 % RT ASME V, Art. 2 & ASME IX | ASME B31.3(1990), Table 341.3.2A, severe cyclic cond. | report | Perform | Witness point | review point |
| 3 | FINAL INSPECTION TEST | | | | | | |
| 3.1 | Hydrostatic Shell Test (duration minimum 15 min) | BS 1873 / API 598 / ASME B16.34 / ASTM A-530 & Data Sheet | BS 1873 / API 598 / ASME B16.34 / ASTM A-530 & Data Sheet | certif. 3.2 | Perform | Witness point | Random Witness point |
| 3.2 | Hydrostatic Seat Test (duration minimum 30 min) | | | certif. 3.2 | Perform | Witness point | Random Witness point |
| 3.3 | Hydrostatic Back Seat Test (duration minimum 30 min) | | | certif. 3.2 | Perform | Witness point | Random Witness point |
| 3.4 | Pneumatic Shell & Seat Test (at 7 Bar with Nitrogen) | | | certif. 3.2 | Perform | Witness point | Random Witness point |
| 3.5 | Air seat test (duration minimum 5 min) | | | certif. 3.2 | Perform | Witness point | Random Witness point |
| 3.6 | Helium Leak Test (duration minimum 30 min) | | | certif. 3.2 | Perform | Witness point | Random Witness point |
| 3.7 | Cyclic Pressure Test - 1 per valve per size (6" & above) (10 Open Close - Open Cycles with Maximum differential Pressure) | | | certif. 3.2 | Perform | Witness point | Random Witness point |
| 3.8 | Torque Test | | | certif. 3.2 | Perform | Witness point | Random Witness point |



**QUALITY ASSURANCE PLAN
GLOBE & CHECK VALVES**

| | | |
|-------------|---|-----------|
| QAP No | P.014714 G 11013 M004 Rev.0 | |
| Date | | |
| Prepared by | | Checked : |
| Approved by | | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS | |
| Client | CUGL | |
| Consultant | | |

| Sl. Nos. | ACTIVITY | Applied standard e/o Procedure | Acceptance criteria | Document type | Scope of Inspection | | |
|----------|---|---|------------------------------------|---------------|---------------------|--|----------------------|
| | | | | | Manufacturer | TPIA (By Manufacturer / Contractor) | Control Authority |
| 3.9 | High Pressure Closure Test & Low Pressure Closure Test (3 Opening & Closure at Atmospheric & Maximum differential pressure) | | | report | Perform | Witness point | Random Witness point |
| 3.1 | Cyclic Pressure Test - 1 Valve per size (6" & above) (10 Open - Close - Open cycles with Maximum differential pressure) | | | report | Perform | Witness point | Random Witness point |
| 3.11 | Fire safe tested (Type Test) (Certificates of previously conducted tests shall be submitted) | API 6FA / API 607 / BS 5146 / OCMA | API 6FA / API 607 / BS 5146 / OCMA | report | Perform | review report | Random Witness point |
| 3.12 | Actuator Functional Test (If applicable) | Open, Close time, Torque, Limit setting | Functioning in Hydrostatic Test | report | Perform | Witness point | hold point |
| 3.13 | Visual & Dimensional examination | ASME Sec-V, Art. 9 | Referred ANSI dimensions | report | Perform | hold point | review report |
| 4 | Surface Preparation, Painting & Preservation | As per Approved procedure | As per Approved procedure | | Perform | Witness point | review report |
| 5.1 | Marking | As per Approved procedure | As per Approved procedure | X | Perform | Witness point | review report |
| 5.2 | Inspector's stamp | - | - | X | Perform | hold point | review report |
| 6 | Control of all certificates & Final Certificate | - | - | certif. 3.2 | Perform | hold point | review report |

| | | | | | | | |
|-----------------------|--|---------------------------|--|----------------------------|--|--|--|
| LEGENDS: | | | | | | | |
| RT: Radiographic test | | PT: Liquid penetrant test | | MT: Magnetic particle test | | TPIA: Third Party Inspection Agency; . | |
| P: Performed | | R: Review | | W: Witness | | Control Authority : Owner/Engineer or their Authorized Inspection Agency | |

Hold point = No further steps may be undertaken before the intervention of the appointed responsible takes place.

Witness point = The appointed responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not.

- Notes:**
- The Above Testing and acceptance criteria are minimum requirements, however, equipment supplier shall ensure and that the product also comply to the additional requirements as per Technical specifications and data sheets. TPIA shall issue the EN10204 3.2 Certification for the Final Product. Welding & Welder Qualification "W" for Customer/CA. Heat treatment as per Specification.
 - The supplier shall submit their own detailed QAP prepared on the basis of the above for approval of Owner/Owner's representative and TPIA.
 - Supplier shall submit Calibration certificates of all Instruments/Equipment to be used for Inspection and Testing to TPIA with relevant procedures and updated standards for TPIA review/Approval.
 - TPIA will have Right to Inspect minimum 10% of all manufacturing activities on each day or as specified above.
 - TPIA along with Owner/Owner representative shall review/approve all the documents related to QAP/Quality manuals/Drawings etc. submitted by supplier.
 - TPIA shall also Review the Test certificates submitted by the Actuator manufacturer.
 - Contractor shall in coordination with Supplier/Sub vendor shall issue detailed Production and Inspection schedule indicating the dates and the locations to facilitate Owner/Owner's representative and TPIA to organize Inspection.
 - Certification requirements shall comply with European Standard EN 10204 (latest edition)
 - All bought out items will be procured with 3.2 Certificates.
 - The hold points in this QAP pertains to mechanical tests and hydro test. These tests on all the components can be clubbed together to be performed during a single visit of TPIA
 - For All Forging / Casting Materials, The Specimen Shall Be Taken From The Integral Part of The Forging / Casting
 - Heat treatment start and stop temperature chart shall be Witnessed & signed by TPIA. Power failure log book / sheet shall be maintained
 - In case of conflict between purchase specification, contract documents and QAP, more stringent conditions shall be applicable.



QUALITY ASSURANCE PLAN

PE FITTINGS

| | | |
|-------------|---|--------------|
| QAP No | P.014714 G 11013 M005 Rev.0 | |
| Date | 10.07.2023 | |
| Prepared by | | Checked :MKS |
| Approved by | | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI Gas | |
| Client | CUGL | |
| Consultant | | |

| Sl. No.. | COMPONENTS/OPERATIONS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENTS | ACCEPTANCE NORMS | FORMAT OF RECORD | VENDOR | CA/TPI | REMARKS |
|----------|--|-----------------------|------------------------|--|---|-------------------|--------|--------|--|
| 1 | Review of test certificate for Raw material | | Each Batch certificate | Raw Material manufacturer's test certificate | Raw Material manufacturer's test certificate | Test Certificate | R | R | |
| 2 | Hydrostatic strength | | | | | | | | |
| 2.1 | At 20° C | Strength test | As per EN 1555-7 | EN 1555 - 3/ EN 921 / PTS / GTS | No leakage through the fittings during the test | Inspection report | P | W | |
| 2.2 | At 80° C | Strength test | As per EN 1555-7 | EN 1555 - 3/ EN 921 / PTS / GTS | No leakage through the fittings during the test | Inspection report | P | W | |
| 3 | Cohesive Resistance | | | | | | | | |
| 3.1 | Length of Initial rupture \leq L2/3 in brittle failure | Mechanical properties | As per EN 1555-7 | ISO 13954 / ISO 13955 / PTS / GTS | EN 1555 – 3 | Inspection report | P | R | This test is applicable only for Electrofusion socket fittings |
| 3.2 | Surface of rupture \leq 25% brittle failure | Mechanical properties | As per EN 1555-7 | ISO / DIS 13956 / PTS / GTS | EN 1555 – 3 | Inspection report | P | R | This test is applicable only for Electrofusion saddle fittings |
| 4 | Tensile strength for butt fusion | Mechanical properties | As per EN 1555-7 | ISO / DS 13953/PTS | ISO / DS 13953/PTS | | P | R | This test is applicable only for Spigot end fittings |
| 5 | Impact strength | Mechanical properties | As per EN 1555-7 | EN 1716 / PTS / GTS | EN 1716 / PTS / GTS | Inspection report | P | R | This test is applicable only for Electrofusion saddle fittings |



QUALITY ASSURANCE PLAN

PE FITTINGS

| | | |
|-------------|---|--------------|
| QAP No | P.014714 G 11013 M005 Rev.0 | |
| Date | 10.07.2023 | |
| Prepared by | | Checked :MKS |
| Approved by | | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI Gas | |
| Client | CUGL | |
| Consultant | | |

| Sl. No.. | COMPONENTS/OPERATIONS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENTS | ACCEPTANCE NORMS | FORMAT OF RECORD | VENDOR | CA/TPI | REMARKS |
|-----------------|---|--|------------------|------------------------------------|--|-------------------|--------|--------|--|
| 6 | Pressure Drop | Air flow rate | As per EN 1555-7 | EN 12117 / PTS | EN 12117 / PTS | Inspection report | P | R | This test is applicable only for Electrofusion saddle fittings |
| 7 | Electrical Resistance test | | As per EN 1555-7 | EN 1555 - 3 / PTS / GTS | EN 1555 - 3 / PTS | Inspection report | P | W | |
| 8 | Oxidation induction time(Thermal stability) | | As per EN 1555-7 | EN 1555 - 3 / EN 728 / PTS / GTS | > 20 min | Inspection report | P | W | |
| 9 | Melt mass/ Flow rate (MFR) | | As per EN 1555-7 | EN 1555 - 3 / ISO 4440 / GTS / PTS | (0.2 ≤ MFR ≤ 1.4) g / 10 min and after processing maximum deviation of ± 20 % of the nominated value declared by manufacturer. | Inspection report | P | W | |
| 10 | Dimensional Check | Dimensions | 100% | As per EN 1555 -3 / PTS / GTS | As per EN 1555 -3 / PTS / GTS | Inspection report | P | RW | |
| 11 | Storage | Visual | All materials | - | Manufacturer Recommendation | Stock register | H | M | |
| 12 | Marking | Visual | 100% | EN 1555 / PTS / GTS | EN 1555 -3 | Inspection report | P | RW | |
| 13 | Documentation | All Inspection Reports and Certificates | - | EN 1555 | All Inspection Reports and Certificates | Inspection Report | P | R | |
| LEGENDS: | | H-HOLD, P-PERFORMANCE, W-WITNESS, RW - RANDOM WITNESS, TC-TEST CERTIFICATE, MTR-MANUFACTURER TEST REPORT, TPIA-THIRD PARTY INSPECTION AGENCY, CA - OWNER/OWNER'S REPRESENTATIVE | | | | | | | |

Notes :

- The Above Testing and acceptance criteria are minimum requirements, however, manufacturer shall ensure that the product shall also comply to the additional requirements as per Particular Technical specifications(PTS)
- Vendor shall in coordination with supplier/ sub vendor issue detailed Production and inspection schedule indicating the dates and the locations to facilitate Owner/ Owner's representative and TPIA to organize inspection.
- Owner/ Owner's representative including TPIA will have the right to inspect any activity of manufacturing at any time.
- All reference Codes/ Standards, Documents, P.O. Copies shall be arranged by vendor / supplier for reference of TPIA/CA at the time of Inspection
- Only calibrated instruments shall be used for inspection.
- Before dispatch of the materials to the contractors, manufacturer shall submit copy of all related document of inspection along with release note and MTC to the owner /PMC for the dispatch clearance.
- Sampling Frequency of the testing shall be done as per EN 1555-7



QUALITY ASSURANCE PLAN
MDPE VALVES

| | | |
|--------------------|---|--------------|
| QAP No | P.014714 G 11013 M006 Rev.0 | |
| Date | 10.07.2023 | |
| Prepared by | | Checked :MKS |
| Approved by | | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS | |
| Client | CUGL | |
| Consultant | | |

| SR. No | DESCRIPTION | TYPE OF CHECK | QUANTUM OF CHECK | REF. DOC. | ACCEPTANCE NORMS | DOCUMENTATION | INSPECTION | | REMARKS |
|--------|--|----------------------------------|------------------------|--|--|-------------------|------------|-----------|---------|
| | | | | | | | MANUF. | CA / TPIA | |
| 1 | Review of mill test certificate for Raw material | | Each Batch certificate | Raw Material manufacturer's test certificate | Raw Material manufacturer's test certificate | | R | R | |
| 2 | Test of Raw Material Inspection | | Each Batch | | As per material test certificate | Test report | H | R | |
| 3 | Hydrostatic strength @ 80 degree C | | 100% | EN 917/ISO 5208/PTS/GTS | EN 917/ISO 5208/PTS/GTS | Inspection report | P | W | |
| 4 | Leak Tightness test @ 11 bar and 25 mbar | External & internal leak testing | 100% | EN 1555-4 / PTS / GTS | EN 1555-4 / PTS / GTS | Inspection report | P | R | |
| 5 | Running torque | Mechanical properties | 100% | EN 1555-4 / PTS / GTS | EN-28233/PTS/GTS | Inspection report | P | R | |
| 6 | Initiating Torque | Mechanical properties | | EN 1555-4 / PTS / GTS | EN 1555-4 / PTS / GTS | Inspection report | P | R | |
| 7 | Impact strength | Mechanical properties | | As per standard | GTS /PTS | Inspection report | P | R | |
| 8 | Pressure Drop | Air flow rate | | As per standard | GTS /PTS | Inspection report | P | R | |
| 9 | Oxidation induction time(Thermal stability) | | | EN 728/ GTS/PTS | EN 728/GTS/PTS | Inspection report | P | W | |



QUALITY ASSURANCE PLAN
MDPE VALVES

| | | |
|-------------|---|--------------|
| QAP No | P.014714 G 11013 M006 Rev.0 | |
| Date | 10.07.2023 | |
| Prepared by | | Checked :MKS |
| Approved by | | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS | |
| Client | CUGL | |
| Consultant | | |

| SR. No | DESCRIPTION | TYPE OF CHECK | QUANTUM OF CHECK | REF. DOC. | ACCEPTANCE NORMS | DOCUMENTATION | INSPECTION | | REMARKS |
|--------|----------------------------|---------------|------------------|-----------------------|-----------------------------|-------------------|------------|-----------|---------|
| | | | | | | | MANUF. | CA / TPIA | |
| 10 | Melt mass/ Flow rate (MFR) | | | ISO 1133/ GTS/PTS | ISO 1133/GTS/PTS | Inspection report | P | W | |
| 11 | Dimensional Check | | Each Batch | ISO 1183/ GTS/PTS | ISO 1183/ GTS/PTS | Inspection report | P | RW | |
| 11 | Storage | | All materials | | Manufacturer Recommendation | Stock register | H | M | |
| 12 | Marking | | Each Batch | GTS /PTS | GTS /PTS | Inspection report | P | R | |
| 13 | Lot release test | | Each lot | EN 1555-7 / GTS / PTS | EN 1555-7 / GTS / PTS | Inspection report | P | R | |

LEGEND:

P:Perform
TPIA: Third Party Inspection Agency
R:Review
W:Witness
H : Hold
M : Monitor
CA : Owner/Owner's Representative

Note:

- 1 The Above Testing and acceptance criteria are minimum requirements, however, manufacturer shall ensure that the product shall also comply to the additional requirements as per Particular Technical specifications(PTS)
- 2 The supplier shall submit their own detailed ITP prepared on the basis of above for approval of Owner/Owner's representative and TPIA.
- 3 Supplier shall submit Calibration certificates of all Instruments/Equipment to be used for Inspection and Testing to TPIA with relevant procedures and updated standards for TPIA review/Approval.
- 4 TPIA will have Right to Inspect minimum 10% of all manufacturing activities on each day or as specified above.
- 5 TPIA along with Owner/Owner representative shall review/approve all the documents related to ITP/Quality manuals/Drawings etc. submitted by supplier.
- 6 Contractor shall in coordination with Supplier/Sub vendor shall issue detailed Production and Inspection schedule indicating the dates and the locations to facilitate Owner/Owner's representative and TPIA to organize Inspection.
- 7 Special manufacturing procedures have to be specially approved or only previously approved procedures have to be used, in case of conflict between specifications more stringent condition shall be applicable.
- 8 Certification requirement shall comply with European standard EN 10204 (latest edition)
- 9 For Mechanical fittings, the Requirement of ISO / DIS 10838-1 /2 / 3, as applicable , apply
- 10 Sampling Frequency of the testing shall be done as per EN 1555-7



QUALITY ASSURANCE PLAN
INSULATING JOINTS

| | | |
|--------------------|---|------------------|
| QAP No | P.014714 G 11013 M007 Rev. 0 | |
| Date | 10.07.2023 | |
| Prepared by | | Checked : |
| Approved by | | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS | |
| Client | CUGL | |
| Consultant | | |

| Sn. | ACTIVITY | PTS | Extent of Check | Applied standard e/o Procedure | Acceptance Criteria | Document type | Scope of Inspection | |
|----------|--|------------|--|--------------------------------|---|---------------|---------------------|-------------------------|
| | | Clause No. | | | | | Manufacturer | Client Appointed TPIA |
| 0 | CONTROL BEFORE MANUFACTURING | | | | | | | |
| | - list of operation in manufacturing and control | annex 1 | | | specification | | P | Hold (kick-off meeting) |
| | - material part list | 2 and 3 | | | specification | | | |
| | - dimensional drawings | 2 | | | specification | | | |
| | - calculation butt welding ends | 2 | | | specification | | | |
| | - calculation coupling | 2 | | | specification | | | |
| | - qualified welding procedures (WPS,PQR,WQT) | 4.2 and 6 | | | specification | | | |
| | - heat treatment procedure | 4.3 and 6 | | | specification | | | |
| | - non destructive testing procedures | 4.6 and 6 | | | specification | | | |
| | - painting procedure | 7 | | | specification | | | |
| 1 | BASE MATERIAL | | | | | | | |
| 1.1 | MATERIALS with Certified Material Test Report | | | ASTM A 370 | specification | CMTR | R | RR |
| | Tensile tests, Micrographic Examination, Micro Structure Grain Size Examination, (remark : marking transfer by TPIA) | 3.9 | 1 Per Size / Per Raw Material Lot / Heat Treatment Lot | | PTS & Material Specification | certif. 3.2 | P | RR |
| | Charpy Impact test at 0 °C (remark : marking transfer by TPIA) | 3.9 | 1 Per Size / Per Raw Material Lot / Heat Treatment Lot | | - At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction. | certif. 3.2 | P | RR |
| 1.2 | CHEMICAL COMPOSITION | | | | | | | |
| | Check chemical analysis | 3.10 | 1 Per Size / Per Raw Material Lot / Heat Treatment Lot | | PTS & Material Specification | certif. 3.2 | P | RR |



QUALITY ASSURANCE PLAN
INSULATING JOINTS

| | | |
|-------------|---|-----------|
| QAP No | P.014714 G 11013 M007 Rev. 0 | |
| Date | 10.07.2023 | |
| Prepared by | | Checked : |
| Approved by | | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS | |
| Client | CUGL | |
| Consultant | | |

| Sn. | ACTIVITY | PTS | Extent of Check | Applied standard e/o Procedure | Acceptance Criteria | Document type | Scope of Inspection | |
|-----------------|--|-------------------------------|--|---|------------------------------|---------------|---------------------|-----------------------|
| | | Clause No. | | | | | Manufacturer | Client Appointed TPIA |
| 2 | FABRICATION AND TESTS | | | | | | | |
| 2.1 | Welds and repair welds shall be Ped according to client approved qualified procedure | 4.1 & 4.2 | | ASME IX + spec. | ASME IX + spec. | | P | RR |
| 2.2 | Heat treatment (Loading & Unloading shall be witnessed by TPIA, Power failure log shall be maintained) | | | | | | | |
| | time temperature chart | 4.3.1 | 1 per furnace charge | | | report | P | RR |
| | micrographic examination | 4.3.2 | 1 Per Size / Per Raw Material Lot / Heat Treatment Lot | ASTM E 112 | Grain size : range 8 to 12 | certif. 3.2 | P | RR |
| 2.3 | Mechanical tests, Micro Structure Grain Size Examination, (remark : marking transfer by Client/Client approved TPIA) | | | | | certif. 3.2 | P | RR |
| | 2.3.1 Tension test for coupling NPS ≥ 2 | | | | | | | |
| | - base material | 4.4.1 | 1 Per Size / Per Raw Material Lot / Heat Treatment Lot | ASTM A 370 | PTS & Material Specification | certif. 3.2 | P | RR |
| | - weld | 4.4.1 | 1 Per Size / Per Raw Material Lot / Heat Treatment Lot | | | | | |
| | 2.3.2 Impact test | | | | | | | |
| - base material | 4.4.2 | 2 sets of 3 specimens per lot | ISO 148 - Charpy V - Notch | - At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction. | certif. 3.2 | P | RR | |
| - weld | 4.4.2 | 1 sets of 3 specimens per lot | | | | | | |
| - HAZ | 4.4.2 | 1 sets of 3 specimens per lot | | | | | | |
| 2.3.3 | Flattening test | 4.4.3 | 1 per group | PTS & Material Specification | PTS & Material Specification | certif. 3.2 | P | RR |



QUALITY ASSURANCE PLAN
INSULATING JOINTS

| | |
|--------------------|--|
| QAP No | P.014714 G 11013 M007 Rev. 0 |
| Date | |
| Prepared by | Checked : |
| Approved by | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS |
| Client | CUGL |
| Consultant | |

| Sn. | ACTIVITY | PTS | Extent of Check | Applied standard e/o Procedure | Acceptance Criteria | Document type | Scope of Inspection | |
|----------|--|-------------------------------|-----------------|--------------------------------|---|---------------|---------------------|-----------------------|
| | | Clause No. | | | | | Manufacturer | Client Appointed TPIA |
| 3 | NON DESTRUCTIVE EXAMINATIONS (NDE) | | | | | | | |
| 3.1 | Radiographic examination butt welds | 4.5.1 and 4.5.3.d | 100% | ASME section V/PTS/API 1104 | Longitudinal welds : ASME section VIII division 1 UW 51 Girth welds : API 1104 section 6.0 | certif. 3.2 | P | W |
| 3.2 | Fillet weld shall be dye penetrant tested | 4.5.1 | 100% | ASME section V/PTS/API 1104 | ASME section VIII div. 1 /PTS/API 1104 | certif. 3.2 | P | W |
| 3.3 | Ultrasonic inspection | | | | | | | |
| | 3.3.1 - base material (if t ≥ 6 mm) | 4.5.1.2a and 4.5.1.3c | 100% | ASME section V | ASME section VIII division1 UF-55 | certif. 3.2 | P | W |
| | 3.3.2 - weld (if t ≥ 6 mm) | 4.5.1.2a and 4.5.1.3c | 100% | ASME section V | ASME section VIII division 1 appendix 12 | | | |
| 3.4 | Magnetic particle inspection butt welds + external surface + accessible internal surface | 4.5.1.2a and 4.5.1.3b | 100% | ASME section V | ASME section VIII division1 appendix 6 | certif. 3.2 | P | W |
| 3.5 | Visual examination | 4.5.1.2b and 4.5.1.3a | all | | PTS & Material Specification §4.5.3.a | certif. 3.2 | P | W |
| 3.6 | After machining | | | | | | | |
| | 3.6.1 Magnetic particle inspection of the bevels | 4.5.1.2.c and 4.5.3.b and 3.e | 100% | ASME section V | PTS & Material Specification §4.5.3.e | certif. 3.2 | P | W |
| | 3.6.2 Ultrasonic inspection of 25 mm of base material (if t ≥ 6 mm) | 4.5.3.c | 100% | ASME section V | PTS & Material Specification 4.5.3.e | certif. 3.2 | P | W |
| 3.7 | Dimensional examination | 4.5.3.d | 100% | Approved Drg../PTS | Approved Drg../PTS | | P | RR |



**QUALITY ASSURANCE PLAN
INSULATING JOINTS**

| | | |
|--------------------|---|------------------|
| QAP No | P.014714 G 11013 M007 Rev. 0 | |
| Date | 10.07.2023 | |
| Prepared by | | Checked : |
| Approved by | | |
| Project | LAYING OF 3 LPE COATED CARBON STEEL PIPELINE IN BAREILLY, KANPUR & UNNAO AND JHANSI GAS | |
| Client | CUGL | |
| Consultant | | |

| Sn. | ACTIVITY | PTS | Extent of Check | Applied standard e/o Procedure | Acceptance Criteria | Document type | Scope of Inspection | |
|----------|------------------------------|-------------|-----------------|--------------------------------|---|---------------|---------------------|-----------------------|
| | | Clause No. | | | | | Manufacturer | Client Appointed TPIA |
| 4 | FINAL INSPECTION TEST | | | | | | | |
| 4.1 | Hydrostatic Test | 2 and 4.6.1 | all | PTS | No pressure drop / leakage at 1.5 x Design Pr. for 15 minutes duration. | certif. 3.2 | P | W |
| 4.2 | Air Leak Test | 2 | all | PTS | No pressure drop / leakage at 5 Kg/cm ² for 10 minutes duration. | certif. 3.2 | P | W |
| 4.3 | Electrical testing | 4.6.2 | all | PTS | 5000V AC, 50Hz for minimum 1 min. | report | P | W |
| 4.4 | Marking | 5 | all | PTS | | report | P | R |
| 4.5 | Inspector's stamp | 6 | all | PTS | | report | P | R |
| 4.6 | Control of all certificates | 6 | all | PTS | | certif. 3.2 | P | Hold Point |

LEGEND: **PTS** - Particular Technical Specification
RT : Radiographic test **PT**: Liquid penetrant test **MT**: Magnetic particle test **HT**: Heat treatment **VT**: Visual test **TPIA** : Third Party Inspection Agency
P : Perform **R**: Review **W**: Witness **WPS**: Welding Procedure Specification **WQT**: Welder Qualification Test **PQR** : Procedure Qualification Record
RR: Review Report

- Note:**
- The Above Testing and acceptance criteria are minimum requirements, however, equipment supplier shall ensure that the product also comply to the additional requirements as per Technical specifications and data sheets. QAP/ITP shall be prepared in line of client approved format/template.
 - The supplier shall submit their own detailed QAP prepared on the basis of the above for approval of Client/Client's representative and TPIA.
 - Supplier shall submit Calibration certificates of all Instruments/Equipment to be used for Inspection and Testing with relevant procedures and updated standards for TPIA review/Approval.
 - TPIA will have Right to Inspect minimum 10% of all manufacturing activities on each day or as specified above.
 - TPIA along with Owner/Owner's representative shall review/approve all the documents related to QCT/QAP/Quality manuals/Drawings etc. submitted by supplier.
 - For all Forging materials, the specimen shall be taken from the Integral part of the Forging.
 - Manufacturer shall submit detailed production and inspection schedule.
 - Welding shall not be permitted after heat treatment.
 - Certification requirements to comply with EN 10204 - 3.2.(Latest edition). All bought out items shall be provided with 3.2 certificates.



**PIPING
SPECIFICATIONS**

SPECIFICATION NO.
P.014714 G 11076 M001
(3C1)

SHEET 1 OF 6

| BASIC PIPING SPECIFICATION DATAS | | MAXIMUM DESIGN CONDITIONS | | | |
|----------------------------------|------------------|---------------------------|-------------|----------------|-------------|
| | | TEMPERATURE ° C | | PRESSURE bar g | |
| PRIMARY FLANGE RATING | 300#-RF | NG | 0 to 50 | NG | 49.00 |
| | | AG | 60 | AG | 49.00 |
| BASIC MATERIAL | CARBON STEEL | | | | |
| CORROSION ALLOWACE | 1.6 mm | | | | |
| X-RAYS | 100% | | | | |
| SIZE RANGE | 1/2"-18" | | | | |
| CODE | ANSI B 31.8 | | | | |
| FLUIDS | | | | | |
| NG : NATURAL GAS | | | | | |
| AG : ACTUATING GAS | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 0 | ISSUE FOR TENDER | 10.07.2023 | | | |
| REV | DESCRIPTION | DATE | PREPARED BY | CHECKED BY | APPROVED BY |



**PIPING
SPECIFICATIONS**

SPECIFICATION NO.
P.014714 G 11076 M001
(3C1)

SHEET 2 OF 6

| ITEM | SHORT CODE | SIZE FROM-THRU | END CONNECTION | RATING AND/OR SCHED. | DIMENSION STANDARD | MATERIAL | REMARKS |
|------------------------|------------|----------------|----------------------------------|----------------------|--------------------|-------------------------------------|--------------------------|
| PIPES | P | 1/2" - 2" | BE-ANSI B16.25 | 80 | ANSI B36.10 | ASTM A 106 Gr. B | SEAMLESS |
| | | 4" | BE-ANSI B16.25 | 6.4 mm | API 5L | API 5L X 52 | ERW / SMLS |
| | | 6" | BE-ANSI B16.25 | 6.4 mm | API 5L | API 5L X 52 | ERW / SMLS |
| | | 8" | BE-ANSI B16.25 | 6.4 mm | API 5L | API 5L X 52 | ERW / SMLS |
| | | 10" | BE-ANSI B16.25 | 6.4 mm | API 5L | API 5L X 52 | ERW / SMLS |
| | | 12" | BE-ANSI B16.25 | 7.2 mm | API 5L | API 5L X 52 | ERW / SMLS |
| | | 16" 18" | BE-ANSI B16.25 BE-ANSI B16.25 | 8.7 mm 9.5 mm | API 5L API 5L | API 5L X 52 API 5L X 52 | ERW / SMLS ERW / SMLS |
| ELBOWS 90 LR | E | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| ELBOWS 45 LR | E45 | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| ELBOWS 30 LR | E30 | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| ELBOWS 22.5 LR | E22.5 | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| ELBOWS 15 LR | E15 | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| REDUCERS CONCENTRIC | RC | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| REDUCERS ECCENTRIC | RE | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| TEES EQUAL | T | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | 08.11.19 | MKS | BKS | CKS ASTM A860 WPHY 52 | |
| TEES RED | TR | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| WELDOLETS | WEL | 3/4"-18" | BW - ANSI B16.25 | SEE PIPE | MANUFACTURER | ASTM A 105 | SEAMLESS |
| CAPS | C | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| NIPPLES | NBEP | 1/2" - 1.1/2" | BOTH ENDS PLAIN | 80 | ANSI B36.10 | ASTM A 106 Gr. B | SEAMLESS-LG=100mm |
| | NOET | 1/2" - 1.1/2" | ONE END THRD-MNPT | 80 | ANSI B36.10 | ASTM A 106 Gr. B | SEAMLESS-LG=100mm |
| | NBET | 1/2" - 1.1/2" | BOTH ENDS THRD-MNPT | 80 | ANSI B36.10 | ASTM A 106 Gr. B | SEAMLESS-LG=100mm |
| FULL COUPLINGS THRD | CF | 1/2" - 1.1/2" | FNPT ANSI B1-20-1 | 3000# | ANSI B16.11 | ASTM A 105 | SEAMLESS |
| CAPS THRD | C2 | 1/2" - 1.1/2" | FNPT ANSI B1-20-1 | 3000# | ANSI B16.11 | ASTM A 105 | SEAMLESS |
| PLUGS THRD | PL | 1/2" - 1.1/2" | MNPT ANSI B1-20-1 | 3000# | ANSI B16.11 | ASTM A 105 | SEAMLESS |



**PIPING
SPECIFICATIONS**

**SPECIFICATION NO.
P.014714 G 11076 M001
(3C1)**

SHEET 3 OF 6

| ITEM | SHORT CODE | SIZE FROM-THRU | END CONNECTION | RATING AND/OR SCHED. | DIMENSION STANDARD | MATERIAL | REMARKS |
|----------------------|------------|----------------|------------------|----------------------|------------------------------|---|--|
| WN FLANGES | F | 1/2" - 2" | | 300# RF | ANSI B16-5 | ASTM A 105 | Always to be welded on 3C1 pipe |
| | | 4" - 18" | | | | ASTM A 694 F 52 | |
| ORIFICE FLANGES | FO | 1" - 2" | | 300# RF | ANSI B16-36 | ASTM A 105 | COMPLETE WITH GASKET BOLTS, NUTS JACK-SCREWS AND PLUGS |
| | | 4" - 18" | | | ANSI B16-36 | ASTM A 694 F 52 | |
| BLIND FLANGES | FB | 1" - 2" | | 300# RF | ANSI B16-5 | ASTM A 105 | |
| | | 4" - 18" | | | ANSI B16-5 | ASTM A 694 F 52 | |
| DRIP RINGS | DR | 1" - 2" | | 300# RF | ANSI B16-36 | ASTM A 105 | 3/4" FNPT OUTLET CONNECTION |
| | | 4" - 18" | | | ANSI B16-36 | ASTM A 694 F 52 | |
| SPECTACLE BLINDS | SB | 1" - 2" | | 300# RF | ANSI B16-5 | ASTM A 515 GR 70 | |
| | | 4" - 18" | | | ANSI B16-5 | ASTM A 694 F 52 | |
| RESTRICTION ORIFICES | RO | 1" - 2" | | 300# RF | ANSI B16-5 | ASTM A240 GR 304 | |
| | | 4" - 18" | | | ANSI B16-5 | ASTM A 694 F 52 | |
| MONOLITHIC | IJ | 2" | BW - ANSI B16-25 | 300# | ANSI B16-5 | PIPE PUPS: Same as pipe Material Forged Ring - ASTM A 105 | REFER DATA SHEET |
| INSULATING | | 4" - 18" | BW - ANSI B16-25 | 300# | API 5L | PIPE PUPS: API 5L X 52 Forged Ring - ASTM A 694 F52 | REFER DATA SHEET |
| | | | BW - ANSI B16-25 | 300# | API 5L | PIPE PUPS: API 5L X 52 Forged Ring - ASTM A 694 F52 | REFER DATA SHEET |
| JOINTS | | | BW - ANSI B16-25 | 300# | API 5L | PIPE PUPS: API 5L X 52 Forged Ring - ASTM A 694 F52 | REFER DATA SHEET |
| STUD BOLTS | B | 1/2" - 18" | | 300# RF | ANSI B18.2.1 ANSI B18.2.2 | ASTM A 193 B 7 HEXAGONAL NUTS ASTM A194 GR 2H | |
| GASKETS SPIRAL WOUND | G | 1/2"-18" | | 300# RF | API 601 MSS SP 44 | WINDING ANSI 304 FILLING PURE GRAPHITE CENTERING RING | 4.5 mm THK |



**PIPING
SPECIFICATIONS**

**SPECIFICATION NO.
P.014714 G 11076 M001
(3C1)**

SHEET 4 OF 6

| ITEM | SHORT CODE | SIZE FROM-THRU | END CONNECTION | RATING AND/OR SCHED. | DIMENSION STANDARD | MATERIAL | REMARKS |
|--------------------|------------|----------------|--|----------------------|--------------------|---|--|
| BALL VALVES | VBA | 1/2" - 1 1/2" | FLGD RF:ANSI B16-5 | 600# | ANSI B16-10 | BODY: ASTM A 105 BALL: SS 316 | FULL BORE WRENCH OPERATED. FIRE SAFE |
| | | 2" - 4" | FLGD RF:ANSI B16-5 or BW :ANSI B16.25 | 300# | ANSI B16-10 | BODY: ASTM A 216 WCB/A234 WPB BALL: (ASTM A 216 WCB / A 234 WPB) with ENP (75 microns) | FULL BORE / REDUCED BORE AS INDICATED IN DATA SHEET DOUBLE BLOCK & BLEED WRENCH OPERATED. FIRE SAFE |
| | | 6" - 18" | FLGD RF:ANSI B16-5 or BW :ANSI B16.25 | 300# | ANSI B16-10 | BODY: ASTM A 216 WCB/A234 WPB BALL: (ASTM A 216 WCB / A 234 WPB) with ENP (75 microns) | FULL BORE / REDUCED BORE AS INDICATED DATA SHEET DOUBLE BLOCK & BLEED GEAR OPERATED./ACTUATED (AS PER MR/Spec.) FIRE SAFE |
| GLOBE VALVES | VGL | 1/2"-1 1/2" | FLGD RF:ANSI B16-5 | 600# | ANSI B16-10 | BODY: ASTM A 105 TRIM: ASTM A182 F6 | HANDWHEEL FIRE SAFE |
| | | 2" - 18" | FLGD RF:ANSI B16-5 | 300# | ANSI B16-10 | BODY: ASTM A 216 WCB/A234 WPB TRIM: ASTM A182 F6 | HANDWHEEL FIRE SAFE |
| SWING CHECK VALVES | VCH | 1/2" - 1 1/2" | FLGD RF:ANSI B16-5 | 600# | ANSI B16-10 | BODY: ASTM A 105 TRIM: ASTM A182 F6 | HORIZONTAL INSTALLATION VERTICAL INSTALLATION FLOW UPWARDS |
| | | 2" - 18" | FLGD RF:ANSI B16-5 | 300# | ANSI B16-10 | BODY: ASTM A 216 WCB TRIM: ASTM A 216 WCB | HORIZONTAL INSTALLATION VERTICAL INSTALLATION FLOW UPWARDS |



**PIPING
SPECIFICATIONS**

SPECIFICATION NO.
P.014714 G 11076 M001
(3C1)

SHEET 5 OF 6

REDUCERS CHART

SMALL SIZE

**L
A
R
G
E

S
I
Z
E**

| | 1/2" | 3/4" | 1" | 1.1/2" | 2" | 3" | 4" | 6" | 8" | 10" | 12" | 14" | 16" | 18" | 20" | 24" | 28" | 30" | 32" | 36" |
|--------|------|------|----|--------|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1/2" | | | | | | | | | | | | | | | | | | | | |
| 3/4" | X | | | | | | | | | | | | | | | | | | | |
| 1" | X | X | | | | | | | | | | | | | | | | | | |
| 1.1/2" | X | X | X | | | | | | | | | | | | | | | | | |
| 2" | | X | X | X | | | | | | | | | | | | | | | | |
| 3" | | | | X | X | | | | | | | | | | | | | | | |
| 4" | | | | X | X | X | | | | | | | | | | | | | | |
| 6" | | | | | | X | X | | | | | | | | | | | | | |
| 8" | | | | | | | X | X | | | | | | | | | | | | |
| 10" | | | | | | | X | X | X | | | | | | | | | | | |
| 12" | | | | | | | | X | X | X | | | | | | | | | | |
| 14" | | | | | | | | X | X | X | X | | | | | | | | | |
| 16" | | | | | | | | | X | X | X | X | | | | | | | | |
| 18" | | | | | | | | | | X | X | X | X | | | | | | | |
| 20" | | | | | | | | | | | X | X | X | X | | | | | | |
| 24" | | | | | | | | | | | | | | | | | | | | |
| 28" | | | | | | | | | | | | | | | | | | | | |
| 30" | | | | | | | | | | | | | | | | | | | | |
| 32" | | | | | | | | | | | | | | | | | | | | |
| 36" | | | | | | | | | | | | | | | | | | | | |
| 42" | | | | | | | | | | | | | | | | | | | | |

LEGEND

X : CONCENTRIC AND ECCENTRIC REDUCERS-BW



PIPING
SPECIFICATIONS

SPECIFICATION NO.
P.014714 G 11076 M001
(3C1)

SHEET 6 OF 6

BRANCH CHART

BRANCH SIZE

H
E
A
D
E
R
S
I
Z
E

| | 1/2" | 3/4" | 1" | 1.1/2" | 2" | 3" | 4" | 6" | 8" | 10" | 12" | 14" | 16" | 18" | 20" | 24" | 28" | 30" | 32" | 36" |
|--------|------|------|----|--------|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1/2" | T | | | | | | | | | | | | | | | | | | | |
| 3/4" | TR | T | | | | | | | | | | | | | | | | | | |
| 1" | TR | TR | T | | | | | | | | | | | | | | | | | |
| 1.1/2" | W | TR | TR | T | | | | | | | | | | | | | | | | |
| 2" | W | W | TR | TR | T | | | | | | | | | | | | | | | |
| 3" | W | W | W | TR | TR | T | | | | | | | | | | | | | | |
| 4" | W | W | W | W | TR | TR | T | | | | | | | | | | | | | |
| 6" | W | W | W | W | W | TR | TR | T | | | | | | | | | | | | |
| 8" | W | W | W | W | W | BW | TR | TR | T | | | | | | | | | | | |
| 10" | W | W | W | W | W | BW | BW | TR | TR | T | | | | | | | | | | |
| 12" | W | W | W | W | W | BW | BW | BW | TR | TR | T | | | | | | | | | |
| 14" | W | W | W | W | W | BW | BW | BW | BW | TR | TR | T | | | | | | | | |
| 16" | W | W | W | W | W | BW | BW | BW | BW | BW | TR | TR | T | | | | | | | |
| 18" | W | W | W | W | W | BW | BW | BW | BW | BW | BW | TR | TR | T | | | | | | |
| 20" | | | | | | | | | | | | | | | | | | | | |
| 24" | | | | | | | | | | | | | | | | | | | | |
| 28" | | | | | | | | | | | | | | | | | | | | |
| 30" | | | | | | | | | | | | | | | | | | | | |
| 32" | | | | | | | | | | | | | | | | | | | | |
| 36" | | | | | | | | | | | | | | | | | | | | |

LEGEND

T : TEE EQUAL-BW

TR : REDUCING TEE-BW

W : WELDOLET- BW

BW : BRANCH WELD-CHECK IF REINFORCING PLATE IS NECESSARY ACCORDING ANSI B 31.8



**PIPING
SPECIFICATIONS**

SPECIFICATION NO.
P.014714 G 11076 M002
(3CIU)
SHEET 1 OF 6

| BASIC PIPING SPECIFICATION DATAS | | MAXIMUM DESIGN CONDITIONS | | | |
|----------------------------------|--------------|---------------------------|---------|----------------|-------|
| | | TEMPERATURE ° C | | PRESSURE bar g | |
| PRIMARY FLANGE RATING | 300#-RF | NG | 0 to 45 | NG | 49.00 |
| | | AG | 60 | AG | 49.00 |
| BASIC MATERIAL | CARBON STEEL | | | | |
| CORROSION ALLOWACE | 1.6 mm | | | | |
| X-RAYS | 100% | | | | |
| SIZE RANGE | 1/2"-18" | | | | |
| CODE | ANSI B 31.8 | | | | |

FLUIDS

NG : NATURAL GAS

AG : ACTUATING GAS

| REV | DESCRIPTION | DATE | PREPARED BY | CHECKED BY | APPROVED BY |
|-----|-------------------|------------|-------------|------------|-------------|
| 0 | ISSUED FOR TENDER | 10.07.2023 | | | |



**PIPING
SPECIFICATIONS**

**SPECIFICATION NO.
P.014714 G 11076 M002
(3CIU)**

SHEET 2 OF 6

| ITEM | SHORT CODE | SIZE FROM-THRU | END CONNECTION | RATING AND/OR SCHED. | DIMENSION STANDARD | MATERIAL | REMARKS |
|------------------------|------------|----------------|----------------------|----------------------|--------------------|-------------------------------------|-------------------|
| PIPES | P | 1/2" - 2" | BE-ANSI B16.25 | 80 | ANSI B36-10 | ASTM A 106 Gr. B | SEAMLESS |
| | | 4" | BE-ANSI B16.25 | 6.4 mm | API 5L | API 5L X 52 | ERW / SMLS |
| | | 6" | BE-ANSI B16.25 | 6.4 mm | API 5L | API 5L X 52 | ERW / SMLS |
| | | 8" | BE-ANSI B16.25 | 6.4 mm | API 5L | API 5L X 52 | ERW / SMLS |
| | | 10" | BE-ANSI B16.25 | 6.4 mm | API 5L | API 5L X 52 | ERW / SMLS |
| | | 12" | BE-ANSI B16.25 | 7.2 mm | API 5L | API 5L X 52 | ERW / SMLS |
| | | 16" | BE-ANSI B16.25 | 8.7 mm | API 5L | API 5L X 52 | ERW / SMLS |
| | | 18" | BE-ANSI B16.25 | 9.5 mm | API 5L | API 5L X 52 | ERW / SMLS |
| ELBOWS 90 LR | E | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| ELBOWS 45 LR | E45 | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| ELBOWS 30 LR | E30 | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| ELBOWS 22.5 LR | E22.5 | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| ELBOWS 15 LR | E15 | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| REDUCERS CONCENTRIC | RC | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| REDUCERS ECCENTRIC | RE | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| TEES EQUAL | T | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| TEES RED | TR | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| WELDOLETS | WEL | 3/4"-18" | BW - ANSI B16.25 | SEE PIPE | MANUFACTURER | ASTM A 105 | SEAMLESS |
| CAPS | C | 1/2" - 2" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | ASTM A 234 WPB | SEAMLESS |
| | | 4" - 18" | BW - ANSI B16.25 | SEE PIPE | ANSI B16.9 | API 5L X 52 or ASTM A860 WPHY 52 | |
| NIPPLES | NBEP | 1/2" - 1.1/2" | BOTH ENDS PLAIN | 80 | ANSI B36-10 | ASTM A 106 Gr. B | SEAMLESS-LG=100mm |
| | NOET | 1/2" - 1.1/2" | ONE END THRD-MNPT | 80 | ANSI B36-10 | ASTM A 106 Gr. B | SEAMLESS-LG=100mm |
| | NBET | 1/2" - 1.1/2" | BOTH ENDS THRD-MNPT | 80 | ANSI B36-10 | ASTM A 106 Gr. B | SEAMLESS-LG=100mm |
| FULL COUPLINGS THRD | CF | 1/2" - 1.1/2" | FNPT ANSI B1-20-1 | 3000# | ANSI B16.11 | ASTM A 105 | SEAMLESS |
| CAPS THRD | C2 | 1/2" - 1.1/2" | FNPT ANSI B1-20-1 | 3000# | ANSI B16.11 | ASTM A 105 | SEAMLESS |
| PLUGS THRD | PL | 1/2" - 1.1/2" | MNPT ANSI B1-20-1 | 3000# | ANSI B16.11 | ASTM A 105 | SEAMLESS |



PIPING SPECIFICATIONS

SPECIFICATION NO.
P.014714 G 11076 M002
(3C1U)

SHEET 3 OF 6

| ITEM | SHORT CODE | SIZE FROM-THRU | END CONNECTION | RATING AND/OR SCHED. | DIMENSION STANDARD | MATERIAL | REMARKS |
|----------------------------|------------|----------------|------------------|----------------------|------------------------------|---|--|
| WN FLANGES | F | 1/2" - 2" | | 300# RF | ANSI B16.5 | ASTM A 105 | |
| | | 4" - 18" | | | ANSI B16.5 | ASTM A 694 F 52 | Always to be welded on 3C1 pipe |
| ORIFICE FLANGES | FO | 1/2" - 2" | | 300# RF | ANSI B16.36 | ASTM A 105 | COMPLETE WITH GASKET BOLTS, NUTS JACK-SCREWS AND PLUGS |
| | | 4" - 18" | | | ANSI B16.36 | ASTM A 694 F 52 | |
| BLIND FLANGES | FB | 1/2" - 2" | | 300# RF | ANSI B16.5 | ASTM A 105 | |
| | | 4" - 18" | | | ANSI B16.5 | ASTM A 694 F 52 | |
| DRIP RINGS | DR | 1/2" - 2" | | 300# RF | ANSI B16.36 | ASTM A 105 | 3/4" FNPT OUTLET CONNECTION |
| | | 4" - 18" | | | ANSI B16.36 | ASTM A 694 F 52 | |
| SPECTACLE BLINDS | SB | 1/2" - 2" | | 300# RF | ANSI B16.5 | ASTM A 515 GR 70 | |
| | | 4" - 18" | | | ANSI B16.5 | ASTM A 694 F 52 | |
| RESTRICTION ORIFICES | RO | 1/2" - 2" | | 300# RF | ANSI B16.5 | ASTM A240 GR 304 | |
| | | 4" - 18" | | | ANSI B16.5 | ASTM A 694 F 52 | |
| MONOLITHIC | IJ | 2"-8" | BW - ANSI B16-25 | 300# | ANSI B16.5 | PIPE PUPS: Same as pipe Material Forged Ring - ASTM A 105 | REFER DATA SHEET |
| INSULATING | | 4" - 18" | BW - ANSI B16-25 | 300# | API 5L | PIPE PUPS:API 5L X 52 Forged Ring - ASTM A 694 F52 | REFER DATA SHEET |
| JOINTS | | | BW - ANSI B16-25 | 300# | API 5L | PIPE PUPS:API 5L X 52 Forged Ring - ASTM A 694 F52 | REFER DATA SHEET |
| | | | BW - ANSI B16-25 | 300# | API 5L | PIPE PUPS:API 5L X 52 Forged Ring - ASTM A 694 F52 | REFER DATA SHEET |
| STUD BOLTS | B | 1/2" - 18" | | 300# RF | ANSI B18.2.1 ANSI B18.2.2 | ASTM A 193 B 7 HEXAGONAL NUTS ASTM A194 GR 2H | |
| GASKETS SPIRAL WOUND | G | 1/2"-18" | | 300# RF | API 601 MSS SP 44 | WINDING ANSI 304 FILLING PURE GRAPHITE CENTERING RING CS | 4.5 mm THK |



**PIPING
SPECIFICATIONS**

**SPECIFICATION NO.
P.014714 G 11076 M002
(3C1U)**

SHEET 4 OF 6

| ITEM | SHORT CODE | SIZE FROM-THRU | END CONNECTION | RATING AND/OR SCHED. | DIMENSION STANDARD | MATERIAL | REMARKS |
|--------------------|------------|----------------|--|----------------------|--------------------|---|---|
| BALL VALVES | VBA | 1/2" - 1 1/2" | FLGD RF:ANSI B16-5 | 600# | ANSI B16-10 | BODY: ASTM A 105 BALL: SS 316 | FULL BORE WRENCH OPERATED. FIRE SAFE |
| | | 2" - 4" | FLGD RF:ANSI B16-5 or BW :ANSI B16.25 | 300# | ANSI B16-10 | BODY: ASTM A 216 WCB/A234 WPB BALL: (ASTM A 216 WCB / A 234 WPB) with ENP (75 microns) | FULL BORE / REDUCED BORE AS INDICATED IN DATA SHEET DOUBLE BLOCK & BLEED WRENCH OPERATED. FIRE SAFE |
| | | 6" - 18" | FLGD RF:ANSI B16-5 or BW :ANSI B16.25 | 300# | ANSI B16-10 | BODY: ASTM A 216 WCB/A234 WPB BALL: (ASTM A 216 WCB / A 234 WPB) with ENP (75 microns) | FULL BORE / REDUCED BORE AS INDICATED DATA SHEET DOUBLE BLOCK & BLEED GEAR OPERATED/ACTUATED (AS PER MR) FIRE SAFE |
| GLOBE VALVES | VGL | 1/2" - 1 1/2" | FLGD RF:ANSI B16-5 | 600# | ANSI B16-10 | BODY: ASTM A 105 TRIM: ASTM A182 F6 | HANDWHEEL FIRE SAFE |
| | | 2" - 18" | FLGD RF:ANSI B16-5 | 300# | ANSI B16-10 | BODY: ASTM A 216 WCB/A234 WPB TRIM: ASTM A182 F6 | HANDWHEEL FIRE SAFE |
| SWING CHECK VALVES | VCH | 1/2" - 1 1/2" | FLGD RF:ANSI B16-5 | 600# | ANSI B16-10 | BODY: ASTM A 105 TRIM: ASTM A182 F6 | HORIZONTAL INSTALLATION VERTICAL INSTALLATION FLOW UPWARDS |
| | | 2" - 18" | FLGD RF:ANSI B16-5 | 300# | ANSI B16-10 | BODY: ASTM A 216 WCB TRIM: ASTM A 216 WCB | HORIZONTAL INSTALLATION VERTICAL INSTALLATION FLOW UPWARDS |



PIPING
SPECIFICATIONS

SPECIFICATION NO.
P.014714 G 11076 M002
(3CIU)

SHEET 5 OF 6

REDUCERS CHART

SMALL SIZE

L
A
R
G
E

S
I
Z
E

| | 1/2" | 3/4" | 1" | 1.1/2" | 2" | 3" | 4" | 6" | 8" | 10" | 12" | 14" | 16" | 18" | 20" | 24" | 28" | 30" | 32" | 36" |
|--------|------|------|----|--------|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1/2" | | | | | | | | | | | | | | | | | | | | |
| 3/4" | X | | | | | | | | | | | | | | | | | | | |
| 1" | X | X | | | | | | | | | | | | | | | | | | |
| 1.1/2" | X | X | X | | | | | | | | | | | | | | | | | |
| 2" | | X | X | X | | | | | | | | | | | | | | | | |
| 3" | | | | X | X | | | | | | | | | | | | | | | |
| 4" | | | | X | X | X | | | | | | | | | | | | | | |
| 6" | | | | | | X | X | | | | | | | | | | | | | |
| 8" | | | | | | | X | X | | | | | | | | | | | | |
| 10" | | | | | | | X | X | X | | | | | | | | | | | |
| 12" | | | | | | | | X | X | X | | | | | | | | | | |
| 14" | | | | | | | | X | X | X | X | | | | | | | | | |
| 16" | | | | | | | | | X | X | X | X | | | | | | | | |
| 18" | | | | | | | | | | X | X | X | X | | | | | | | |
| 20" | | | | | | | | | | | | | | | | | | | | |
| 24" | | | | | | | | | | | | | | | | | | | | |
| 28" | | | | | | | | | | | | | | | | | | | | |
| 30" | | | | | | | | | | | | | | | | | | | | |
| 32" | | | | | | | | | | | | | | | | | | | | |
| 36" | | | | | | | | | | | | | | | | | | | | |
| 42" | | | | | | | | | | | | | | | | | | | | |

LEGEND

X : CONCENTRIC AND ECCENTRIC REDUCERS-BW



**PIPING
SPECIFICATIONS**

**SPECIFICATION NO.
P.014714 G 11076 M002
(3CIU)**

SHEET 6 OF 6

BRANCH CHART

BRANCH SIZE

**H
E
A
D
E
R

S
I
Z
E**

| | 1/2" | 3/4" | 1" | 1.1/2" | 2" | 3" | 4" | 6" | 8" | 10" | 12" | 14" | 16" | 18" | 20" | 24" | 28" | 30" | 32" | 36" | |
|--------|------|------|----|--------|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| 1/2" | T | | | | | | | | | | | | | | | | | | | | |
| 3/4" | TR | T | | | | | | | | | | | | | | | | | | | |
| 1" | TR | TR | T | | | | | | | | | | | | | | | | | | |
| 1.1/2" | W | TR | TR | T | | | | | | | | | | | | | | | | | |
| 2" | W | W | TR | TR | T | | | | | | | | | | | | | | | | |
| 3" | W | W | W | TR | TR | T | | | | | | | | | | | | | | | |
| 4" | W | W | W | W | TR | TR | T | | | | | | | | | | | | | | |
| 6" | W | W | W | W | W | TR | TR | T | | | | | | | | | | | | | |
| 8" | W | W | W | W | W | BW | TR | TR | T | | | | | | | | | | | | |
| 10" | W | W | W | W | W | BW | BW | TR | TR | T | | | | | | | | | | | |
| 12" | W | W | W | W | W | BW | BW | BW | TR | TR | T | | | | | | | | | | |
| 14" | W | W | W | W | W | BW | BW | BW | BW | TR | TR | T | | | | | | | | | |
| 16" | W | W | W | W | W | BW | BW | BW | BW | BW | TR | TR | T | | | | | | | | |
| 18" | W | W | W | W | W | BW | BW | BW | BW | BW | TR | TR | T | | | | | | | | |
| 20" | | | | | | | | | | | | | | | | | | | | | |
| 24" | | | | | | | | | | | | | | | | | | | | | |
| 28" | | | | | | | | | | | | | | | | | | | | | |
| 30" | | | | | | | | | | | | | | | | | | | | | |
| 32" | | | | | | | | | | | | | | | | | | | | | |
| 36" | | | | | | | | | | | | | | | | | | | | | |

LEGEND

T : TEE EQUAL-BW

TR : REDUCING TEE-BW

W : WELDOLET- BW

BW : BRANCH WELD-CHECK IF REINFORCING PLATE IS NECESSARY ACCORDING ASME B 31.8



LIST OF RECOMMENDED VENDORS / SUBCONTRACTORS



RECOMMENDED VENDOR LIST

P.014714 G 11040
M001

| Sl. No. | Item | Name of the vendor / Brands |
|---|--|---|
| 1 | BALL VALVE | Flow Chem |
| | | L&T Limited (Audco India Limited) |
| | | Microfinish Valves |
| | | Hawa Valves |
| | | leader valve |
| | | Steel Strong Valves (i) Pvt Ltd |
| 2 | PRESSURE GAUGE | Waree |
| | | A N Instrument |
| | | Wika |
| | | Baumer |
| 3 | ELECTRODE | LINCOLN E-6010-2.5mm, E-7010-P1 - 3.2 mm |
| 4 | Field Joint Coating Material (for Open Trench Laying) | HTLP-80 heat shrink sleeve of M/s SEAL FOR LIFE INDIA PRIVATE LIMITED |
| | | GTS-80 heat shrink sleeve of M/s CANUSA, CANADA |
| 5 | Field Joint Coating Material (for HDD Laying) | DIRAX of M/s Seal for Life India Private Limited. |
| | | DDX™ Directional Drilling Kit of M/s Canusa |
| 5 | Casing insulator | Raychem RPG Limited |
| | | Raci, Italy |
| 6 | Casing End closure | Raychem RPG Limited |
| | | Raci, Italy |
| LIST OF MANUFACTURER/VENDORS OF CP MATERIALS/EQUIPMENT FOR PERMANENT / TEMPORARY CP SYSTEM | | |
| 7 | Mixed Metal Oxide (MMO) Anodes | M/s MATCOR USA |
| | | M/S BSSTECH |
| | | M/s Titanor Components Ltd., Goa |
| 8 | Cables | M/s Netco Cable Industries Pvt. Ltd., New Delhi |
| | | M/S KEC, INDIA |
| | | M/s. Delton Cables |
| | | M/S SUYOG CABLES, VADODARA |
| 9 | Spark Gap Arrestor / Surge Diverter | DEHN, Germany |
| | | Mc Miller |
| | | OBO BETTERMAN, GERMANY |
| | | Dairy land electrical industries |
| 10 | Cu/CuSo4 Reference Cells | Mc Miller, USA |
| | | Borin, USA |
| | | HARCO, USA |
| | | TINKER & RAJOR |
| | | Krick |
| 11 | Thermit Weld Material | M/s Erico Europa |
| 12 | Petroleum Coke Breeze | M/s Goa Carbon , Goa |
| | | M/S PETROCARBON & CHEMICAL COMPANY, HALDIA |
| | | M/s India carbon, Durgapur(WB) |
| 13 | Mg/Zn Anode | Corrtech International Pvt. Ltd. |
| | | Titanor Component Ltd., Goa |
| | | M/s Scientific Metal Engineers Karaikudi |
| 14 | Pin brazing | BAC |
| | | Safetrack |
| 15 | Cable Lugs | Ismail, Ranchi |
| | | Dowels, Mumbai |
| 16 | Cable Glands | Flexpro Electrical Pvt. Ltd., Mumbai |
| | | Flameproof Equipment Pvt. Ltd., Mumbai |
| | | Baliga Lighting Equipment Ltd., Chennai |



RECOMMENDED VENDOR LIST

**P.014714 G 11040
M001**

| Sl. No. | Item | Name of the vendor / Brands |
|---------|---|--|
| 16 | Sacrificial Anode- magnesium & Zinc | M/s Sargam Metals, Chennai |
| | | M/s Xian, China |
| | | M/s Platbros USA |
| | | M/s Shakti Enterprises, Ahmedabad |
| | | M/s Yuxi, China |
| 17 | BACKFILL | M/s India Carbon |
| | | M/s Goa Carbon |
| 18 | Polarization cell | Mc Miller |
| | | Krik Engineering |
| 19 | Junction Box | Exprotecta |
| | | Flexpro |
| | | FELP Control Gears |
| | Test Station/ Junction Box(Weatherproof) | M/s UNDTs |
| | | M/s Cortech International |
| | | M/s CCS, MUMBAI |
| | | M/s Raychem RPG Pvt Ltd |
| 18 | Solid State Decoupler | Kriston Systems |
| | | Dehn Germany |
| | | RUSTROL, USA |
| | | Dairyland Electricals,USA |
| 20 | WARNING MAT | Sparco Multiplast Pvt. Ltd. |
| | | Singhal Industries |
| | | Bina Enterprises |
| | | Shree Vijay Wires & Cable |
| 21 | HDPE DUCT FOR OFC | Jain Irrigation System Ltd., Jalgaon |
| | | Parixit Industries Ltd., Ahmedabad |
| | | Veekay Plast |
| | | Himalayan Pipe Industries |
| | | Pioneer plastic Industries Pvt Ltd. |
| 22 | Optical Fibre Cable | Finolex Cable |
| | | Birla Ericsson Optical Ltd., Rewa (M.P.) |
| | | RPG Cables Limited |
| | | Tamilnadu Telecommunications Limited |
| | | U M Cables |
| | | Himachal Futuristic Communications Ltd. |
| 23 | PIPE FITTINGS (SEAMLESS / WELDED) | Sterlite Industries (I) Ltd. |
| | | Amforge Industries Pvt Ltd |
| | | Sky Forge Pvt Ltd, Palwal |
| | | United forge Industries |
| | | Siddharth & Gautam |
| | | A.M.Engineers |
| | | Allied International SRL Italy |
| | | Bassi Luigi Fittings, Italy |
| | | GAM Raccordi Spa Italy |
| | | Vivial Forge Pvt Ltd. |
| | | Teekay Tube |
| | | Pipefit Engineers |
| | | Sawan Engineers |
| | | DEE DEVELOPMENT ENGINEERS PVT. LTD. |

| | | RECOMMENDED VENDOR LIST | | P.014714 G 11040 M001 |
|-----------------------------------|--|--|--|--------------------------|
| Sl. No. | Item | Name of the vendor / Brands | | |
| 24 | PIPE FITTINGS (Forged) | Siddharth & Gautam | | |
| | | Sky Forge Pvt Ltd, Palwal | | |
| | | Amforge Industries | | |
| | | A.M.Engineers | | |
| | | Vivial Forge Pvt Ltd. | | |
| | | Sawan Engineers | | |
| | | United forge Industries | | |
| | | DEE DEVELOPMENT ENGINEERS PVT. LTD. | | |
| 25 | Flanges | Echjay Industries Pvt. Ltd. | | |
| | | CD Industries | | |
| | | Choudhary Hammer Works | | |
| | | Vivial Forge Pvt Ltd. | | |
| | | United forge Industries | | |
| | | A.M.Engineers | | |
| | | Metal Forgings (P) Ltd. | | |
| | | Punjab Steel Works | | |
| | | JAV Forgings Pvt. Ltd. | | |
| | | C D Engineering Co. | | |
| | | J K Forgings | | |
| SANGHVIFORGING & ENGINEERING LTD. | | | | |
| 26 | Insulating Joints | IGP Engineers Pvt. Ltd., Chennai, Tamil Nadu, India | | |
| | | ADVANCE Electronics System, Gujarat, India | | |
| | | Nupros Inc. | | |
| | | Vee Kay Vikram & Co. LLP, AHMEDABAD - 380054 ,Gujarat, India | | |
| 27 | PE(Fitting/Valves/Transition Fittings) | Georg Fischer Piping System | | |
| | | Kimplas piping Systems | | |
| | | Glynwed pipe systems | | |
| | | AL-Aziz | | |
| 28 | Rockshield | Seal for Life | | |

Note: 1. Any other vendor may be accepted based on their PTR (past track record) at the sole discretion of OWNER/PMC

2. For the vendors of items not covered in above vendor list, but required for completion of project successfully, supplier shall take approval form Owner/Owners representative for the same during project execution. Bidder shall submit the required certifications, documents, PTR and Performance letters from clients for the same.