



4.0 PROCESS PARAMETERS

Inlet pressure	:	Max. 4 barg
Out let pressure	:	0.1 barg-4 bar (Variable)
Operating temp	:	0 – 45°C
Design Pressure	:	19 barg
Design temp. (min/max)	:	0/+60°C
Hydro test Pressure (MRS)	:	1.5 x Design Pressure (Hydrostatic Test) with minimum test duration of 4 hrs.
Pneumatic Leak Test	:	6 bar for minimum 4 hrs.
Flow (m ³ /hr)	:	Up to 250 m ³ /hr (at 2 barg 750 SCMh)
Process Fluid	:	Natural Gas

5.0 MATERIAL SPECIFICATION OF PIPING SYSTEM

Materials to be used for piping system shall comply with the minimum requirements of relevant standards & codes.

Pipes	ASTM A106 Gr. B (Seamless)/API 5L Gr.B/ IS-ASTM A 53/A53 M Gr.B/ 1239Heavy
Flanges	ASTM A105/ A 105
Restricting Orifice* plate	SS 304
Rubber Gasket (washer)	High Nitrile Synthetic Rubber Grade 215
Fittings	ASTM A234 Gr WPB
Ball Valves	A 105/A 216 Gr WCB
Insulation	NA
Insulating gasket	Same as Pipe (Ring A 105)
Spiral Wound Gasket (washer)	ANSI B 16.20
Nuts and Bolts	AS per PMS
Rubber hose	Type-4 as per IS:9573
Painting	As per enclosed "

The size of orifice of restricting orifice plate shall be 11 mm for G10/G16/G25, 13mm for G40 and 15mm for G65 RPD meter.

The size of orifice of rubber gasket (washer) shall be 5mm for G4, 8mm for G6, 10mm for G10 & G16 and 13mm for G25 Diaphragm meter.

Note: - Over and above these specifications and materials, please refer below the specifications.



1. For Piping material refer "PMS-1C1"
2. All stud bolts and nuts shall not have dipped galvanized as per ASTM A53.

6.0 SITE ENVIRONMENTAL DATA/CONDITIONS

Environmental/ climatic conditions for various sites are given below

Typical	:	
Temperature	:	(Min/Max.) ^o 1.7 ^o C/48.5 ^o C
Rain fall	:	*
Wind	:	*
Seismic Zone	:	*
Relative humidity	:	90%
Elevation from Mean Sea Level	:	205 met.
Hazardous Area Classification	:	*

7.0 PIPE DESIGN/ SIZING

8.1 Coding of Piping Classes

Each Class is named by a code consisting in three or four parts:

First parts:

A figure designating the material:

- 1= 1500 lbs ANSI - PRESSURE – 18.75 bar g
- 3= 300 lbs ANSI - PRESSURE – 49.00 bar g
- 6= 600 lbs ANSI - PRESSURE - 98.00 bar g
- 9= 900 lbs ANSI -

Second part:

A letter designating the material:

- A= Allot steel
- C= Carbon steel
- F= Fiberglass reinforced plastic/epoxy (FRP)
- G= Galvanized
- P= Plastic (HDPE)
- 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
- AG= Above Ground

8.2 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.

8.3 Corrosion Allowance

The minimum corrosion allowances used to calculate wall thickness as follows:

- Carbon steel and ferrite alloys in classes calculated following ANSI B 31.8 : 1.6 mm
- Carbon steel and ferrite alloys in classed calculated following ANSI B 31.3 : 1.6 mm
- Stainless steel : 0 mm
- Plastic and PRP pipes : 0 mm

8.4 Wall Thickness Calculation

a) Pipes for natural gas shall comply with ASME/ANSI B 31.8 code. Pipe wall thickness will be calculated as follows:

$$t = \frac{PD}{2xSxFxE} + C$$

- T = nominal wall thickness (mm)
- P = design pressure (MPa)
- S = minimum yield strength (Mpa)
- F = design factor = 0.40
- E = longitudinal joint factor
= 1.0 for API 5L (seamless or ERW or SAW)
- T = temperature de-rating factor = 1.0
- C = corrosion allowance (mm)



- b) Pipes for Utilities lines have a wall thickness complying with ASME/ANSI B 31.3 code:

$$t = \left\{ \frac{PD}{2xSxFxE} + C \right\} \times (1+a)$$

- 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 of ANSI 31.3
C = Corrosion allowance (mm)
A = Negative fabrication tolerance (%)

8.0 Wall Thickness Calculation

1.0 Nitrogen at 7kg/cm²

2.0 Above utility data may change according site condition and availability of resources.

9.0 SAFETY

All required Personal Protective Equipments (PPEs) for carrying out the jobs safely to be provided to the workers.

The agency has to ensure that potential safety factors, health and environment effects are assessed before execution of the job and necessary actions required for ensuring safety of human and environment are taken care of.

Jobs at customer locations are to be carried out as per safety Work Permit System of IGL- i.e, permit will be issued at site every day after ensuring all safety precautions and execution of the job to be done in presence of representatives of IGL's Technical, Fire & Safety and designated Contract Supervisor.

10.0 FABRICATION OF MRS AND INTERNAL PIPING:

This part covers fabrication, erection and installation of MRS, Common header for MRS installation, internal pipeline with fittings for supply natural gas to commercials and Industrial units from MRS till customer's appliances. Work for internal Piping shall be carried out as per instructions and after allotment of work by EIC. The Indicative diagram is shown in bid documents.

On allotment of work, Contractor shall carry out join survey along with IGL/IGL's representative of the customer's premises for finalization of location of MRS/Common header



or route of internal Piping and as per requirement and shall subsequently submit construction plan to IGL for Procurement of material (Pipe, fittings, consumables etc.), Inspection, Fabrication Erection Installation Testing and Commissioning of MRS, Common header & Internal Piping as enclosed at Annexure – 3. The material procurement plan includes make of pipes & fittings to be procured as per the approved make list (enclosed in tender document at) for approval from EIC.

After approval of plan from EIC and before start of fabrication, Contractor shall procure material and submit material test certificates (MTC'S) of all materials including pipes, fittings ball valves, consumables (incl. Electrodes) etc. for review of EIC and shall subsequently arrange their physical inspection. Contractor shall also submit documents for welding procedure specifications (WPS) for the similar kind of job for IGL's approval.

IGL may instruct the contractor to carry out survey of proposed customer and shall in turn submit the estimate for material and execution along with drawing without any changes Welder shall be qualified for proposed WPS according to the applicable codes. If the same welder is doing the similar kind of job continuously for the last six months and qualified by reputed consulting organizations like EIL/MECON/TEPL, the welder shall be allowed to work on submission of welder's qualification Certificate.

Only E6010/E7018 electrodes of reputed make (LINCOLN, ESAB etc.) shall be used for welding of piping joints. The electrode E7018 shall be baked in mother oven before usage at site. All flanges used shall be of welded neck type. No plate flanges made by Gas cutting shall be used. Flanges dimensions, ratings, facing, face finish and manufacturing shall be as per ANSI B16.5 unless otherwise specified. All fittings shall be seamless in construction unless otherwise specified. All fittings of size 1" and above shall have butt-welded ends and shall comply with attached piping class.

Mitre joint shall not be used and the same shall be replaced with a Standard Elbow with short radius (<_1D). Piping Spools (If required), Supports etc. shall be pre-fabricated or shop fabricated. Pipe shall be supported on walls or Suitable supports (clamps, steel supports etc.) (refe drawing in tender document at Annexure – 4) and at adequate interval of space not less than 2 metres. The material and size of angles shall be MS and of minimum size 75 x 75x 8 mm.

End Preparation, alignment and fit up of the pipe length to be welded, pre heating, welding, post heating and heat treatment (if required) shall be as per IGL welding specification/design codes and standards. Pipe joints shall be butt-welded. However as per site requirement, flanged joints (if necessary) may also be used Contractor to ensure provision for locking/sealing arrangement for meter/valves to avoid misuse.

All (100%) root joints alignment & fit up shall be witnessed by IGL/IGL representative followed with a mandatory DP (Dry penetrate) test. In addition to the DP test. RT will be carried out in presence of IGL's representative on at least 10% of joints in single MRs using unique joint no. The dimension tolerances for piping fabrication shall be as per IGL's standards design codes and standards.



Contractor shall carry out Hydro test for each MRS in their factory and shall carry out installation only after duly certification from IGL/IGL's representative. The test reports/certificates (DP test RT, Hydro test, NDT) issued against a single MRs shall be presented to IGL's site representative for verification and before start of installation. The format FPR DPT, RT, Hydro test, welding inspection & NDT is attached at Annexure – 5, 6, 7, 8 & 9 respectively.

For MRS, dimensions tolerance of 100% both ways against pre-defined length (refer drawings attached in tender) shall be included in fabrication & installation rates (payable as per SOR Item no. 29.1 to 29.5) and no separate charges shall be claimed in case of any additional joints, fittings etc. used for completion of installation. The bidder shall quote rates against each SOR in correlation with drawings, tentative BOM (Bill of Materials) attached in tender document. Any installation/piping in excess/ short to predefined length of MRS shall be payable/deductible through SOR item no. 31.1.3 to 31.1.5 as per size of pipe used. The length of the MRS shall be measured after installation and RFC and shall duly be certified in RFC card for payments. Contractor shall provide suitable locking arrangement in MRS with isolation valve by wire sealing as per instruction of Engineer In-charge.

The rates for internal piping (downstream of MRS) are payable through SOR item nos. 31 includes procurements, fabrications, welding and installation till commissioning. No separate charges are payable for any repair & modifications (on customer's request) even after installation & testing however before commissioning and are inclusive in rates. The ball valves installed in common header/Internal piping shall be payable separately through SOR item no. 30.9 to 30.11, depending upon the size of pipeline.

Laying of concealed pipeline in the cavity of the walls/ceiling/basement shall be avoided. In locations where the pipeline has to be laid in a covered trench or below ground level, it should be avoided however considering the minimal alternatives/ constraints at site, the laying is possible after written approval from EIC, cold wrap & coating shall be applied on the surface of the pipe followed by Holiday test. The pipe shall be properly supported on clamps/I supports with minimum clearance of 4" from ground level. IGL may also instruct the contractor for installation/laying of MDPE pipeline and transition fittings for such below ground sections which shall be laid in correlation of technical specification of MDPE pipeline laying and payable as per the respective pipe SOR's.

In case where MRs fabrication & installation is carried out considering twin metering and single regulation (in a single MRS), the payment against the installation of both streams shall be made as per SOR item no. 29.3 or 29.4 for one of the stream and as per SOR item no. 31 for the other stream depending upon the type and size of the CS Pipeline used for MRs fabrication. Also, in case of twin metering and twin regulation, the payment against the installation of either of the streams shall be made as per SOR item no. 29.1 to 29.5 and for loop line connecting both streams in running meter as per SOR item no. 31 depending upon the type and size of the CS pipeline used for MRS fabrication.

Any preparation of the threads for installation, completion of MRS, common Header & internal piping is inclusive in rates. All the MRS shall be fabricated in the Contractors workshop and tested in presence of IGL's representative before installation. After complete



installation of the MRS at the allocated locations; the flange joints shall be tested online along with Meter & Regulator before commissioning.

The branches of the pipeline shall be using standard fittings. Also, branching on common header will be payable in running meters.

11.0 ERECTION OF MRS SKID

11.1. Cleaning of piping before erection.

Before erection, all pre-fabricated spool pieces, pipe, fittings etc. shall be cleaned inside and outside by suitable means (Mechanical or chemical). The cleaning process shall include

- Removal of all foreign materials such as scale, sand, weld spatters, cutting chips etc. by wire brush, cleaning tools and blowing out the foreign material with compressed air and/or flushing out with water.
- Special cleaning requirements (if any), shall be carried out as per IGL specification/piping design codes/standards.

11.2. Pipe routing and Layout

Pipe routing and lay-out shall be as per IGL approved pipe route, GAD, P&IDs and piping support drawings and applicable design code and standards. In case of fouling of a line with other piping, structure, equipments etc. The matter shall be brought to the notice of Engineer-in-charge and corrective action shall be taken as per his instructions. Above ground pipeline shall be laid either on MS clamps fixed on the wall or on the pipe supports with BOP more than 2 mtr height.

The selection of route of installation gas pipeline connection in the premises of the industry/ commercial establishment is key to safety and integrity of gas installation and public. It should be installed above ground having in well-ventilated area and having easy approach.

All risers and lateral piping should be clamped to the building at intervals not exceeding one meter. Laying of concealed pipeline inside the cavity of the walls, ceiling, basement etc. should be avoided, Platform and cross-over shall be provided for ease of operation and maintenance of pipeline if required. All supports shall be installed strictly as per approved support drawing/instruction of engineer-in-charge.

While laying the pipeline, care should be taken that valves installed on the pipeline should be approachable for easy operation and maintenance.

11.3. Flanges Connections



While lifting up mating flanges, care shall be taken to properly align the pipe and to check the flanges for trueness so that the faces of the, flanges can be pulled together without inducing any stresses in the pipe and the equipment.

The assembly of the flange joint shall be done in such a way that the spiral wound gasket between the two flange faces is uniformly compressed. To achieve this bolt shall be tightened in a proper sequence. Copper strips/ jumpers shall be installed on all flange joints in order to provide earth continuity to MRS & internal piping.

11.4. Vents

Venting facilities shall be provided for any emergency evacuation of gas from the pipeline. Vent line shall be fitted with a flapper and shall be at 3-meter height from the nearest operating platform, with ends at open space.

11.5. Painting

After installation of the above ground MRS & Internal piping system, painting of MRS/piping shall be done after RFC with proper surface preparation and application of primer and finish coat of paints as per IGL painting specifications enclosed in Annexure I, to prevent atmospheric corrosion, the standard colour code for Natural gas piping shall be 'Canary yellow'. The gas flow direction shall be marked "in Red" on the MRS or Internal Piping.

11.6. Valve Installation

Valve shall be installed in a position as specified in the valve manufacturer installation and O&M manual. Care shall be exercised to ensure that all hL11 bore ball valve shall be installed with the "Gas Flow direction arrow" marked on the valve body pointing in the right direction after written consent from EIC.

11.7. Instruments

All the required instruments (PG, TG, flow control valves, interlocks, control panel etc..) shall be installed on the pipeline as per attached MRS Drawings, Owner's approved installations procedure, applicable design code and standards, manufacturer's installation, O&M Manual after proper calibration, testing and inspection of the instruments as per manufacturer's calibration procedures. It is mandatory to install pressure gauges on the downstream internal piping at start and end point. Any installation of additional pressure gauge will be payable as per **SOR item No. 30.8** and subsequent fillet welding of sockets & installation of pressure gauge will be payable as per **SOR item no. 30.13**.

11.8. Rubber Hose

The Steel Pipe and Appliances connect to Hose shall be in the same room. The length of hose should be kept minimum but shall not exceed 1.50 meters. Hose shall be easily accessible to inspect. Hose shall not be used in conditions where ambient temperature exceeds its design temperature. Hose shall be so installed [hat it is not twisted, looped or kinked in and should be free from external pressure. Design and Construction of Hose shall



be Type IV as per IS: 9573 (Latest revision).

11.9. Supports

Pipeline for PNG supply to Commercial/Industrial connection shall be adequately supported at suitable intervals as per piping design code and standard and good engineering practices. There are various types of clamp supports for supporting and suspending horizontal as well as vertical/riser pipes. The support's schematic drawing for piping are attached with the tender documents at Annexure -- 4. The material & size of the angle shall be MS & minimum size ---75 x 75 x 8 mm.

11.10. Electrical Equipments

All the required Electrical equipments shall be installed as per Owner's approved installation procedure, applicable design code (OISI). 149) and standards, manufacturer's installation / O&M Manual after proper calibration, testing and inspection of the equipments as per manufacturer's calibration procedures.

12.0 INSPECTION AND TESTING

12.1. Material Inspection

All materials, items and their parts shall be subjected to all mandatory as well as supplementary (wherever specified) inspection, testing and checks called for in the respective codes/standards/data sheets/IGL approved manufacturer's QAP of Vendor at manufacturer's workshop/factory as well construction site. All fit-ups shall be checked for proper Root gap, surface cleaning and orientation etc. before starting the welding and inspected by IGL / IGL's representative.

Dye-penetrant test shall be done after root welding for all the butt & Socket weld joints. As per the instruction of EIC/PMC, Radiography test may be performed randomly on joints for 10% (percentage) on random selection basis.

12.2. Execution Inspection

- Ensure availability of Work Permit and Fire permit
- Visual Inspection of installation of various equipments, instruments and their associated components, electrical equipment's, pipe fitting and valves etc.
- Dimensional checking of equipment, pipe, fitting and valves etc.
- Inspection of Calibration of instruments
- Inspection of testing and commissioning of pipeline system
- Inspection and checking of DFT of painting of equipment, pipe, pipe supports etc.
- Inspection and checking of Mechanical completion of pipeline system with the approved construction drawing and work procedures for installation and erection of various equipment/pipeline



- Ensure availability of First AID Box, PPE and fire extinguishers.
- Inspection of flushing, cleaning and Hydro testing of Piping system
- All welded joints shall be subjected to visual inspection according to ASME 1.3/31.8 and radiography according to API1104.
- Inspection test plan shall be as per ANNEXURE-2
- Verification/Inspection of all the mill and workshop test certificates applicable to related material. spare, equipment, pipe, fittings, valves, supports, paints, IJ etc.
- The entire piping system shall be subjected to hydrostatic testing or pneumatic strength testing.
- 10% RT shall be done for all the Butt joints on random selection basis. Overall decisions rests with the EIC to increase %(percentage) of RT on joints, in case of any additional RT (on instruction of EIC) rates shall be payable as per SOR item no. 30.14
- The test pressure should be 1.5 times of design pressure in case of Hydrostatic testing or 1.1 times or the design pressure in case of Pneumatic testing. However, test pressure and time duration may vary depending upon the application and flow.
- Before commencement of strength Test, calibration reports of pressure gauges and equipments shall be reviewed by IGL/IGL's representative.
- Pressure gauge range shall be minimum 1.5 times and maximum 4 times of test pressure.
- Before starting hydrostatic testing, testing and inspection reports shall be submitted to IGL for verification and only after getting formal clearance from IGL, testing shall be carried out.
- The test pressure for the piping system shall be kept on hold for 4 hr with no pressure drop. For internal piping with pipe length less than 25 meters, the test pressure shall be kept on hold for 4 hrs. Whereas if length more than 25 meters, minimum test pressure duration shall be minimum 12 hr to max. 24 hrs. depending upon customer's/ site requirement.
- After hydro testing proper dewatering and purging shall be carried out.
- Care should be taken to ensure that the purge outlet is so located that vent gas cannot drift in the building.
- The method of purging should be such that no pockets of air left in any part of the piping.
- It should be ensured that the area is well ventilated and free from ignition source.
- Inspection and testing of Electrical, Civil and Instrumentation work shall be carried out by quality control inspector of related Engineering disciplines.
- All the MTC/TC, Inspection and test reports for mandatory as well as supplementary (wherever specified) shall be submitted to IGL.

13.0 PRE-COMMISSIONING AND COMMISSINING

The various acceptance criteria and handover of the MRS system shall comprise of