INDRAPRASTHA GAS LIMITED

TENDER DOCUMENT
FOR
SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

TECHNICAL VOLUME
TENDER DOCUMENT NO. IGL/ET2/CP/CP18160

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METERING AND REGULATING SKIDS (MRS) FOR CGD PROJECT

SECTION 1

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

SCOPE OF WORK

(DOC No.- MRS-SOW/IGL/ET2/CP/CP18160)

1.0 SCOPE

The SCOPE shall cover as a minimum the design, manufacture, assembly, test, FAT (Factory acceptance test), supply of MRS skid (as per tender specifications) including loading, transport & unloading at Owner's store / site location, Commissioning, SAT (Site Acceptance Test) with all required accessories, warranty, supply of documentation of Filtration, Metering and Pressure Regulating Skids comprising of complete assembly, NDT report, and other accessories as specified in this document for natural gas supply.

2.0 SPECIAL INSTRUCTIONS TO CONTRACTOR

- Bidder shall submit their offer in a well-documented manner with all required documents as listed in "Material Requisition" (but not limited to) of this tender document. Bidder shall note that no correspondence whatsoever shall be entertained after the bid submission.
- The language of bidder's offer including catalogue, technical literature or any other documents or any software shall be **English** language only. This shall be applicable for bought out items also.
- Scope of the bidder shall be as per the tender specification. Any other activities not specifically mentioned /covered in the tender documents but otherwise required for satisfactory completion/safety of work has to be carried out by the contractor within specified schedule at no extra cost to owner.
- Bidder shall strictly follow the Recommended Contractor List attached with the tender document for various items.
- The submission of prices by the bidder shall be constructed to mean that he has confirmed compliance with all technical specifications.
- Bidder shall complete the pricing schedule indicating against each item the basic model number offered. The prices indicated in the pricing schedule shall include prices for inspection, statutory certificate requirements, testing and documentation.
- Fabrication/ manufacturing shop to be approved by Owner/Owner's representative before actual commencement of fabrication.
- Layout configuration shall be finalized during detail engineering. No extra time and cost implication shall be considered in this regard.

3.0 GENERAL

3.1 Definitions

Subject to the requirements of the context, the terms (hereafter listed in alphabetical order) used in this specification are given the following meaning:

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.
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 ENGINEER	Designates the agency/person 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, 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 by 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.

4.0 STATUTORY APPROVALS / CERTIFICATES (AFTER GETTING ORDER)

4.1 The bidder shall be responsible for obtaining all statutory approvals, as applicable for all instruments and instrumentation systems.

4.2 The bidder shall comply all the requirements of PNGRB T4S regulations.

4.3 Equipment / instrument / systems located in electrically hazardous areas shall be certified for use by statutory authorities for their use in the area of their installation. In general, following certification shall be provided by the bidder.

For all flameproof equipment / instrument / systems, which are manufactured abroad (outside India) certification by any approving authority like BASEFA, FM, UL, PTB, LCIE, CENELEC etc. shall be required.

For all flameproof equipment / instrument / systems manufactured locally (within India), certification shall be carried out by any of the approved testing houses – Central Mining Research Institute (CMRI) etc. The manufacturer shall hold a valid Bureau of Indian Standards (BIS) license.

4.4 Intrinsically safe instruments shall be certified to ATEX directives.

5.0 APPLICABLE CODES & STANDARDS

5.1 The following Indian/ international or relevant codes and standards shall be used for designing the system. In all cases, latest revisions with amendments, if any, to be followed Apart from the specific codes mentioned herein, all other relevant and related codes concerning the specific job under consideration and/or referred to in these codes and technical specifications will be followed wherever applicable. All codes will be of the latest revision as on the date of issuing the tender/ bid document.

In the event of any conflict between this specification, related standards and codes, any other attachment to this tender, the Contractor shall refer the matter to OWNER'S/OWNER' REPRESENTATIVE for clarification and only after obtaining the confirmation on the same, should proceed with the manufacture/ supply / engineering of the item in question. The decision of the OWNER'S/OWNER' REPRESENTATIVE shall be binding on the Contractor.

CONTRACTOR shall seek CLIENT final interpretation of any conflicts prior to the execution of work. Rework of engineering and relevant scope arising out of underestimation shall be done at no additional cost to the CLIENT.

Sr. No	Codes	Description
1	OISD-STD-226	Natural Gas Transmission Pipelines and City Gas Distribution Networks.
2	ANSI/ISAS 51.1	Process Instrumentation Terminology.
3	ISA 5.4	Instruments Loop diagrams.
4	IEC 60529 / IS 2147 / NEMA	Specification for Weatherproof Enclosure.
5	IEC 60079	Specification for Flame Proof Enclosure
6	IEC 61000	Electromagnetic Compatibility for Industrial Process Measurement and Control equipment.
7	IEC 60801	EMI and RF interference
8	IS-1554 Part 1	PVC insulated (heavy duty) electric cables- working voltage up to and including 1100V.
9	BS-5308 Part 1, Type 2	Specification for PVC insulated cables.
10	IS 8130	Conductors of insulated cables
11	IS 5831	Specification for PVC insulation and sheath of insulated cables.
12	IS-3975	Mild steel wires, formed wires and tapes for armoring of cables.
13	ASTM D 2843	Test method for Max smoke density for cable
14	ASTM D 2863	Test method for measuring of Temp and O2 Index.
15	IEC 60754	Acid generation test
16	IEC-332-3 Part 3	Tests on bunched wires and cables.
17	BS 6121, EN 50262	Cable gland – flame proof Ex"d" or Exe increase safety.
18	DIN- 50049	Document on Material Testing.
19	ASME PTC 19.3	Temperature Measurement- calculation of natural frequency.

Sr. No	Codes	Description
20	IEC 751 / DIN 43760	RTD
21	IEC 584 / DIN 43710 / ANSI MC 96.1	Thermocouple
22	ISO 5167	Measurement of fluid flow by means of orifice plates, Nozzles and Venturi tube inserted in filled piping circular profile.
23	ASME B 16.36	Orifice flange with flange pressure tap.
24	ASME B16.5	Pipeline flanges and flanged fittings
25	API-RP-520	Sizing and selection of safety relief valves.
26	IS 3624 / BS EN 837	Pressure gauge
27	AGA 3	Orifice flow measurement
28	AGA 9	Ultrasonic flow measurement
29	AGA 8	Compressibility factor of natural gas.
30	AGA 10	Calculation of Speed of sound in Natural gas
31	API Spec 6A	Valve design methodology
32	API 6D	Petroleum and natural gas valve
33	ISA 75.01	Flow equation for sizing of control valve
34	ISA 75.02	Testing of CV rating, control valve capacity test
35	ISA 75.05	Control valve terminology
36	ISA 71.07	Laboratory measurement of aerodynamic noise generated by control valves.
37	FCI 70.2/ANSI B 16.104	Control valve seat leakage.
38	ASME/ANSI B 16.34	Valves-Flanged, Threaded and welding end.
39	IEEE 802	The LAN standards.
40	IEC-60870-5-04/101	SCADA Communication protocol

Sr. No	Codes	Description
41	DNP 3 (TCP/IP), DNP 3 (Modbus)	SCADA Communication protocol
42	IEC 61131	RTU, remote terminal unit
43	IEC 60870-5-101	Modbus serial RS232/Rs485
44	ISA 5.3-1983	Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic, and Computer Systems.
45	ISA-5.5-1985	Graphic Symbols for Process Displays
46	TIA/EIA 58	Communication standard
47	OISD	Oil Industry Safety Directorate Government of India
47.1	OISD 118	Layouts for Oil & Gas installations
47.2	OISD 152	Safety Instrumentation for Process System in Hydrocarbon Industry
47.3	OISD 153	Maintenance and Inspection of Safety Instrumentation in Hydrocarbon Industry
47.4	OISD 163	Process Control Room Safety
47.5	OISD 195	Safety in Design, Operation, Inspection and Maintenance of Hydrocarbon Gas Compressor stations and Terminals
48	NFPA	National Fire Protection Association
48.1	NFPA-70	National Electrical Code
48.2	NFPA-497	Electrical installation, classification of Class1 & Class 2 hazardous locations
48.3	NFPA-101	Life Safety Code
48.4	NFPA 325M	Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids for LEL of Gases
49	PNGRB	Technical & safety standards statutory requirements for natural gas pipelines.
50	RPD meter	EN 12480

Sr. No	Codes	Description
51	AGA 7	Turbine flow Meter
52	AGA 11	Coriolis type mass flow meter

6.0 POWER SUPPLY

6.1 Contractor shall supply a 12/24 V DC solar power supply system with 72 hrs back up for powering to EVC with GSM/GPRS modem, detectors, and skid equipment's. System should be capable of working in hazardous area.

7.0 SYSTEM CONFIGURATION

7.1 **MRS skid**

Type-1

Single stream dry gas Cartridge type filtration skid and instruments as per P&ID. The Cartridge Filter is designed/ provided with polyethylene / polypropylene / synthetic fibre elements for fine filtration up to **5 microns**.

7.2 Single stream rotary positive displacement (RPD) type gas flow metering skid with pressure, temperature element, Electronics Volume Corrector (EVC) battery operated along with inbuilt or external GSM/GPRS modem with bypass arrangement as per P&ID.

7.3 Dual stream (1W+1S) pressure reduction skid with Regulator and slam shutoff valve as per P&ID. Regulator and Slam shut valve can be separate or integrated.

7.4 Point gas detector (2Nos.). Common signals shall be interfaced with EVC as digital input.

7.5 AMR (Automated Meter Reading) System for data logging and hosting services in supplier's server for five years. Supplier shall supply software for remote data monitoring through GSM modem. The software shall be installed in IGL office / control room and actual performance of software for remote data monitoring shall be carried out by Supplier. All necessary arrangement required to perform software operation shall be done by Bidder at no extra cost.

7.6 Solar power with 72 hours battery backup.

7.7 All instruments shall be provided with skid.

7.8 Any other requirements as per PNGRB Guidelines

Type-2

7.9 Dual stream (1W+1S) dry gas Cartridge type filtration skid and instruments as per P&ID. The Cartridge Filter is designed/ provided with polyethylene / polypropylene / synthetic fiber elements for fine filtration up to **5 microns**.

7.10 Single stream rotary positive displacement (RPD) type gas flow metering skid with pressure, temperature element, Electronics Volume Corrector (EVC) battery operated along with inbuilt or external GPRS modem with bypass arrangement as per P&ID.

7.11 Dual stream (1W+1S) pressure reduction skid with Regulator and slam shutoff valve as per P&ID

7.12 Point gas detector (2Nos.). Common signals shall be interfaced with EVC as digital input.

7.13 AMR (Automated Meter Reading) System for data logging and hosting services in server for five years. Supplier shall supply software for remote data monitoring through GSM modem. The software shall be installed in IGL office / control room and actual performance of software for remote data monitoring shall be carried out by Supplier. All necessary arrangement required to perform software operation shall be done by Bidder at no extra cost.

7.14 Solar power with 72 hours battery backup.

7.15 All instruments shall be provided with skid.

7.16 Any other requirements as per PNGRB Guidelines

8.0 SCOPE OF WORK

The Contractor's scope of work shall include but not limited to the following

8.1 This document shall read in conjunction with material requisition and other specification enclosed with tender document.

8.2 Scope of work shall comprise of System Design, Detail Engineering, Procurement of Materials, manufacturing or fabrication, Supply, Inspection & Factory Acceptance Testing (total Equipment & System Integration) & Testing of system, Packaging, forwarding, Insurance, Shipping related all formalities, Inland Transportation to site, and Supply of all related goods including Supply of all type of Erection Items, Supervision of erection and installation activity, site engineering, Pre-Commissioning activity, Testing, Interconnection and interfacing with other System, Trial Run, Commissioning, Training, support and Warranty & documentation of total system, Testing certificates, calibration certificates of equipment required to complete in all respect.

8.3 Supply & installation of copper jumpers provided at flange & other point of electrical discontinuity.

8.4 Supply the flanges, with given size & rating along with mating flanges, required gasket & studs & bolts.

8.5 Supply of power, signals, control, communication cables, earthing cables and cable glands. cable as per requirement.

Note – Contractor shall choose the cable size and type according to requirement, but cable size and type of the cables shall be according to PTS- Instrument package unit with appendices.

8.6 Any other equipment / material not specifically mentioned herein but required to complete the work and meet the required functionality shall be supplied by contractor without any extra cost implication to Owner.

8.7 Contractor shall be sole responsible for the material selection, design, engineering, and supply to the designated delivery point and performance testing of MRS as per the data sheet and specification furnished and taking into consideration successful operation, safety as per the established international standards.

8.8 Contractor shall be responsible for replacement / repairing of skids if any part of skid is found damaged during unloading at site or store with no cost to owner.

8.9 Contractor shall perform all the tests as per the owner approved QAP.

8.10 CONTRACTOR has to supply the general items as per below minimum specifications and approval of detail specification shall be taken by the CONTRACTOR during document approval stage

- U-Clamp shall be with PVC Sleeve

- Tag plate material shall be Aluminium.
- Silicon Jelly shall be used for sealing.
- HDPE sheet shall be used as Insulation pad.

8.11 Contractor shall provide all Test certificate, calibration certificate and reports of supplied materials.

8.12 Contractor shall provide companion flanges with skid inlet and outlet valve.

8.13 Contractor shall design a skid in such a way that all equipment's & Valves of the assembly shall be easily accessible for O&M.

8.14 Contractor shall arrange the N2 gas cylinder for SAT at site in line with approved Procedure. However, pipeline natural gas can be used in case of availability at site.

8.15 Site acceptance test (SAT) shall be carried out by the Contractor post completion of fabrication work at site by Owner's pipeline laying contractor.

8.16 Contractor shall provide additional items that are needed at the time of commissioning and same will be considered as a part of work and no additional cost will be paid.

8.17 Contractor shall supply the necessary repair kit and consumables required as part of commissioning process with no cost to Owner.

8.18 OWNER'S SCOPE OF WORK / SUPPLY

- Provide clearance of Site locations.

9.0 SCOPE MATRIX

Sr. No	Equipment / Packages	Contractor's Scope of work	Free issue items by Owner
1	Type-1 Single Stream Filtration skid, Metering skid (1 x 100 %) with & Bypass arrangement & PRS skid (1W+1S). Type-2 Filtration skid (1W+1S), Metering skid (1 x 100%) with & Bypass arrangement & PRS skid (1W+1S).	Supply, Supervision of erection, installation & commissioning of MRS skids with required accessories, erection material. Supply of pressure, temperature element, RPD meter with EVC (explosion Proof) with ex proof GSM/GPRS Modem, pressure, temperature & differential pressure gauge, CRV, PRV, PCV, Slam shut valve and 2 nos. point gas detectors gas detectors etc as per P&ID. Supply of all mechanical items, piping, interconnected piping (skid to skid), mating flange, all sizes valves, expander / reducer, flanges with studs, bolt, gaskets etc. Supply & laying, glanding, termination of power, signals, control, communication cables, earthing cables and interconnecting cable, glands. Cable tray as per requirement Skid inlet and out expander /reducer and mating flanges. Supply & laying, glanding, termination of power, signals, control, communication cables, earthing cables and interconnecting cable, glands. Cable tray as per requirement Preparation of one power earthing pits and one instrument earthing pit as per requirement, including supply, installation	Skid foundation will be done by other based on skid footprint drawing. Inlet & Outlet mechanical/piping connectivity upto skid will be done by other.

		of earthing rod, funnel, earthing strips, connecting with skid frame, instruments etc. Supply, erection, installation & commissioning of 12/24 V DC solar power system along with solar cell, mounting pole, 72 hrs battery backup with charger and interconnecting cables. Skid installation, test and commissioning, any minor civil work during installation of skid, cable laying and panel or damages shall be done by skid supplier. Data Hosting services in supplier's Server for five years as per technical specification.	

NOTE: Skid to be supplied with Nitrogen pre-filled at 1 bar pressure.

10.0 GENERAL TECHNICAL REQUIREMENTS

10.1 General site equipment shall be suitable for operation under the following site conditions.

Sand & dust	:	With a built-up of dust on operational surface to a level such as may occur because of imperfections in the sealing of equipment, housing and conditions prevailing in sub- tropical dust conditions.
Topicalization	:	The equipment shall be fully tropicalized.
Shock & vibration	:	The equipment shall withstand transportation and handling by air, sea and road under packed conditions.

10.2 The equipment shall also be resistant to termite, fungus, rodents and salty environment. Environmental Specification of Equipment to be supplied.

10.3 The equipment at Stations shall be designed for non-air-conditioned environment.

10.4 Compliance of Area and zone classification

10.5 All the control rooms wherever available are classified as Safe Areas.

10.6 All the fields wherever available are classified as Hazardous area.

10.7 Surge Protection, Transient Suppressors, RFI filters Equipment shall be designed with built-in safety to protect against the effects of monitor induced high voltages.

10.8 Earthing

Transmitters, Junction box and control cabinets shall be provided with earthing lugs. All these lugs/ strips shall be properly secured to the electrical earthing bus.

All system grounds of various cards and equipment, shields of instrument cables shall be connected to system ground bus, which is electrically isolated from the AC mains earthing bus. The equipment shall provide separate earthing strip for the same. The system ground bus shall be connected to independent ground buses through insulated wires.

The wire and cable shielding are required to prevent the equipment from propagating interference and to protect the equipment from the effect of interference propagated by other devices. Shielding is typically floating on the device end, tied to IE at the control console.

a) Instrument / System grounding (earth resistance less than 1 ohm)

b) Power / Frame and AC mains grounding (earth resistance less than 5 ohms)

Accordingly, the equipment shall provide separate earthing strips as mentioned above.

a. Instrument earth (IE)/system ground

IE earth shall be copper earth. IE ground protects sensitive electrical and electronic device, circuit and wiring from electromagnetic interference (EMI) and radio frequency interference (RFI). IE should be free from transient voltages and electromagnetic noise. It is, therefore, normally isolated from PE ground. Instrument earth should be tied in the most direct possible path to a common earth electrode.

IE grounds resistance is less than 1 ohm to ground

b. Power Earth (PE)/AC mains grounding

PE ground provides a route to dissipate the power line transient to earth potential. PE should be tied in the most direct possible path to a common earth electrode

PE grounds resistance is less than 5 ohm to ground

10.9 Safety Requirements

It is the intent of the OWNER that operational hazards be reduced to a minimum. Contractor shall use sound engineering judgment to complete installation that will perform the required function without compromise of safety.

All controls shall operate in a fail-safe mode. A fail-safe mode defines what a plant, equipment or system will do when it fails, so as to ensure a safe condition.

Provision shall be made to isolate all 230 V AC (If any) incoming signals to a cabinet, before gaining access to cabinet internals. Shrouded terminals with warning labels shall be provided, with these terminals being segregated from other incoming terminals.

10.10 ELECTROMAGNETIC COMPATIBILITY - EMC

The equipment shall be efficiently screened against EMI, RFI and conductive interference and shall not interfere with other equipment in the vicinity or installed in the same building.

The equipment shall be required to meet one of the relevant EMC standards (IEC, MIL, VDE, BS, IEEE etc.).

10.11 The entire electronic component shall be protected from airborne contaminants as per ISA 71.04 environmental conditions for process measurement and control system.

11.0 QUALITY ASSURANCE AND QUALITY CONTROL

Contractor shall be fully responsible for their Quality Assurance and associated Quality Control process.

Unless otherwise agreed by the PURCHASER, the Contractor's quality system shall meet the requirements of ISO 9001:2015 Quality System and shall be accredited by a recognized authority.

Contractor is required to establish an acceptable Quality Plan, inclusive of quality manual and procedures that cover all activities of the order, in order to comply with the Quality System requirements.

Contractor shall be responsible for arranging / liaising with the Third-party Inspection Agency and other agencies for design appraisal, inspection, survey and certification requirements as required by the specification/requisition.

When required, waiver and acceptance of non-conformances shall be subjected to Third Party Inspection Agency approval before COMPANY endorsement. These concession records shall be included in the Manufacturer's Final Documentation.

SECTION 2

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

MATERIAL REQUISITION

(DOC No.- MR/IGL/ET2/CP/CP18160)

TABLE OF CONTENTS

A. DESCRIPTION OF GOODS AND/OR SERVICES

Item	Quantity	Description	Identification Number
1	As per SOR	Design, Engineering, Manufacturing, fabrication, procurement of bought out items/components, assembly at shop, Testing, Nameplate marking, Painting, Inspection, Packaging, Forwarding, Transportation, Shipment, handling, Unloading of skid at store / site, Calibration and Supply of RPD based MRS (Capacity 450 ,750,1500, 2000 & 3000 SCMH) which comprise of Filtration, Pressure reduction skid with Slam shut valve & regulating valve, RPD meter with bypass arrangement. Online solar panel (with battery bank 72 Hrs battery backup explosion proof enclosure) based Battery operated field mounted EVC with GPRS, 2 nos. gas detectors and its accessories as per technical specification and P&ID. MRS skid shall consist of following:	
1.1	Type-1 Single stream Natural Gas Cartridge single chamber filtration skid of 5-micron size complete with all accessories, instruments (PG, DPG), manual isolation valves, SS 316 tubing, SS316 fittings, flanges, pipes, tubes, all structure/supports/operating platform, inter skid cables if any ends, supports, mounting stands, SS blind plugs, etc. Type-2 Dual stream (one working + one standby) Natural Gas Cartridge single chamber filtration skid of 5-micron size complete with all accessories, instruments (PG, DPG), manual isolation valves, SS 316 tubing, SS316 fittings, flanges, pipes, tubes, all structure/supports/operating platform, inter skid cables if any ends, supports, mounting stands, SS blind plugs, etc. Refer P&ID and Technical specifications of bid document.	
1.2	Type-1& 2 Single stream rotary positive displacement (RPD type gas flow metering skid, Ex Proof IP 65 EVC with inbuilt/separate GSM /GPRS modem along with pressure transmitter (PT), Temperature transmitter Element, with bypass arrangement and complete with all accessories, instruments, manual isolation valves, fittings, flanges, pipes, SS 316 tubing, SS316 fittings, all structure/supports/operating platform, inter skid cables and cabling from field instruments to field JBs/EVC with cable trays, glands, ferrules, lugs, tags at both ends, supports, JBs, SS blind plugs, mounting stands, etc. Lubricant required (first time fill and additional five times fill for every flow meter in separate bottles) shall be supplied skid. Refer P&ID and Technical specifications of bid document.	
1.3	Type-1& 2 Dual Stream (One working + One Standby) Pressure reduction skid complete with all accessories, instruments, instruments erection hardwire, manual isolation valves, CRV, PSV, SSV with Regulator Valve, SS 316 tubing, SS316 fittings, flanges, pipes, tubes, all structure/supports/operating platform, inter skid cables and cabling from field instruments to field JBs/EVC with cable trays, glands, ferrules, lugs, tags at both ends, supports,	

Item	Quantity	Description	Identification Number
	JBs, mounting stands, SS blind plugs, etc. Refer P&ID and Technical specifications of bid document		
1.4	All types of cables (Power, signals, earthing and communication) within skid along with cable glands, ferrules, lugs, cable tags at both ends, as required.		
1.5	Supply as per scope of work as above 12/24 V DC solar power system along with solar cell, mounting pole with LED, 72 hrs battery backup and interconnecting cables		
SERVICES			
1	Configuration, Supervision of Erection & Installation, interfacing, field Testing and Commissioning of skid at respective site, consisting of Filtration, Pressure reduction, Metering through RPD Meter, Online Battery-operated Electronics Volume Corrector (EVC) with GSM/GPRS Modem. Data Hosting services in supplier's Server for five years as per technical specification. The price shall be inclusive of Airfare Boarding, Lodging, Local Transport, Incidental trips, Traveling etc. & all other expenses.		

NOTE:

1. Skid shall be supplied with complete enclosure & skids to be purged with Nitrogen during dispatch from works at a minimum pressure of 1 Bar-g for safe storage at site.
2. Skid shall be compact type. For 450 / 750 SCMH flow, skid footprint shall not exceed 5 (L) X 2 (W) mtr. For 1500 / 2000 / 3000 SCMH flow skid footprint shall not exceed 6 (L) X 3 (W) mtr.
3. As per ARC contract, IGL will issue lot wise PO for skid supply. After successful commissioning of each skid of respective lot, supplier shall provide data hosting services for each skid of respective lot for remaining contract period

B. REMARKS / COMMENTS

1. GENERAL NOTES

Contractor's Compliance

Contractor shall submit his bid in full compliance with the requirements of this MR and attachments. Contractor must include the following statement in his bid:
We certify that our bid is fully complying with your enquiry dated……,and referenced……

Compliance with this material requisition in any instance shall not relieve the Contractor of his responsibility to meet the specified performance.

2. COMPLIANCE WITH SPECIFICATION

The CONTRACTOR shall be completely responsible for the design, materials, fabrication, testing, calibration, inspection, preparation for shipment and transport of the above equipment strictly in accordance with the Material Requisition and all attachments thereto.

3. CONTRACTOR'S SCOPE

Contractor scope of work includes the equipment/material with all internals and accessories shown in the data sheets, specifications and all unmentioned parts necessary for a satisfactory operation and testing except those, which are indicated to be out of the Contractor's supply.

4. INSPECTION

Contractor shall appoint anyone of the following TPIA for inspection purpose. Vender has to propose minimum 2 no of below listed agencies to be approved by Owner/Owner's Representative

a. Moody International (India) Pvt. Ltd.,
b. Dr. Amin Controllers Pvt. Ltd.,
c. Certification Engineers International Ltd.,
d. International Certification Service Pvt. Ltd.,
e. Bureau Veritas (India) Pvt. Ltd.,
f. Hertz Inspection & Services Pvt. Ltd.,
g. Meenar Global Consultant,
h. Quality Evaluation and Systems Team Pvt. Ltd.
i. TUV SUD South Asia
j. ABS Industrial Verification (India) Pvt. Ltd. (Formerly Apave Assessment India Pvt. Ltd. / Vincotte International India Assessment Service Pvt. Ltd.),
k. TUV India Pvt. Ltd.,
l. Llyod Register,
m. SGS India Pvt. Ltd.,
n. TUV – Nord,
o. DNV-GL,
p. ABS,
q. Gulf Lloyds Industrial Services (India) Pvt. Ltd.
r. Rina India Pvt. Ltd.
s. Edlipse Engineering Global Pvt. Ltd.

In addition to the above list, TPIA agency approved in Technical Standards and Specifications including Safety Standards of PNGRB can be considered.

5. APPLICABLE DOCUMENTS

General descriptions, requirements and information are listed in annex C of this Material Requisition.

6. CONTRACTOR'S DOCUMENTS

Contractor shall supply the documentation as listed under point D of this Material Requisition. All documents shall be supplied in English language.

C. LIST OF ATTACHMENTS

The table here below lists the documents which are integral part of this Material Requisition. The applicable revision index of each document is mentioned in the column below the current Material Requisition revision index. When the Material Requisition revision index is "A" or "1", all listed documents are attached. For other Material Requisition revision index, only modified or new documents are attached.	**Material Requisition revision**							
	0	1	2	3	4	5	6	7
Documents	**Revision of documents**							
Introduction	0							
Material Requisition	0							
Recommended Vendor list	0							
Instrumentation								
PTS – Scope of work	0							
PTS – Filtration & Metering Skid	0							
PTS – Pressure Reduction Skid	0							
PTS – Instrumentation for Package Unit with appendices Appendix 1 – Instrument data sheets Appendix-2- Process parameters Appendix-3- Solar System Appendix-4- Data Hosting	0							
Mechanical								
PTS – Pipeline valves	0							
PTS – Fittings and Flanges.	0							
PTS - Piping Specifications	0							
Painting system & colour code for final layer	0							
Data Sheet – Cartridge/Dry Gas Filter	0							
Data Sheet-Ball Valves	0							
Data Sheet-Globe Valves	0							
Data Sheet-Check Valves	0							
QAP Pressure, Differential pressure transmitter	0							
QAP Slam shut valves & regulators.	0							
QAP Pressure gauge	0							
QAP RTD and Thermo-well	0							
QAP – Skid fabrication, Filtration, Pressure reduction, metering skid.	0							
QAP Pressure safety valve	0							

The table herebelow lists the documents which are integral part of this Material Requisition. The applicable revision index of each document is mentioned in the column below the current Material Requisition revision index. When the Material Requisition revision index is "A" or "1", all listed documents are attached. For other Material Requisition revision index, only modified or new documents are attached.	**Material Requisition revision**							
	0	1	2	3	4	5	6	7
Documents	**Revision of documents**							
QAP-Ball Valves	0							
QAP-Globe & Check Valves	0							
QAP-Flanges	0							
QAP-Fittings	0							
QAP- Fastener	0							
QAP- Gasket	0							
QAP- Cartridge / Dry Gas Filter	0							
Standard drawings								
Thermocouple/RTD assembly with thermo well	0							
Field Instrument Hook-Up Diagram	0							
Instrument support	0							
Support details and tray arrangement for junction box	0							
Piping & Instrumentation Diagrams	As enclosed							

D. DOCUMENTS & DATA REQUIREMENTS

The table hereunder specifies the quantities and the nature of the documents to be submitted by the SUPPLIER to the ENGINEER.

The documents required at the inquiry stage and to be included in the bid are listed under column A.

The documents required after award of the AGREEMENT and subject to the written approval of the ENGINEER are listed under column B.

The final and certified documents are listed under column C.

Any document, even when preliminary, shall be binding and therefore duly identified and signed by the SUPPLIER. It shall bear the ENGINEER's Project reference, the Material Requisition number and the identification number.

THE DOCUMENTS ARE FULLY PART OF THE SUPPLY WHICH SHALL BE COMPLETE ONLY IF AND WHEN THE DOCUMENTS COMPLYING FULLY WITH THE MATERIAL REQUISITION REQUIREMENTS ARE RECEIVED BY THE ENGINEER.

Item	Documents and Data	A	B		C	
		Number of copies	Number of copies	Required date	Number of copies	Required date
1	Drawing/ data submittal list/schedule (per item)	1	3	1 week + fort nightly	6	2 weeks
2	Fabrication, test and delivery schedule (per item)		3	1 week	6	2 weeks
3	Progress report		3	2 weeks + Periodically monthly	6	2 weeks
4	Catalogues / References		3	2 Weeks		With final tech. file
5	Compliance to tender specification and recommended vendor list with list of deviations clause wise if any	1				
6	Skid P&ID and GA drawing with tentative space requirement for skid with enclosure.	1	3	1 week + fort nightly	6	2 weeks
7	Make, size and model of meter & EVC, Technical specification/data sheet, type certificate of meter, Ex proof certificate, Ingress protection certificate.	1				

Item	Documents and Data	A	B		C	
		Number of copies	Number of copies	Required date	Number of copies	Required date
8	Technical document Calibration certificated of meter Datasheet of all instruments / equipments, Metering, EVC, SSV / monitor / active valve data sheet along with sizing calculations, safety valve sizing calculation, Cable data sheets, JB data sheet, loop diagram, cable schedule, cable interconnection diagram, control scheme diagram, metering panel GA drawing , MTO , thermowell wake frequency calculation and other calculations as per ASME PTC 19.3(if any), SKID GA drawings, including Impulse tubing drawings, instruments location layout drg. Inside the skid, JB location drg, cable tray layout drg. Inside the skid, panel wiring diagram along with TB details, datasheets and designing documents of valves, filter, pipes, fittings, flanges, all mechanical items etc.		3	2 weeks	6	2 weeks
9	P&IDs, GAD, BOM, Foundation arrangement drgs. Assembly drgs. in approved AutoCAD format.	-	3	2 weeks	6	2 weeks
10	Welding & painting description		3	2 weeks	6	2 weeks
11	Welding procedure specification and records WPS/PQR.		3	8 weeks	6	2 weeks
12	QA/QC program.	-	3	8 weeks	6	2 weeks
13	Inspection and test procedures.	-	3	6 weeks	6	2 weeks
14	List of fabrication and control operations (LOFC).	-	3	6 weeks	6	2 weeks
15	Inspection & Test reports.	-	3	1 week after test	6	2 weeks
16	NDE reports.	-	3	1 week after test	6	2 weeks
17	Heat treatment reports, if any.	-	3	1 week after test	6	2 weeks
18	Hydrotest and air test report.	-	3	1 week after test	6	2 weeks
19	QAP of all Mechanical & Instrumentation item.	-	3	2 weeks	6	2 weeks

Item	Documents and Data	A	B		C	
		Number of copies	Number of copies	Required date	Number of copies	Required date
20	Transportation procedure to site & erection procedure of equipment at site.	-	3	2 weeks	6	2 weeks
21	Maintenance and operating manuals.	-	3	4 weeks before shipping	6	2 weeks
22	Packing/shipping list with weights and dimensions.	-	3	4 weeks before shipping	6	2 weeks
23	List of subcontractors with their scope.	-	3	2 weeks	6	2 weeks + with final techn. file
24	FAT & SAT procedure	-	3	7 weeks	6	2 weeks
25	Final technical file	-	3	2 weeks	6	2 weeks

NOTES

1. Durations in column B (Required date) are weeks after Purchase Order date.
2. Durations in column C (Required date) are weeks before final despatch.
3. Final technical document file shall be supplied in hard copy as indicated and in electronic format (.pdf Acrobat files). These documents shall be submitted along with despatch of the system to site.
4. An offer without any of the documents mentioned in material requisition during submission of bid shall be liable for Rejection.
5. In case of "**E- bidding**" bidder shall submit only one copy during bid for column A
6. Approval of tentative skid sizes before start of detailed engineering shall be taken from Owner / Owner's Representative

SECTION 3

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

RECOMMENDED VENDOR LIST

(DOC No.-RECD-VL/IGL/ET2/CP/CP18160)

RECOMMENDED VENDOR LIST

Sr.N.	NAME OF VENDOR	ADDRESS	DELHI / NCR ADDRESS	Telephone & Fax.No.	Email-Id
MECHANICAL					
			STATION PIPE		
1	Maharashtra Seamless Ltd.	106, Nilgiri Appt., 9, Barakhamba Road, New Delhi 110 001		Tel: 91-11-23718367, 23710862, 23213631 Fax:	E-mail: contact@mahaseam.com
2	Indian Seamless Metal Tubes	Eden Park, C-Wing, Off Pune - Nagar Road, Viman Nagar, Pune - 411 014		Tel: 020-2650 4038 / 26630715 Fax:	E-mail: rawmaterials@ismt.co.in
3	DYLAN Belgium	Lerenveld 20 2547 Unity, Belgium		Tel: 32 3 488 48 80 Fax: 32 3 488 48 80	E-mail: mail@dylan.be
4	F.B.F. Belgium	Dynamicalaan 4-8, 2610 Antwerpen, Belgium.		Tel: 32 3 820 58 80 Fax: 32 3 828 96 22	E-mail: office@fbf.be
5	Ferrostaal (MAN Group), Germany	Hohenzollernstrasse 24, 45128 Essen, Germany	MAN Ferrostaal AG Liaison Office 401, Bhikaiji Cama Bhawan, 11 Bhikaiji Cama Place New Delhi 110 066 Phone +91 11 26185304, 26173143, 26185882 Fax +91 11 26192731	Tel : 49 201 81801 Fax : 49 201 8182822	E-mail: ravi.narayan@manferrostaal.com www.ferrostaal.com
6	INTERFORGE	Grobe Strabe 14, D-27356 Rotenburg, Germany		Tel: 49 4261 6709-0 / 42614081 Fax: 49 4261 3090	E-mail: info@interforge.de
7	KURVERS Piping, Neitherlands	Mark S. Clarkelaan 13 a Haven No. M 512 4761 RK Zevenbergen \ THE NETHERLANDS		Tel: 31 168 334344 Fax: 31 168 334349	E-mail: germany@kurvers.com
8	MEREK Engineering	Premier estate Leys Road Brockmoor Brierley Hill, DY5 3UT West Midlands, UNITED KINGDOM		Tel: 44 121 544 9938 Fax: 44 121 544 9132	E-mail: sales@merek.co.uk
9	TelOCEENNE, Belgium	Ten Bergstraat 4 2830 WIllebroek BELGIUM		Tel: 32 3 860 73 70 Fax: 32 3 860 7371	E-mail:
10	VAN LEEUWEN BUIZEN	Schaarbeeklei 189 1800 Vilvoorde BELGIUM		Tel: 32 2 255 40 00 Fax: 32 2 253 20 92	E-mail:
			BALL VALVES		
1	COOPER CAMERON VALVES	NO.2, Gul Circle, Jurong Industrial Estate, Singapore-629560		Tel: 0065-865 288,7 0065 9783 7381	
		A-1/14-3, Millenium Tower, Sector 9, Sanpada, Navi Mumbai 400705		Tel : +91 99675 96081	E-mail : rajankumar.makadia@c-a-m.com
		Level 33, menara Maxis, Kuala Lumpur City Centre, 50088 Kuala Lumpur, Malaysia		Tel : 6(03) 23000762 fax : 6(03) 2300 0760	E-mail :shane.kirkebride@c-a-m.com
2	MSA	Hlucinska, 41747 22 Dolni Benesov CZECH REPUBLIC		Tel :+ 420 553 881 111 Fax : 420 553 651 236	Email: sales@msa.cz
3	PETRO VALVES	11248 East Hardy St. Houston, Tx 77093	713-676-1212 800-255-9527 fax 713-467-3876	Tel : 39-331334111 Fax : 39-331675, 830	

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
4	RMA Maschinen- und Armaturenbau Faulhaber & Truttenbach	RMA Maschinen & Apparatebau Faulhaber & Truttenbach KG OSTSTR. 17, 77694 KEHL / GERMANY		Tel : +49 (0) 7851 - 868 - 0 Fax : +49 (0) 7851 - 868 - 13	
5	SCHUCK ARMATUREN (ex BORSIG)	FRANZ SCHUCK GMBH DAIMLERSTRABE 4-7 89555 STEINHEIM, GERMANY	418, QUTAB PLAZA, DLF CITY PHASE - 1, GURGOAN - 122002 Tel : +91-124- 423 58 00	Tel : +49 7329 950 - 0	E-mail : info@schuck-group.com E-mail : sks@schuckindia.org
6	TORMENE GAS TECHNOLOGY - (VALVITALIA)	Via Campolongo, 97 35020 Due Carrare PD, Italy		Ph: +39.049.9199611 Fax: +39.049.9125455	E-mail info@valvitalia.com
7	Breda Energia Spa	Viale Sarca 336, 20126 Milano, Italy		Tel: 39 02 64477512, 02- 644771 Fax : 39 02 64477544	E-mail : valves@bredaenergia.com
8	TRP (Perar), srl, Italy	Via Grigna,37 20027 Rescaldina (MI) - Italy		Tel: 39 0331 465208 Fax : 39 0331 465731	E-mail : info@perar.it
9	Grove dresser Italia, Italy	23018 TALAMONA (SO) VIA ROMA 32, ITALY			
10	Microfinish Valves	Microfinish Group of Companies B 161-162, Industrial Estate, Gokul Road, Hubli - 580 030, Karnataka, India	Tel : 0120-3259966, 2510145 Fax : 0120-2510157	Tel : 0836 - 2212404, 2210611	Email : salesdelhi@microfinishgroup.com Email : sales@microfinishgroup.com
11	Virgo Valves	Virgo Engineers Limited Virgo Valves and Controls Limited 277, Hinjewadi Telase - II, Maan (Mulshi), Pune - 411 057, India		Tel : 020 - 66744000	Email : salesindia@virgoengineers.com Email : webmaster@virgoengineers.com
12	L & T Limited (Audco India Ltd.)	Larsen & Toubro Limited Valves Business Group 10 Club House Road, Anna Salai, Chennai - 600 002, India	32, Shivaji Marg, Moti Nagar, New Dekhi - 110015 Tel : 011 - 41419500-02 Fax : 011 - 41419600, 41419596	Tel : 044 - 2846 2082 / 22492323 Fax: 044 - 22495055	Email : AnandA@larsentoubro.com
13	Flow Chem	Flowchem Industries 10, Navdurga Industries Estate, Opp. Forge & Blower Co., Naroda Road, Ahmedabad - 380 025, Gujarat - India		Tel : 079 - 2220 4773	
GAS OVER OIL ACTUATORS					
1	M/s BIFI	Italy			
2	M/s Rotork fluid Sytem	Italy			
3	PC Intertecnik	Germany			
4	M/s Bettis	Belgium			
5	Schuck				

		RECOMMENDED VENDOR LIST			
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
6	Rotex				
		GLOBE VALVES			
1	NECO Valves	NSSL Limited F-8, M.I.D.C Industrial Area, Hingna Road, NAGPUR - 440 016 INDIA	Neco Schubert and Salzer Ltd., D- 307, Defence Colony, New Delhi - 110024 Tel : 011 - 24642190, 24641579 Fax : 011 - 24642190	Tel : 07104 -237276, 237471 Fax : 07104 -236255, 237583	E-mail - contact@necoindia.co E- mail - necodel2@bol.net.in
2	Oswal Industries	Oswal Valves Pvt. Ltd 1-A, Patel Industrial Estate, Navpada Road, Oshiwara, Jogeshwari (W), Mumbai - 400102		Tel : 022 - 6771733, 30088001 - 5 Fax : 022 - 23861642	Email : j.bokadia@oswalvalves.com
3	L & T Limited (Audco India Ltd.)	Larsen & Toubro Limited Valves Business Group 10 Club House Road, Anna Salai, Chennai - 600 002, India	32, Shivaji Marg, Moti Nagar, New Dekhi - 110015 Tel : 011 - 41419500-02 Fax : 011 - 41419600, 41419596	Tel : 044 - 2846 2082 / 22492323 Fax: 044 - 22495055	Email : AnandA@larsentoubro.com
4	Panchvati Valves & Flanges Pvt. Ltd.	Panchwati Valves & Flanges Pvt. Ltd. Shop No. 5, Ground Floor, Sejal- Kajal Apartments, Ram Mandir Road, Goregaon (W), Mumbai - 400104		Tel : 022 - 26762957	
5	Leader Valves Ltd.	LEADER VALVES LTD. S-3, S-4, Industrial Town, Jalandhar - 144 004		Tel : 0181 - 2490666, 777, 888, 999	
6	Galperti Engineering & Flow control spa	Zona Industriale-23823 Colico (LC), Italy		Fax : 0039 0341-930780	Email: galpeng@galperti.com
7	Douglas Chero SPA	Loc Pradaglie, 29013 Carpento, Piacentino, Italy		Tel : 0039 0523 854011 Fax :0039 0523 85 03 89	Email: sales@douglas-chero.com
8	Niton Valves Industries Ltd.	D-115/116 Ghatkopar Industrial Estate, L.B.S. Marg, Ghatkopar(West), Mumbai-400086		Tel : 022-5008315 Fax : 022-5007654/5007436	Email : nitonvalve@vsnl.com
9	Shalimar	Plot NO. R-846/1, MIDC, TTC Industrial Area, Rabale Dist.-Thane, Navi Mumbai - 400 701		Tel : 91-22-27642546/47/48 Fax : 91-22-27605551/3	E-mail : svpl@bom3.vsnl.net.in
		CHECK VALVES			
1	Econo Valves Pvt. Ltd.	197 SIDCO Industrial Area Ambattur CHENNAI - 600 098		Tel : +91 44 6251829 / 6254371 Fax :+91 44 6257501	
2	L&T Audco Valves	Chennai			
3	Steel Strong Valves (P) Ltd.	Plot no. R-241, TTC Industrial Area MIDC,Rabale, New Bombay- 400 701		Tel : +91 22 27699489/90 Fax: +91 22 27695537	
4	Oswal Industries Ltd	Oswal Industries Limited 404, Sakar-III Opp. Old High Court Ahmedabad – 390 014		Tel : +91 79 30947636 Fax: +91 79 27540839	

RECOMMENDED VENDOR LIST

Sr.N.	NAME OF VENDOR	ADDRESS	DELHI / NCR ADDRESS	Telephone & Fax.No.	Email-Id
5	B.D.K Engineering Ltd., Hubli	B.D.K. Engineering (I) Ltd. Gokul road Hubli 580 030		Tel : +91 836 331499/ 333930	
6	Flow Chem Industries	Flow Chem Industries 10, Navdurga Indl. Estate Opp. Forge Blower Naroda Road Ahmedabad – 25		Tel : +91 79 220 4773/3623	
7	NECO Schubert & Salzer Ltd.	Nagpur			
8	Leader Valves Ltd.	S-3&4, Industrial Town, Jallandhar 144 004		Tel : +91 181 2290341/2290342 Fax: +91 181 2290894	
9	Niton Valve Industries Pvt. Ltd.	D-115/116 Ghatkopar Industrial Estate L.B.S. Marg Ghatkopar (West) MUMBAI - 400 086		Tel : +91 22 5008315 Fax: +91 22 5007654 / 5007436	
PRESSURE RELIEF/SAFETY VALVE (PRV/PSV)					
1	FMC Sanmar Ltd.	147, Karapakkam Village, CHENNAI - 600 096		Tel : +91 44 4925455	
2	Protego Equipments Pvt. Ltd. ,	Navi Mumbai			
3	Larsen & Toubro	32, Sivaji Marg, Post Box No.6223, Near Moti Nagar, NEW DELHI		Tel :+91 11 5931302 Fax:+91 11 5438624	
4	Mekaster (Formerly SEBIM) Valves India Pvt. Ltd.	908, Ansal Bhawan, 16, Kasturba Ghandhi Marg, New Delhi-110 001		Tel : +91 11 3312110/ 3318360 Fax: +91 11 3712155	
5	RMG Regal + Messtech GmbH, Germany	Germany		Tel : 0181 - 2490666, 777, 888, 999	
PIPE FITTINGS					
1	GENOYER	Group Genoyer 9/11, rue de Losbonne, 13742 Vitrolles		Tel :+32 3 860 73 70 Fax : 322 253 20 92	
2	TECHNOGORGE- Italy (International Piping Group)	International Piping Group, Inc. 2523 Fairway Drive, Suite 500 Houston, Texas 7003			E-mail : sales@intpg.com
3	Siddharth & Gautam- Faridabad	Siddharth Makker Piyala Road, Sikri Ballabhgarh, Faribabad		Tel : +129 - 2205120 -121 Fax : +129 - 2205135	E-mail:siddharthgautam@airtelbroadband.in
4	FBF Global Services Co.	5000 Watkins Way, Suite 124, Friendswood, TX 77546		Tel: 832.434.3236 Fax: 281.648.2272	Email:- sales@fbfglobal.com, info@fbfglobal.com
5	Allied International SRL Italy	loc. Vascellino 29010 Nibbiano (PC) - ITALY		Tel : +39 0523 991 211 Fax : +39 0523 993 036	

RECOMMENDED VENDOR LIST

Sr.N.	NAME OF VENDOR	ADDRESS	DELHI / NCR ADDRESS	Telephone & Fax.No.	Email-Id
6	Bassi Luigi Fittings B.V. Holland	Bassi Luigi & C spa Stabilimento e Uffici : Via Buttirone, 1 26865 S Rocco al Porto (LO), ITALY		Tel: ++39 377 56023 Fax : ++39 377 569371	
7	GAM Raccordi Spa Italy	GAM Raccordi S.P.A Via Roma, 29, GAZZOLA (Placenza) ITALY 29010		Tel: +39 0523 975500 Fax: +39 0523 975544	E-mail : m.tirinti@gam-group.it
8	TelOCEENNE (Groupe Genoyer)	Teloceene Asia Pte Ltd. 171 Chin Seww Road, #11 - 09 San Centre Singapore			
9	Teekay Tube	315/317, Navratna 69, P D Mello Road, Near Camac bridge, Mumbai- 400009		Tel: +91 22 23423382/83, 23437716/23445477	
10	Pipefit Engineers	496/1, GIDC Industrial estate, Majarpura, Baroda-390010		Tel: +91 265 2645177 Fax: +91 265 2645477	Up to 12"
11	Sawan Engineers	Baroda			
12	N J Engineers				
			FLANGES		
1	Echjay Industries Pvt. Ltd.	AJI Industrial Estate, Lalpari Lake road, Rajkot-360003, Gujarat		Tel :+91 281 2387482-86/3018300 Fax : +91 281 2387847	echjay@echjayindustries.com
2	CD Industries	Plot No. 3, South of GT road, BS road Industrial area, Ghaziabad		Tel :+91 120 2866744/2866742 Fax : +91 120 2866743/2866369	pa@cdind.org marketing@cdind.org
3	Choudhary Hammer Works	PO Box No. 20, Near Hapur road Opposite Power House, Ghaziabad		Tel :+91 120 4388000/4376972-74 Fax : +91 120 4376970/71	chw@chaudharyhammer.com
4	Metal Forgins (P) Ltd.	B-1, Mayapuri Industrial area, Ph. -1, New Delhi		Tel :+91 11 28114376/28114458 Fax:+91 11 28115759/41833103	metalforgings@metalforgings.co.in
5	Punjab Steel Works	B 38, Mayapuri Industrial Area, Ph.-1, New Delhi		Tel :+91 11 28115960 Fax:+91 11 28117432	pswforge@yahoo.com
6	JAV Forgings Pvt. Ltd.	Plot No. 5, Sector-6, Mathura road, Faridabad-121006, Haryana,		Tel: +91 129 2480275/2480046 Fax:+91 129 2481750	
7	C D Engineering Co.	C-199, Bulendshahar Road Industrial Area, Ghaziabad		Tel: +91 120 2866315/316/317 Fax: +91 120 2866319	cdec@vsnl.com
8	J K Forgings	B - 83, Mayapuri Industrial area, Ph. - 1, New Delhi-110064		Tel: +91 11 25141825/28115213/28114484 Fax: +91 11 25133161	jkforgings@sify.com
□	N J Engineers				
			FASTENERS		
1	Multi Thread Fasteners ,Baroda	MultiThread Fasteners.,885/B GIDC Makarpura, Baroda – 390010		Tel :+91 265 2647310 Fax:+91 265 2642821	

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
2	Precision Engineers	Baroda			
HEAT SHRINKABLE SLEEVES					
1	Covalence Raychem (BERRY Plastics Corporation)	709/710, Tolstoy House, Tolstoy Marg, New Delhi - 110 001			
2	Canussa (Bhotika Brothers-Indian Represntative)	Bhotika Brothers, 59, R.N.Arcade,1st Floor, Lokhandwala Complex, Andheri West ,Mumbai-400053		Tel :+91 22 6331458/9 Fax:+91 22 6362253	
COLD APPLIED TAPES					
1	Denso GmbH	P.O.Box 15 01 20 * D-51344 Leverkusen, Germany		Tel :+49 214 2602-0 Fax:+49 214 2602-318	
2	Polyken (BERRY Plastics Corporation)	709/710, Tolstoy House, Tolstoy Marg, New Delhi - 110 001			
PUR COATING					
1	Denso GmbH	P.O.Box 15 01 20 * D-51344 Leverkusen, Germany		Tel :+49 214 2602-0 Fax:+49 214 2602-318	
2	Powercrete (BERRY Plastics Corporation)	709/710, Tolstoy House, Tolstoy Marg, New Delhi - 110 001			
LR & INDUCTION BENDS					
1	Welspun Gujarat Stahl Rohren Ltd	Trade World, B-wing, 9th Floor, Kamala Mills Compound, Senapati Bapat Marg, Lower Parel, Mumbai - 400 013, India.	36, Bawa Potteries Complex, Aruna Asaf Ali Marg, Vasant Kunj, New Delhi - 110 070, India. Tel : +91 11 2602 2051 / 2612 2054 Fax : +91 11 2612 2064	Tel : 022-66136000 Fax : 022-24908020, Fax : 022-24908021	sales_wgsrl@welspun.com deshbandhu_gupta@welspun.com sanjay_batra@welspun.com
2	Jindal Saw Ltd.		Jindal Center 12. Bikhaji Cama place New Delhi-110066	Tel : 011-26188360 Fax : 011-26170691	Email : info@jindalsaw.com Email : alok.jain@jindalsaw.com
3	PSL Holdings Ltd	PSL Towers, Plot no. 615, Makwana Road, Marol, Andheri(E), Mumbai-400025, Maharastra	B-96, Greater Kailash - 1, New Delhi - 1100 48 Tel : 011 - 292447124 , 29238290 Fax: 011 - 29235745, 2923 6753	Tel : 022-56447777 / 88 Fax : 022-56447700	pslnd@del2.vsnl.net.in psldelhi@pslltd.co.in contact@psldelhi.com
CASING END CLOSURE					
1	Raci	Italy			
2	Raychem RPG Limited	709/710, Tolstoy House, Tolstoy Marg, New Delhi - 110 001			
SPACER / INSULATOR					

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
1	Raci	Italy			
HDD CONTRACTORS					
1	PLN Construction Pvt. Ltd. (India)				
2	Cherington Asia (India) Pvt. Ltd.				
3	Essar Construction Ltd.	Essar House, PO 7945, Mahalaxi, Mumbai -400 034			
4	Mersing Construction and Engineering Sdn Bhd., Selangor (Malaysia)				
5	Herrenknecht (Asia) Ltd. (Thailand)				
6	Horizontal Drilling International (France)				
7	COE Drilling Australia PTY Ltd. (Australia)				
INTELLIGENT PIGGING CONTRACTOR					
1	Rosen Euro BV, Netherlands				
2	M/s PII, U.K				
3	NGKS, Russia				
4	TDW Williams				
5	VEE KAY Vikram	Ahmedabad			
CIVIL					
VITREOUS CHINA SANITARYWARE					
1	Parry	EID, Parry (India) Ltd. Chennai			
2	Hindustan	Hindustan Sanitaryware and Industries, Bahadurgarh			
3	Cera	Madhusudan Ceramics, Ahmedabad			

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
STAINLESS STEEL SINKS					
1	AMC	Ashok Mfg. Co., New Delhi			
2	Neelkanth	Neelkanth Mfg. Co. , New Delhi			
C.P FITTINGS					
1	Parco	Prakash Brassware Ind., New Delhi			
2	GEM	Germ Sanitary Appliances Pvt. Ltd.			
C.P ACCESSORIES, WASTE FITTINGS					
1	ESS	ESS Bathroom Products Pvt. Ltd., Panchkula, Haryana			
2	Lotus	DP Gupta & Co. New Delhi			
3	Orient	Venus Metal Ind. New Delhi			
PVC PIPES					
1	Supreme	Supreme Industries, Mumbai			
2	Prince	Selfshine Industries Mumbai			
FILTERS					
1	Ultra filter				
2	Chemtrols				
3	Emerson				
4	Flash Point				
5	Grand Prix Fab (Pvt.) Ltd				
6	Multitex Filteration Engg. (P) Ltd.				

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
7	Forain SRL (Italy)				
8	Perry Equipments Corp. (USA)				
9	SYRTEC International Contractor SPA (Itealy)				
10	Faudi Filter Systems GMBH (Germany)				
11	Axsia Howmar Ltd (UK)				
12	Plenty Filter (UK)				
13	Vanaz				
14	Control Plus				
15	Nirmal Industrial Controls Pvt. Ltd.				
GI PIPES/MS PIPES					
1	TATA	TISCO-Tubes, Jamshedpur			
COMPOSITE PIPES & FITTINGS					
1	KITEC	Kitec Industries, Baroda			
GUN METAL VALVES AND LOCKS					
1	Leader	Leader Engineering Works, Jalandhar			
2	Zolote	Zolote Industries, Jalandhar			
CI DOUBLE FLANGED SLUICE VALVES, NON RETURN VALVES					
1	Kirloskar	Kirloskar Bros Ltd., Pune			
STONE WARE PIPE AND GULLY TRAPS					
1	Perfect	Perfect Potteries, Jabalpur			

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
HDPE PIPES AND FITTINGS					
1	Hasti	NOCIL, Bangalore			
2	Oriplast	Oriplast Ltd., Balasore, Orissa			
WATER TANKS					
1	Sintex				
ALUMINIUM HARDWARE					
1	Earibihari				
GLASS					
1	Modiguard				
2	Atul				
ALUMINIUM DOOR/WINDOW SECTION					
1	Hindalco				
CEMENT					
1	L&T				
2	Birla				
PAINTS					
1	Asian				
2	Beger				

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
3	Nerolac				
4	Shalimar				
5	Bombay				
CERAMIC/VITRIFILED/VITREOUS TILES					
1	Kajaria				
2	Johnson				
3	Somany				
STRUCTURAL STEEL					
1	SAIL				
REINFORCEMENT STEEL					
1	TISCO	Jamshedpur			
	SAIL				
ELECTRICAL					
AMF DG SET					
1	Sudhir Engg. Co.	507, International Trade Tower, Nehru Place, NEW DELHI - 110 019		Tel: +91 11 646 6293	
2	Powerica Limited	1214, Hemkunt Tower, Nehru Place, NEW DELHI - 110 019		Tel: + 91 11 646 2451	
3	Bhaskar Power Project Ltd.	B-137, Sector - 2, NOIDA - 201 301 UTTAR PRADESH		Tel: +91 118 4521355	
4	Jakson Engineers Ltd.	A-43, Phase II (Extension), NOIDA - 201 305 UTTAR PRADESH		Tel: +91 118 4563156	

RECOMMENDED VENDOR LIST

Sr.N.	NAME OF VENDOR	ADDRESS	DELHI / NCR ADDRESS	Telephone & Fax.No.	Email-Id
SILENT D.G. SET					
1	Diesel Engine	Cummins / Kirloskar			
2	Geneerator	KEC / Jyoti / NGEF / Stamford / CGL			
SILENT D.G. SET SUPPLIER					
1	Sudhir Engg. Co.	507, International Trade Tower, Nehru Place, NEW DELHI - 110 019		Tel: +91 11 646 6293	
2	Powerica Limited	1214, Hemkunt Tower, Nehru Place, NEW DELHI - 110 019		Tel: + 91 11 646 2451	
3	Jakson Engineers Ltd.	A-43, Phase II (Extension), NOIDA - 201 305 UTTAR PRADESH		Tel: +91 118 4563156	
MAIN / SECONDARY, MEDB, DCDB & UPS DISTRIBUTION BOARD					
1	Contronics Switchgear (I) Pvt. Ltd.	A-30, Sector-58, NOIDA - 201301, UTTAR PRADESH		Tel: +91 118 4583472	
2	Elpro Engineering	Plot No.4458, Y-95, 8th Street, Anna Nagar, CHENNAI-600040		Tel: +91 44 6281214	
3	RYB Switchgears Pvt. Ltd.	C-543, 2nd Floor, Saraswati Vihar, DELHI - 110034		Tel: +91 11 27012329 / 07010097	
4	Trident Switchgears	Mata Bhavan, C-49, Jangpura Extension, NEW DELHI - 110014		Tel: + 91 11 24313946	
5	Birla Ericsson Optical Ltd.	Udyog Vihar, P.O. Chorthala, Rewa, MADHYA PRADESH-486006		Tel: +91 7662 280580 Fax: +91 7662 280680	
6	MileStones Switchgear Pvt. Ltd.	D-92/8, Okhla Industrial Area, Phase-I, NEW DELHI - 110020		Tel: +91 11 26815500 / 26815501	
7	Vidhyut Control (I) Pvt. Ltd.	D-12, Sector-17, Kavi Nagar Industrial Area, GHAZIABAD-201301, UTTAR PRADESH		Tel: +91 575 4701223 / 4700112	
8	Electronic Insatrumentation & Control	Plot No.436, Phase-II, G.I.D.C. Estate, Vatva, AHMEDABAD-382445, GUJARAT		Tel: +91 5830505, 5831665	
9	Crompton Greaves Ltd.				
10	Larsen & Toubro Ltd.				

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
11	Control & Switchgear Co. Ltd.	222, Okhla Industrial Estate, NEW DELHI - 110020		Tel: +91 11 26847154 / 26829063	
POWER CABLES					
1	Universal Cables Ltd., M.P.				
2	Fort Gloster Industries Ltd.				
3	Associated Flexibles & Wires Pvt. Ltd., Mumbai				
4	NICCO Corporation Ltd., Baroda				
5	Cable Corporation of India Ltd.				
6	KEI Industrie Ltd.				
7	Grandlay				
8	Ravin Cables Ltd.				
9	Thermopads Pvt. Ltd.				
10	R.P.G. Cable Ltd.				
11	Finolex Cable				
12	Delton Cables Ltd.				
13	Polycab Wire Pvt. Ltd.				
14	CORDS Cable Industries				
15	Finolex Cable				
16	GESCAB Industries Ltd.				

		RECOMMENDED VENDOR LIST			
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
17	INCAB				
FLAMEPROOF LIGHTING FIXTURES, FLP, J.BOX/FLP SWITCH SOCKET					
1	Balinga Lighting Equipments Pvt. Ltd.				
2	Sudhir Switch Gears Pvt. Ltd.				
3	Flame Proof Control Gears Pvt. Ltd.				
4	Flame Proof Equipment Pvt. Ltd.				
5	Flex Pro Electricals Pvt. Ltd., Navsari				
6	CEAG				
SWITCH SOCKET AND PLUGS					
1	B.C.H.				
2	Baliga Lighting Equipments Pvt. Ltd.				
3	CGL				
4	MDS				
LIGHTING FIXTURES					
1	Crompton Greaves Ltd.				
2	Philips				
3	Bajaj Electrical Ltd.				
4	KESELEC Schreder				

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
U.P.S					
1	Fuji Electric Company Limited				
2	Hi-REL Controls Ltd.	B-14/1, G.I.D.C. Electronics Zone, Sector-25, GANDHINAGAR - 382044, GUJARAT		Tel: +91 7932 21636 / 22531	
3	Emmerson Network Power Management (Formerly known as Tata Libert)				
4	Gutor Electronics Ltd.	(L&T Representative)			
5	Kerala State Electronics Development Corporation Ltd.	Keltron Equipment Complex, Karakulam, Thiruvananthapuram - 695564			
6	Gutor Electronics Ltd. (L&T Representative)				
AIR CIRCUIT BREAKER					
1	L&T / Siemens / CGL / GE / CSC / Schneider Electric				
MOULDED CASE CIRCUIT BREAKER					
1	L&T / Siemens / CGL / GE / SCS / Schneider Electric				
SWITCH					
1	L&T / Siemens / CGL / GE / CSC / Schneider Electric				
FUSE					
1	L&T / EE / CGL / GE / Schneider Electric / CSC				
CONTACTOR					

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
1	L&T / Siemens / CGL / GE / Schneider Electric / CSC				
INSTRUMENT / METER					
1	IMP / Rishab / AE				
CT / PT					
1	Indcoil / Gm / Koppa / Silkana / Siemens / AE / Pragati Electricals				
PUSH BUTTON					
1	L&T / Siemens / BCH / Kaycee				
SELECTOR SWITCH					
1	Kaycee				
INDICATION LAMP					
1	Concord / L&T / Vashinu				
CABLE GLANDS					
1	Control Switch Gear / Electromac / Comment / Baliga / Flameproof Control Gear				
CABLE LUGS					
1	Commet / Dowells / Ismail				
TERMINAL BLOCKS					
1	Eleme / DAV / Essem / BCH / Connect well / Tosha				

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
2	Phonix Contact (India) Pvt. Ltd.				
NICKEL CADMIUM BATTERY					
1	AMCO				
2	HBL NIFE Power System Ltd.				
LIGHTING MCB DB					
1	MDS				
2	Indo-Asian				
3	Clipsal				
4	Datar				
5	Havels				
6	Standard				
7	Shrenik and Co., Ahmedabad				
AIR CONDITIONER					
1	Voltas				
2	Carrier				
3	LG				
4	Amtrex Hitachi Appliances Ltd.				
BATTERY CHARGER					

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
1	Chhabi Electricals Pvt. Ltd.				
2	Universal Instruments				
3	HBL NIFE Power System Ltd.				
PANEL					
1	ICA				
2	Swati Switchgears(I) Pvt. Ltd., Ahmedabad				
3	Elemech Switchgears & Instrumentations, Ahmedabad				
4	Rittal				
5	Pyrotech Controls				
6	Enclotek				
I.S. BARRIER / REPEATER					
1	MTL				
2	P&F				
TRANSFORMER					
1	Patson Transformers Pvt. Ltd., Ahmedabad				
2	Voltamp Transformers Pvt. Ltd., Ahmedabad				
CATHODIC PROTECTION SUB-CONTRACTOR					
1	Mitcorr Cathodic Protection Pvt. Ltd., Baroda	West Wing, 1st Floor, G.S.C.B Building, B/h Bank of India, Ellora Park, Baroda - 390007		Tel: +91 265 2397424 / 2396844 Fax: +91 265 2397424	

RECOMMENDED VENDOR LIST

Sr.N.	NAME OF VENDOR	ADDRESS	DELHI / NCR ADDRESS	Telephone & Fax.No.	Email-Id
2	Corrosion Control Servcies(B) Pvt. Ltd., Mumbai	405, Arun Chambers, Tardeo Road, Mumbai - 400034		Tel: +91 22 23524593, 56627010 Fax: +91 22 24934570	
3	Raychem RPG Ltd.	709/710, Tolstoy House, Tolstoy Marg, New Delhi - 110 001			
4	Corrtech International Pvt. Ltd., Ahmedabad	22, Dhara Centre, Vijay Cross Road, Navrangpura, Ahmedabad - 380009		Tel: +91 79 26563443, 26568639 Fax: +91 79 26431615	
SOLAR LIGHT					
1	Saroj Urja Services Co	A-14, navjivan Soc., Dahej bypass road		Tel: +91 98244 75574	
2	Solartech System	B-2, Lalita Co-op Hou.Soc. Isanpur raod, Ahmedabad		Tel: +91 98254 11692	
3	Khodiyar Enterprise	Jay marketing, Sukrut Apt., HJ Doshi Hospital Road, Rajkot		Tel: +91 98251 62853	
4	Hitech Industrial Corp.	206, Kalptaru Complex, Indira Circle, Rajkot		Tel: +91 281 258 5532	
INSTRUMENTATION					
PRESSURE, DIFF.PRESSURE/ TEMPERATURE TRANSMITTER					
1	Emerson Process Management				
2	Invensys				
3	Honeywell				
4	Fuji				
5	Yokogawa				
6	ABB				
7	Endress & Hauser				
TEMPERATURE ELEMENT WITH THERMOWELL					

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
1	Pyroelectric Instruments				
2	General Instruments				
3	A.N. Instrument				
4	Altop industries				
5	Baumer Bourdon				
6	Thermo-Couple Product co india				
7	Techno Instruments				
8	Wika				
TEMPERATURE GAUGE WITH THERMOWELL					
1	General Instruments				
2	Pyroelectric Instruments				
3	A.N. Instrument				
4	Waree Instruments				
5	Bumer Technologies india				
6	Wika Instrument India Ltd				
7	Altop Industries				
LEVEL SWITCH					
1	Magnetrol				

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
2	Magnetrol-USA				
3	Dag Process Instruments – India				
4	Chemtrols Engineering – India				
5	MSW Controls – UK				
6	Bliss Anand Pvt. Ltd. – India				
7	Forbes Marshal				
8	Tokyo Keiso - Japan				
LEVEL GAUGE					
1	Chemtrols				
2	V.Automate				
3	Bliss Anand				
4	Magnetrol – USA				
5	Ametek – USA				
6	Manometer – India				
7	Gauge Bourdon				
8	R.K Dutta India				
DISPLACER LEVEL INSTRUMENTS					
1	Chemtrols Industries lts				

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
2	Dresser Product Industrial India				
3	Foxboro eckardt GmBh				
4	Invensy India Ltd				
5	Emerson Process Management				
RADAR LEVEL INSTRUMENTS					
1	ABB INC				
2	Endress & Hauser				
3	Emerson Process Management				
4	Khrone Messtechnik GmBH				
5	L&J Technologies				
6	Mangnetrol International				
DIFFERENTIAL/ PRESSURE GAUGE					
1	H. Guru				
2	General Instruments				
3	A.N. Instrument				
4	Fiebig				
5	Waree Instruments				
6	Wika				

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
7	Gauge Bourdon				
8	Switzer Instrument Ltd				
ULTRASONIC METERS					
1	Daniel				
2	Insromet International				
3	FMC				
4	Krohne				
5	SICK Maihak Germany				
PRESSURE REGULATOR AND SLAM SHUT VALVES					
1	RMG				
2	Pietro Fiorenteni				
3	Emerson Process Management				
4	Schlumberger				
5	Gorter controls				
6	Nirmal				
7	Instromet International NV				
GAS CHROMATOGRAPH					
1	ABB Ltd (Faridabad), India				

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
2	Daniel Measurement & Control Asia Pacific, India				
3	Instromet Internationa, NV				
4	Honeywell				
FLOW COMPUTERS					
1	Daniel / Emerson				
2	Omni				
3	FMC				
4	Bristol Babcock Inc.				
5	Honeywell				
6	Elster				
7	ABB				
RPD METER					
1	Dresser				
2	Romet				
3	Elster-Honeywell				
4	RMG Regel + Messtechnik GmbH Germany				
5	Itorn				
6	Raychem RPG Limited				

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
7	FMG				
8	Tancy				
TURBINE METER					
1	Dresser				
2	Rockwin				
3	Elster-Honeywell				
4	RMG Regel + Messtechnik GmbH Germany				
5	Daniel/Emerson				
6	Itron				
7	Vemtech				
PRESSURE REGULATORS, SLAM SHUT VALVES AND SHUT DOWN VLAVES					
1	RMG				
2	Pietro Fiorenteni				
3	Emerson Process Management				
4	Schlumberger				
5	Gorter controls				
6	Instromet International NV				
7	Nirmal Industrial Controls Pvt. Ltd.				
FIRE DETECTION SYSTEM					

		RECOMMENDED VENDOR LIST			
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
1	Agnice Fire protection pvt ltd				
2	Honeywell india Pvt Ltd				
3	System sensor				
4	Siemens				
5	Apollo				
6	Semetronics Instruments				
7	Tyco fire & Security				
8	New Fire engineering				
GAS DETECTION SYSTEM					
1	Detector Electronics Pvt.Ltd.				
2	Detection Instruments India Pvt. Ltd.				
3	Drager safety Pvt. Ltd.				
4	Det-Tronics				
5	Honeywell Analytics India				
6	Oldham				
7	Crowcon Electronics Corp India				
8	Simtronics SAS				
RELAYS					

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
1	Omron				
2	OEN				
3	Jyoti				
PLC					
1	Allen Bradley/Rockwell				
2	GE Fanuc				
3	Yokogawa				
4	Honeywell				
5	Schnieder				
6	ABB				
7	Siemens				
MCT					
1	NEIMEX				
2	Signet International				
OFC					
1	Finolex Cable				
2	Birla Ericsson Optical Ltd., Rewa (M.P.)				
3	RPG Cables Limited				

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
4	Tamilnadu Telecommunications Limited				
5	U M Cables				
6	Himachal Futuristic Communications Ltd.				
7	Sterlite Industries (I) Ltd.				
HDPE DUCT FOR OFC					
1	Jain Irrigation System Ltd., Jalgaon				
5	Parixit Industries Ltd., Ahmedabad				
6	Pennwalt Agru Plastic Ltd., Baroda				
I.S BARRIER/REPEATER/SIGNAL MULTIPLIER					
1	MTL				
2	P&F				
INDICATORS					
1	YOKOGAWA				
2	Masibus				
3	ABB				
4	Honeywell				
5	Emerson				
PANEL/CABINET					

		RECOMMENDED VENDOR LIST			
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
1	RITTAL				
2	ICA				
3	Siemens Buliding Solutions				
4	Pyrotech Controls				
5	Positronics Pvt Ltd				
6	Instrumentation Ltd				
7	Industrial Controls & Appliances Ltd India				
INSTRUMENT CABLES					
1	CORDS Cable Industries				
2	Associated Cables				
3	KEI Industries Ltd.				
4	Universal Cables Ltd., M.P.				
5	Delton Cable Pvt Ltd				
6	Polycab Wires				
EX PROOF/WP - CABLE GLANDS / PLUGS					
1	Flex Pro Electrical Pvt. Ltd., Navsari				

2	Baliga				
		RECOMMENDED VENDOR LIST			
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
3	Comet industries India				
4	Sudhir Switch Gears Pvt. Ltd.				
5	Flame Proof Equipment Pvt Ltd India				
EX PROOF PANLE/JUNCTION BOX / CABLE GLANDS / PLUGS					
1	Flex Pro Electrical Pvt. Ltd., Navsari				
2	Baliga				
3	Exprotecta				
4	Sudhir Switch Gears Pvt. Ltd.				
5	Flame Proof Equipment Pvt Ltd India				
INSTRUMENT FITTINGS, TUBE, VALVES AND MANIFOLDS					
1	Swagelock				
2	Parker				
3	Sandvik				
4	Ratnamani Metals and Tubes india				
5	Heavy Metals & Tubes ltd India				
6	Jindal Saw Ltd.				
7	Comfit & Valves				
8	Prime Engineers India				

	RECOMMENDED VENDOR LIST				
Sr.N.	**NAME OF VENDOR**	**ADDRESS**	**DELHI / NCR ADDRESS**	**Telephone & Fax.No.**	**Email-Id**
9	Excel Hydro Pneumatics Pvt Ltd India				
SOLENOID VALVES					
1	Asco Penumtics India				
2	Asco Joucomatic Ltd India				
3	Rotex Automation Ltd India				
4	Presision Instrument Company India				
LAPTOP					
1	DELL				
2	HP				
3	IBM				
4	LENOVO				
GPRS MODEM					
1	IN HAND NETWORKS				
2	CALAMP – USA				
3	ELPRO – AUSTRALIA				
4	T-CAM SINGAPORE				
5	MOXA				
6	SIEMENS				

RECOMMENDED VENDOR LIST

Sr.N.	NAME OF VENDOR	ADDRESS	DELHI / NCR ADDRESS	Telephone & Fax.No.	Email-Id
THIRD PARTY INSPECTION AGENCY					
1	Lloyd Register of Industrial Services				
2	Technische Ulierwachungs Verein (TUV)				
3	Det Norske Veritas (DNV)				
4	AIB-Vincotte				
5	Bureau Veritas				
6	SGS				
7	American Bureau Services (ABS)				
8	Velosi Certification Services				

Note : 1) The details of Vendors indicated in this list are based on the information available with IGL, Contractor shall verify capabilities of each vendor for producing the required quantity with. IGL does not Guarantee any responsibility on the performance of the Vendor, it is the contractor's responsibility to verify the correct status of vendor and quality control of each parties and also to expedite the material in time.

Note : 2) Above vendor list is indicative only and any other vendor (s) apart form as mentioned above are acceptable subject to approval by Owner/Owners representative based on past track record. Also for the vendors of items not covered in above vendor list, but required for project, bidder has to take approval from Owner/Owners representative for the same.

SECTION 4

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

PTS – FILTRATION & METERING SKID

(DOC No.-PTS-F&MS/IGL/ET2/CP/CP18160)

TABLE OF CONTENTS

1. SCOPE

This technical specification covers the minimum requirements for the engineering, fabrication, testing, calibration and supply of Filtration and metering skids.

2. DESCRIPTION OF THE SUPPLY

CONTRACTOR shall consider and offer the following for the skid:

2.1. Skid shall be supplied with 2 nos. of point gas detectors. Both the point gas detectors alarm (Potential free contract) shall be group and common Potential free contract shall be interface with EVC. Initiation of any on PGD alarm, alarm shall be initiated in EVC and further SCADA/RTU

2.2. FILTRATION SKID

2.2.1. The filter shall be of the single chamber Cartridge type.

2.2.2. Filtration skid comprising of all the material required for removing the solid and liquid particles larger than 5 micron from the gas.

2.2.3. Cartridge filter shall be made of carbon steel, design according to ASME VIII DIV 1

2.2.4. An impact test @-20deg c is required for the material of the shell and head.

2.2.5. A relief valve shall be fitted on the shell side

2.2.6. The supply shall include all the required material (filter, piping, valves, safety devices, instruments, and wiring) inside the battery limits of the skid, as shown in the P&ID and mentioned in MR and PTS.

2.3. <u>RPD METER SKID</u>

2.3.1. Metering system shall be provided with 1 X 100% metering line comprising all the material required to as per P&ID.RPD type meter along with EVC and GPRS Modem to transmit the reading. The accuracy of complete metering system shall be as per specified in the datasheets. These shall be intrinsically safe/ flameproof.

2.3.2. Metering system shall be provided as per P&ID, required material mentioned in MR.

2.3.3. Pressure and temperature shall be provided for compensation and connected with EVC, EVC should have provision to interface SSV limit switch (DI signals two numbers) & Gas Detectors (2Nos.), Each meter shall be equipped with Common EVC, Modem & GPRS.

2.3.4. Area classification shall be IEC Zone-1, Gas Gr. IIA & IIB, T3 and meter shall have Temperature Class T3. All electrical instruments in the field shall be suitable for the specified area classification and certified by a statutory body such as FM, UL, CENELEC, BASEEFA, and PTB etc. The transducers shall be intrinsically safe certified suitable for the specified area classification and weatherproof to IP65/NEMA-4 and Skid vendor shall supply necessary isolating barriers between the transducers and preamplifier/transmitter. However, the transducer/sensor housing can be flameproof (EEx d) certified suitable for the specified area classification in case of non-availability of intrinsically safe.

2.3.5. The supply shall include all the required material, instruments along with valves impulse pipes, tubes etc inside the battery limits of the metering system along with instrumentation cables, power cable, JBs, cable glands, cable trays as required, as shown in the P&IDs.

2.3.6. For details specification refer technical datasheet of EVC enclose with tender document.

2.3.7. Meter shall be calibrated on AIR. Type test report for correlation between air calibration and that with natural gas for the offered model of RPD flow meter is to be furnished duly endorse by accredited test labs as per tender specification. The meter shall be approved by NMI/ PTB/ NPL/MID/W&M/OIML or equivalent body.

2.3.8. The calibration facility should be traceable to International Standards/FCRI/NABL approved lab. Any property or thermophysical values (e.g. density, compressibility, speed of sound, critical flow factor, etc) used during flow calibration shall be computed as per EN 12480 or equivalent.

2.3.9. Meter shall be provided with lubrication oil; Meter vendor shall provide oil grade in data sheet used for lubrication.

2.3.10. Lubricant required (first time fill and additional five times fill for every flow meter in separate bottles) shall be supplied along with each meter.

2.3.11. The maximum permitted velocity shall be as per latest PNGRB for filtered natural gas. As per PNGRB, velocity upto filter is 20 m/s and velocity at downstream of filter is 30 m/s is acceptable.

2.3.12. If required, At the downstream of the RPD meter, one restriction orifice (RO) shall be provided to protect the RPD meter from over speeding. Vendor shall do the sizing for the same and shall submit the same for approval during detail engineering with all details of RO, GA drawings etc.

2.3.13. The supply shall include all the required material, instruments along with valves impulse pipes, tubes etc. inside the metering system along with instrumentation cables, JBs, cable glands, cable trays as required, as shown in the P&IDs.

2.3.14. Process connections shall be flanged type meeting the requirements of ANSI B 16.5 (at inlet and outlet) as per attached P&IDs. The metering facilities shall be able to measure the mentioned flow rate as per appendix 2.

2.3.15. Manufacturer's test & calibration certificate with vendors NABL accredited laboratory calibration certificate shall be acceptable for calibration of meter.

2.4. METER SIZING

The sizing of meter shall be carried out considering:

- Density/ compressibility of the given composition of gas.
- Minimum operating pressure, maximum operating temperature and maximum flow rate.
- Velocity for metering application shall as per PNGRB (exclude USM meter).

3. ELECTRONIC VOLUME CONVERTER (EVC)

3.1. Offered EVC shall be approved for custody transfer of natural gas by NMI or PTB or Measurement Canada or Directorate of Legal Metrology (India) or equivalent laboratory under provision of OIML or equivalent. Vendor to attach complete certifications along with test certificate along with the offer.
Alternatively, Microprocessor /PLC/RTU based Data logger along with GSM /GPRS modem certified for Zone 2, IIA/ IIB, T3/T4 can be considered in place of EVC. Data logger shall meet functional requirement of EVC.
Data logger shall be approved for custody transfer of natural gas by NMI or PTB or Measurement Canada or Directorate of Legal Metrology (India).

3.2. Detailed technical catalogue from manufacturer of items must be submitted with datasheet.

3.3. Power Supply - Lithium Battery with suitable capacity, battery life should be as per data sheet. Battery should be capable of working in hazardous area. No setup data should be lost while changing battery.

3.4. EVC shall be supplied with inbuilt / Separate GSM/GPRS modem.

3.5. EVC shall be capable to interface with RTU/SCADA. EVC shall, have Analog input and digital input facility for interface. EVC shall be capable of continuing with flow measurement even when downloading / uploading of data is going on.

3.6. For details specification refer technical datasheet of EVC enclose with tender document.

4. COMPUTATIONAL CAPABILITY:

4.1. Volume flow rate at standard, normal or operator specified base conditions (Sm3/hr). Initially configured at Base pressure: 1.01325 bara, Base temp: 15.556OC)

4.2. Integrated corrected volume in SCM

4.3. Calculation of compressibility factor as per AGA-8 detail method.

4.4. Previous day's flow / energy (i.e. yesterday's Base time total volume / energy to today's Base time total volume / energy) & current running total for the day (i.e. volume totalizer/ integrator value at Base time from first day) to be stored in a separate location (register) and base time shall be user configurable.

4.5. Today's accumulated flow /energy (running total since Base time to current time) and base time shall be user configurable.

4.6. Generation of reports for totalised volume & energy at daily, weekly, fortnightly & monthly intervals, flow rate, pressure, temperature, Uncorrected Flow, compressibility factor, alarms etc. shall be user configurable.

5. CALIBRATION AND SYSTEM TESTING

5.1. All master equipment's to be used for calibration of all instruments should be traceable to NPL and their calibration certificates should be provided. Also, all the masters required for calibration should be at least 3 times more accurate than the instruments.

5.2. Certification for meters: The Skid vendor shall provide certification from Calibrating agency/ Laboratory / OEM of Flowmeter confirming that the meter being calibrated shall work with specified accuracy/ repeatability with the actual gas composition mentioned in the tender documents.

5.3. Skid vendor shall carryout performance test and certify the meter in combination with its companion electronics. A recognized test facility with traceable reference measurements shall be used. Flow test data at 6 points covering the minimum to the maximum flow rate shall be obtained for ascertaining the meter linearity and repeatability within the specified limits.

6. OTHER SUPPLIES

The following supplies shall be included in Contractor bid:

- The shop painting in accordance with paint system specification.
- Spare parts for mandatory spares as per List of Mandatory.
- The engineering documents requested in the DDR attached to the Material Requisition.
- The material certificates, Ex certificates.

- Supply of erection hardwares, cables & accessories, etc.
- Skid structure and platforms.

6.1. SERVICES

The contractor shall include in his bid the following services:

- The complete engineering / design of the skids.
- The mechanical tests.
- The non-destructive tests.
- The performance tests.
- The assistance for Supervision of Erection, Testing, pre-commissioning, commissioning and start-up
- The services of a Control Authority for the delivery of 3.1 certificate as per attached QC/QA sheets.
- TPI for all supplies
- Thermal insulation (If required).

7. LIMITS OF SCOPE

The scope of the CONTRACTOR includes:

- Detailed drawings and calculations.
- Third party inspection agency.
- Design, fabrication, assembly, testing, installation, testing & commissioning of the complete.
- Mechanical tests;
- Material certificates;
- Non destructive tests ;
- Performance tests;
- Preparation and application of shop painting;
- FAT & SAT of the skids;

8. LIMIT OF SUPPLY (Battery limit)

8.1. Piping

The battery limit connections shall be as per P&IDs and scope of work.

9. GENERAL DISCRIPTION FOR SUPPLY AND DESIGN CONSIDERATION

9.1. The vents shall be min. 3 meters high from the highest operating platform within 15meter radius.

9.2. Contractor shall confirm the size and furnish the foundation loads and footprints of skid. Before submission, contractor shall take concurrence from Owner/Owner representative for space available for skid installation, skid size shall be adjusted according to space.

9.3. Skid vendor shall maintain minimum level of 1.5m above the bottom of the skid for all main headers of the system. This shall be finalized during detailed engineering.

9.4.

9.5. All structural members of skid base shall conform to IS: 2062 Grade A. Outer member of skid base shall be minimum ISMB 200 or equivalent. Internal and supporting member shall be minimum ISMC 200 or equivalent. The supporting details with valve shall be approved by Owner / Owner's Representative.

9.6. The skid can be split from the consideration of transportation. Additional pipe fittings for this purpose are to be taken into consideration by the skid vendor.

9.7. A structural skid completes with necessary drip pan, walkways, staircase, platforms, crossover, gratings, handrails for access for operation and maintenance.

9.8. The sun / rain protection for electronic instruments shall also be supplied by the Skid vendor.

9.9. Platforms & cross-over(s) / jump-over(s) to be provided for the operation and maintenance of the equipment/ instruments/ JBs installed in the skid. Proper spacing shall be maintained between the equipment for operation & maintenance. The vent & drains shall be properly supported in the skid.

9.10. Skid field instruments shall be supplied along-with the skid as per P&ID.

9.11. All installation and erection materials such as impulse piping, pipe fittings and valves, tubing, tube fittings, cable tray and supports, foundation bolts of the skid, gaskets, companion flanges for tube fittings, instrument supports, tray supports, handles of the SSVs shall be along with skid.

9.12. All types of cables such as signal, alarm, control, power cables including junction boxes, cable tray, earthing strip for grounding of skid all the materials including cable glands, ferrules, lugs, cable tags at both ends shall be with skid.

9.13. EVC shall be interfaced with respective flow meter, pressure transmitter, temperature transmitter of each stream. Each stream EVC shall have provision to interfaced with RTU/ SCADA on serial communication (if any).

9.14. The tubing and fittings used for impulse piping shall be of SS 316. Tube fittings shall be flare less compression type of three-piece construction consisting of ferrule, nut and body suitable for use on SS tubes. Instrument valves and manifolds shall be of SS316 construction of forged type. All impulse tubing and instrumentation valves, fittings within the skid shall be SS316 and shall be of ½" size.

9.15. All limit switches, Junction boxes, cable glands & accessories shall be certified weather proof to minimum IP65 and Flame proof suitable for hazardous area classification.

9.16. The Skid vendor shall include isolation valves (lock open type) in Impulse Lines for the pressure regulators active & monitors and slam shut valves etc. The pressures instruments shall be provided with individual process isolation valves and manifolds.

9.17. Skid vendor shall provide all the software (with CDs) with license copy on the name of Owner. The software is EVC validation software for authentication of the algorithm written in EVC as per AGA.

9.18. The supply of skids shall cover as a minimum the design, manufacture, assembly, calibration, testing and commissioning of the skid and safety associated devices. The package shall also include all the necessary control equipment with enclosures suitable for the working environment.

9.19. The meter shall be installed in a region of zero stress in the pipeline to minimize strain on the meter. The upstream pipe work shall be carefully aligned to minimize flow disturbances, especially at the upstream flange of the meter.

9.20. Lifting lugs and their supporting structure and spreader bar (one for each skid) shall be

designed for a load equal to two times the weight to be lifted (shipping weight).

9.21. Supplier shall note that the complete skid to be pneumatically tested in the factory premises @ 7.0 Barg with N2/Air. In case of dismantling of the skid due to transportation, same shall be re-tested once again at the installation SITE @ 7.0 Barg with N2/Air. If line gas is available, then sat can be done using natural gas. In case of non-availability of gas, vendor shall arrange the N2 gas cylinder for SAT & Commissioning of skid at site in line with approved procedure.

9.22. The custody transfer equipment at field like transmitters (pressure & temperature) shall be installed in an environmental enclosure to minimize the effects of ambient temperature variations and shall be lockable for prevention of unauthorized data entry. The size of the cabinet shall be suitable for removing and fixing of transmitters for ease of maintenance. The transmitters shall be fixed in mounting brackets inside the cabinet. The cabinet shall be mounted and fixed in the skid.

9.23. Contractor shall submit meter approved by MID/OIML/Weights & Measure/FCRI/NMI/ PTB/ NPL or equivalent for custody transfer application. The total uncertainty calculation of the metering system to be submitted as per the design data prior to the fabrication of skid. Critical components within the custody transfer metering system should be compatible to ensure "Overall System Uncertainty" for this critical fiscal transaction purpose with all components within the metering system must be well proven and compatible in the similar application.

9.24. Proper spacing shall be maintained between the equipment for operation & maintenance. The vent & drains shall be properly supported in the skid.

9.25. All types of cables such as signal, alarm, control, power cables including junction boxes, cable tray, earthing strip for grounding of skid all the materials including cable glands, ferrules, lugs, cable tags at both ends shall be included with skid.

10. SYSTEM TESTING

10.1. A written field verification test procedure for all the flow metering system shall be provided by the vendor that will allow the "flow meter" to be functionally tested to ensure that they are operating correctly. This procedure shall include the following requirement:

10.2. The meters shall be removed and replaced with temporary spools during all hydrostatic testing and line cleaning operations to prevent damage to the transducers and to prevent altering the meter's physical dimensions or surface roughness and finish.

10.3. Prior to the flow of gas through the meters, the line shall first be cleaned to remove any rust accumulation or collection of pipeline debris.

10.4. This procedure should include a combination of a cross comparison, measurement analysis, internal inspection, dimensional verification and other such mechanical or electrical tests as per the specification.

10.5. A written field verification test procedure shall also be provided by the vendor that will allow the secondary instrumentation to be functionally tested to ensure that the secondary instrumentation is operating correctly.

10.6. A full commissioning pack shall be developed by the vendor for these activities incorporating the results from each check, test or calibration plus all support documentation such as commissioning test equipment and calibration certificates.

11. PIPING REQUIREMENTS

11.1. All the piping part of the package shall be in accordance with the piping classes given in the project relevant PTS.

SECTION 5

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

PTS – PRESSURE LETDOWN SKID

(DOC No.-PTS-PLS/IGL/ET2/CP/CP18160)

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1. SCOPE

The supply shall cover as a minimum the design, manufacture, assembly, test and supply of the gas pressure reduction skids(1W+1S) with self-actuated pressure regulator with SSV and safety associated devices.

2. DESCRIPTION OF THE SUPPLY

2.1. Pressure Reduction Skids

The design, fabrication, supply, calibration, testing and commissioning shall include all the material required, inside the battery limits of the skids, as shown on the attached "P&ID of a Pressure reduction Skid".

For details of the instruments, refer PTS-Instrumentation Package unit.

2.1.1. **Self-actuated pressure control valves and slam shut valves:**

2.1.2. Set point of the Gas pressure regulators and Slam Shut Valves (SSVs) shall be adjustable. Vendor shall furnish the adjustable range of the Gas pressure regulators/monitors and slam shut valves.

2.1.3. Pressure control valve shall have facility of mechanical type position indicator for monitoring the position.

2.1.4. It is intended to provide slam shut valves on upstream of self-actuated pressure control valves at gas receiving points for tight shut off at increasing pressure beyond a pre-set limit, to take care of self-actuated pressure control valves failure. SSV shall have UPSO and OPSO set points.

2.1.5. Each pressure regulator valve shall be designed for maximum gas flow rate at the minimum inlet arrival pressure.

2.1.6. Pressure regulators/ monitors shall be self-actuated pilot operated with regulation accuracy of better than +/- 1% of set point.

Leakage class for pressure control valve & slum-shut valve shall be class-VI as per ANSI B16.104

2.1.7. The construction of the Regulators / monitors shall be such that there will be no continuous gas bleeding.

2.1.8. Vendor to note that the noise level, at one-meter distance from valve, shall be less than limit specified in the data sheets. Vendor shall provide noise treatment to limit the noise level and include silencers or expanders as required in their scope of supply. Vendor to provide Noise calculation giving full details and standards used and any assumptions considered in calculation. Slam shut valve shall be self-contained type requiring external control line such that the line pressure acts directly on the diaphragm.

2.1.9. Closing time of slam shut valve shall be less than 2 seconds for all sizes of the valves. Actual closing time of the valve shall be furnished by vendor with the quotation.

2.1.10. The automatic switchover shall be achieved with appropriate staggered setting of Pressure regulator and slam shut valves. Vendor shall select the appropriate set points such that the switch-over is smooth without affecting the safety and performance of the system and without any interruption in gas supply to consumers.

2.1.11. Resetting of slam shut valves shall be only manual.

2.1.12. Slam shut valves shall be provided with a mechanical indicator to indicate valve open or close position as well as limit switch for Open & close feedback signal received at EVC.

2.1.13. Slam shut valve shall have a set point accuracy of ±1% over the whole operating range.

2.1.14. The PCV & SSV shall be designed in such a way the noise generated by this equipment shall not interfere with the performance of the meter.

2.1.15. The self-actuating Pressure regulating valve shall be designed as per EN334 or Pressure Equipment Directive PED 97/23/EC covering the production quality assurance.

2.1.16. The Slam shut valve shall be designed as per EN14382 or Pressure Equipment Directive PED 97/23/EC covering the production quality assurance.

2.1.17. Vendor to furnish the Maximum Flow Rate (in SM3/hr) at Minimum Inlet Pressure for all the PCVs at Valve full open condition.

2.1.18. Vendor to furnish minimum Flow Rate (in Sm3/hr) through each PCV without damaging the Trim and Valve internals at minimum Inlet Pressure.

2.1.19. Vendor shall furnish the Flow Rate versus Trim Lift Curve to justify the Valve range ability and Valve regulation characteristics.

2.1.20. Any soft material used in valves shall be able to retain its functional properties for a minimum period of 3 years.

2.1.21. **Valve Materials**

The materials selected for the valve components shall be conform to the process requirements and shall be specified in the data sheets.

Valves manufactured from rolled plates or from assembly by welding of cast parts are prohibited.
Asbestos and/or asbestos compound are not acceptable for packing. Teflon ring type packing shall be used up to 230°C.

Valve Sizing

Sizing of control valves shall be performed by using the flow equations given in ANSI/ISA - S 75.01 or by using the method recommended by the valve Manufacturer.
The Cv of the valve shall be calculated on basis of 1.3 times the operating flow or of 1.1 times the maximum flow (the highest value is chosen).
The calculated Cv value shall be corrected considering pipe reductions, cavitation and/or critical velocity.

Accessories

Fittings shall be stainless steel compression type (two-ferrule type).

Connections

Control valves shall have flanged connections. The flange rating and facing shall be in accordance with piping class. The face-to-face dimensions shall comply with ANSI/ISA S 75.03.
Connections for on-off valves shall be in accordance with piping class.

Pressure regulators may be of flanged type or of screwed type. Screwed type is subject to ENGINEER approval.
The material of construction shall be as specified in related PTS. All the internals/ wet parts shall be SS316. However, for valve sizes 2" & below only SS 316 shall be used.
All tubing within the skid shall be SS316. All tube fittings shall be SS316. The supply of tube fittings shall be from single vendor throughout the skids.
Mechanical works covers mainly supply of pipes, Fitting & Flanges, Valves etc. (size shall be decided by the contractor as per process parameters) Laying of new piping inside the allotted area, underground /above ground Trenching, restoration works etc.

2.1.22. VALVE NAME PLATE

Each valve shall have SS name plate permanently fastened to the super structure which shall be visible when the valve is in service and fully insulated. The name plate shall contain the following information:

- Manufacturer's name and trade mark.
- Valve Tag no., model no. & serial no.
- Actuator model no. & serial no.
- Valve body / bore size and pressure rating.
- Failure position.

2.1.23. INSPECTION

All valves shall be tested as per API 6D, BS 6755 as mentioned in the ITP. Purchaser or their representative(s) reserve (s) the right to witness the tests.

Actuator shall be mounted on the valve and tested as follows:

To ensure smoothness of operation vendor shall perform at least five (5) Cycle (open and shut) for each valve with its actuator.

Shut valve and apply hydraulic differential pressure as given in the data sheet, across the valve. This shall be repeated at least 3 times and shutdown time noted at minimum supply pressure.

Test shall be witnessed by Purchaser or their representatives.

Final testing and approval made by Purchaser's representative shall not relieve the contractor from his responsibilities as per contract obligations.

2.1.24. PACKING AND SHIPPING

Valves shall be dried, greased, devoid of test media and provided with unused dry packing before dispatch. All exposed parts of the valve not made of stainless steel and other corrosion resistant material shall be coated as per relevant painting specification.

Valves shall be suitably protected against damage while in transit.

All threaded and flanged openings shall be suitably protected to prevent entry of foreign material during shipment.

Valves shall be supplied as a whole, complete with all accessories and properly packed.

2.2. Other Supplies

The following supplies shall be included in vendor bid:

- The shop painting in accordance with paint system specification.
- The engineering documents requested in the DDR attached to the Material Requisition.
- The material certificates.
- Skid structure and platforms.

2.3. Services

The vendor shall include in his bid the following services:

- The complete engineering / design of the skids.
- The mechanical tests.
- The non destructive tests.
- The performance tests.
- The assistance / supervision of the erection.

- The assistance for commissioning and start-up.
- Testing, pre-commissioning, commissioning and start up.
- The services of a control authority for the delivery of certificates as per QC/QA
- TPI for all supplies.

3. ELECTRICAL REQUIREMENTS

Electrical materials will in general follow the IEC standards and be in compliance with all applicable local regulations.

As per IEC, the material will be installed in hazardous area zone 1 and classified as EEx-d IIA/IIB, T3. Enclosure protection degree as per min. IP65.

4. PIPING REQUIREMENTS

All piping and valves shall be in accordance with the piping classes attached to the Material Requisition.

5. UTILITIES

5.1. Consumptions

The Contactor shall indicate the expected utilities consumption, i.e. electrical power, gas (for SSV, monitor & regulator valve) whichever applicable.

The contractor shall propose a guarantee value for both.

SECTION 6

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

PTS – INSTRUMENTATION FOR PACKAGE UNIT WITH APPENDICES

(DOC No.-PTS-IPUA/IGL/ET2/CP/CP18160)

TABLE OF CONTENTS

1.0 INTRODUCTION

This specification covers the basic requirements for the design, the selection, the requisitioning and the installation of instrumentation and control systems associated with equipment purchased as a "Package Unit".

2.0 INSTRUMENT IDENTIFICATION

Each instrument shall be identified by unique tag no. as per P&ID.

3.0 DESIGN PRINCIPLES

3.1 General

Instrumentation, control and monitoring systems of Package units shall be in accordance with this specification and as defined in the P&I Diagrams.

The Package Units shall be supplied complete with all instrumentation, fully piped, wired and tested to ensure safe, reliable and effective operation as well as easy maintenance of the complete Package Units.

Protection and packing of all materials shall be suitable for shipment and protection on jobsite during storage prior to erection.

3.2 Instrument Selection

Instruments and instrumentation systems of proven reliability suitable to Area classification Zone 1, Gr. IIA / IIB, T4, shall be used.

Selection of instrumentation shall be made from the approved Instrument Supplier Lists. Any exception has to be justified and is subject to approval by the Owner/Owner's Engineer.by the Owner/Owner's Engineer.

3.3 Tagging

All instruments and instrumentation equipment shall be permanently identified by tags, labels and/or nameplates. Use of adhesive tapes shall not be allowed.

3.4 Painting

Manufacturer's standard colours shall be used for all instrumentation equipment in control and instrument rooms, unless otherwise specified.

Field instruments shall generally be epoxy painted, unless otherwise specified.

3.5 Transmission Systems

1) Transmission of the process variables shall generally be by means of electronic or low level signals.
2) The output signal for electronic instruments shall be 4 to 20 mA DC or digital.
3) As far as possible, a true two-wire transmission system shall be used.
4) Each pneumatic instrument shall be provided with its own air/gas filter regulator.
5) No process fluid shall be piped into the control rooms or the instrument rooms.

3.6 Enclosures and Materials

1) All instruments shall be suitable to withstand the environmental conditions specified for the plant location.
2) All parts subject to moisture, fungus growth or insect attack shall be suitably treated (tropicalisation).
3) Local instruments/ equipment's housing shall be weather-proof (WP to IP65 minimum) and shall meet the electrical area classification requirements.

a. Control / Electronics Room mounted instruments/equipment's housing shall be Ingress Protection IP-42 minimum and shall meet the electrical area classification requirements.

4) All parts of instruments exposed to process fluids shall be resistant to corrosion by the corresponding fluid.

3.7 Electronic Instrumentation in Hazardous Areas

1) In hazardous areas, intrinsically safe instrumentation shall be provided.
2) If not possible or not practical, flameproof concept may be applicable.
3) All electrical instruments to be installed in hazardous locations shall be certified to ATEX directives or other international agencies like CSA, UL, and FM.
4) Contacts shall be encapsulated and, if used in intrinsically safe circuits, contacts shall be gold plated.

3.8 R.F. Immunity

All instruments and control systems shall be immune from the effects of any R.F. interference that may occur at the plant location in accordance with IEC 801 "Electromagnetic compatibility for industrial-process measurement and control equipment".

3.9 Instrument Connections

1) In general, process connections on instruments shall be 1/2" NPT.
2) Pneumatic connections shall generally be 1/2". Larger sizes may be used for special applications, e.g. for high-speed actuators.
3) Electrical connections on field instruments shall be ½" NPT.

3.10 Measuring Units

The metric SI system shall be used for all documents. The following units of measurement as well as their multiples and sub-multiples, shall be used :

3.10.1 **Flow**

Gas : Sm^3/h (15.556^{O}C; 1.01325 bara), MSCMD

Liquid : m^3/h (at flowing temperature) L/h for flow lower than 0.1 m^3/h

Steam, condensate and mass flow : kg/h.

3.10.2 **Pressure**

Gauge pressure : kg/cm^2 (g) and Bar (g)

Absolute pressure : kg/cm^2 (a) and Bar (a)

Differential pressure : kg/cm^2, mm of H_2O, mm of Hg and mill bar

3.10.3 **Level**

0 - 100 % (Process)

3.10.4 **Temperature**

Deg C

3.10.5 **Other Measurements**

Current: A or mA

Voltage: V or mV

Power: kW

Force: N

Mass: kg or t

Density: kg/m^3

Time: d or h or s.

3.11 Scales and Charts

1) Temperature instruments shall have scales calibrated in °C.
2) Pressure instruments shall have scales calibrated in bar g.
3) Absolute pressure instruments shall have scales calibrated in bar g(a).
4) Flow instruments shall have either 0 - 10 square roots (local instruments) or 0 – 100 linear scales (control room instruments).Scale multipliers shall be based on the measurement units defined.
5) Level instruments shall have scales calibrated 0 - 100 %.
6) Charts for all instruments shall be 0 - 100 linear.

4.0 ENGINEERING AND DESIGN DOCUMENTS & DRAWINGS

The documents and drawings to be prepared by the CONTRACTOR are listed hereunder. These shall be submitted for Owner/Owner's Engineer's approval during engineering stage.

4.1 Documents

As a minimum requirement, the following documents shall be provided, when applicable.

4.1.1 **Instrument index**

Instrument Index shall include all tag nos. shown in P&ID and it shall be prepared by contractor

4.1.2 **Instrument data sheets**

The data sheets shall comprise all necessary technical data associated with the Instruments as per the enclosed format (Ref. Appendix 1).

4.1.3 **Calculation sheets**

Sizing Calculation sheets for meters, safety relief valves, sizing calculation of SSV, monitor and regulator valve, T/W wake frequency calculation, filter etc. shall be provided along with data sheet.

4.1.4 **I/O Point Database**

This document shall indicate all input / output tag nos. for control system.

4.1.5 **Certification files**

They shall contain copies of all electrical safety certificates and all documents applicable to the safety of electrical equipment installed in hazardous areas (e.g. intrinsically safe loop specifications).

4.2 **Drawings**

As a minimum requirement, the following drawings shall be prepared, when applicable.

4.2.1 **Functional loop drawings**

The functional loop drawings shall illustrate the process control philosophy.

4.2.2 **Cable Schedule**

The cable schedule shall indicate details of the required cables (e.g. cable number with size, type, length, termination points, pair no., colour code etc.).

4.2.3 **Instrument Interconnection diagrams**

The instrument interconnection diagrams shall show schematically an overview of the cable interconnections between panels, cabinets, racks, junction boxes and instruments.

4.2.4 **Cable layout drawings**

The cable layout drawings shall show the main routing of instrument cables and the location of all instrument junction boxes and metering panel.

4.2.5 **Earthing drawings**

The earthing drawings shall show the requirements of earth cabling up to the earthing systems.

4.2.6 **Loop diagrams**

The loop diagrams shall show the connections between components of each loop with identification of terminals and cables.

4.2.7 **Process hook-up drawings**

The process hook-up drawings shall show installation details for the various instruments, complete with a schedule of required material as per enclosed standard drawings.

4.2.8 **Tubing hook-up drawings**

The tubing hook-up drawings shall show installation details for control valves and on-off valves complete with a schedule of required material as per enclosed standard drawings.

Contractor shall develop applicable standard hook up drawing for PG, PT, DPG, LT, DPT, tubing connection for SSV, monitor and regulator valve as standard practice and shall submit for approval.

5.0 INSTRUMENT INSTALLATION

5.1 Accessibility

1) The installation of instrumentation shall be such as to minimise the effects of fire, solar radiation, vibration, heat from process equipment, condensation, spillage, rain, and maintenance activities, etc.
2) Instruments and their connections shall always be accessible from ground level, floors, platforms, walkways (2 m above or 1 m either side of).

5.2 Instrument Process Piping

1) The instrument impulse lines shall include facilities for Isolation, Drain/Vent, Maintenance, Protection, Testing and Calibration.
2) Instrument installation shall be as per enclosed Standard Drawings.

5.3 Erection Works

Supervision of installation/erection, calibration, checking, testing and commissioning of skids, equipments, instrumentation at site shall be in the contractor's scope.

5.4 Installation Material

5.4.1 **Instrument Process Piping**

Stainless steel tubing, compression fittings, manifolds and valves shall be used for instrument process piping connected to the isolating valves on process lines and equipment, unless process conditions require another material. All tube fittings shall be Swagelock / Parker. However, the supply of fittings shall be from single Contractor throughout the plant.

5.5 **Instrument Supports**

The supports for instruments and junction boxes shall be in accordance with the enclosed standard drawings.

5.6 **Instrument Canopy**

In case of skid is outside the enclosure then Canopy to be provided for all transmitters for protection from direct sunlight and rain.

The custody transfer equipments at field like, transmitters (pressure & temperature) shall be installed in an environmental enclosure to minimize the effects of ambient temperature variations and shall be lockable for prevention of unauthorized data entry. The size of the cabinet shall be suitable for removing and fixing of transmitters for ease of maintenance. The transmitters shall be fixed in mounting brackets inside the cabinet. The cabinet shall be mounted and fixed in the skid.

The method of protection shall be carefully selected in function of the fluid properties, toxicity and hazard.

Fragile instruments shall be supported independently of equipment which may generate nuisances (e.g. possible damage by mechanical vibrations).

6.0 INSTRUMENTATION WIRING

6.1 General

1) All field mounted electrical and electronic instruments shall be connected by means of individual cables to field mounted junction boxes. All the field cables and cables from field to control room shall be intrinsically safe type.

2) The field mounted junction boxes shall be provided for the connection of multicore cables and of individual cables to local instruments.
Different types of signals shall be segregated into separate junction boxes:

   Analogue signals,

   RTD signals,

   Thermocouple signals,

   Frequency signals,

   Logic signals,

   Solenoid valves,

   Power supply.

   A further segregation shall be made between intrinsically safe and non-intrinsically safe signals.

3) Multipair cables shall be used between each field mounted instrument junction box to control panel/metering panel.

4) All field cable runs shall be designed to prevent ingress of moisture. Side or bottom entries to instruments or junction boxes should be used to ensure this. Cables shall have drip loops.

5) Spare capacity to be provided in multipair cables is defined in Appendix 6. This spare capacity is applicable to the as built situation.

6) The cables shall be installed above ground on cable trays and/or ladders made of heavy duty galvanised steel. Cable runs shall be designed to avoid all possible fire hazards. Where this is not practical, cable runs shall be fireproofed using metal trunking, mineral wool and galvanised cladding.

7) The numbering system for cables, junction boxes, cross boards, panels, cabinets, consoles, shall be specified by the ENGINEER.

8) All cables and wires shall be numbered. All cables shall be marked at each end. Each wire shall be labelled (terminal strip reference).

9) Where field cables are run in areas with little available means of support (e.g. structural steelwork), cables shall be laid in trenches.

10) All cables shall pass through a compression type cable gland before being terminated.

11) Glands shall meet the requirements of the area in which they are installed and certification shall be required where applicable.

6.2 Cables

The instrumentation cables shall be selected in function of the application on basis of the ENGINEERING specification.

6.3 Terminations

1. Screw / Clamp type terminals shall be used. Conductor ends shall be lugged with crimped end-sleeves.

   Only one wire shall be connected to each terminal side.
   Terminal straps shall be used for bridges between terminals.

2. Sufficient slack cable shall be left neatly coiled or looped at terminals to allow for the re-making of terminations, additions and testing.

3. Attention shall be given to the location of terminal rails in junction boxes, etc., in order to provide sufficient space to install field cables without bunching or congestion. All cable and terminal numbers shall be clearly visible.

4. All spare wires of instrument cables shall be terminated to terminals in junction boxes, control room panels, etc.

6.4 Segregation of Cables

Instrumentation cables (4-20 mA, mV signals, etc.) shall be adequately separated from power wiring and electrical equipment to minimize interferences. The physical distance between instrumentation cables and power cables in parallel routing shall be as follows:

Voltage (V)	Min. distance (mm)
110	400
230	400
400	600
690	600
6000	1200

If required, the instrumentation cables shall cross the power cables at right angle and with a minimum distance of 300 mm.

6.5 **Earthing**

Earthing of instruments, panels, consoles, shall be carried out by others in accordance with the applicable code requirements. Contractor shall provide only earth bus / terminal for connectivity. Supply of earth pits is excluded from contractor's scope.

The skids shall be bonded for earth continuity and two external earthing bosses shall be provided, on each skid at diagonally opposite ends, for connection to the plant earth grid

6.6 **Screening**

Screens on instrument cables carrying 4-20 mA and on-off signals (low level, low impedance signals) shall be interconnected and earthed at one point (preferably in the instrument room).

Exception shall be done for cables carrying digital (serial) signals, high frequencies, etc. In those cases, the screens shall be earthed at both ends to prevent against electromagnetic interferences caused by HF radiations.

7.0 INSTRUMENT CABLES

7.1 All cables shall be Flame retardant low smoke (FRLS) type.

7.2 Voltage Grade of cables shall be 650/1100 V.

7.3 1Px1.5 mm², 1Qx1.5mm², 2Px1.5 mm², 8Tx1.5mm², 6Px 0.5 mm², 12Px0.5 mm², 1Tx1.5mm² cables shall be used for instrumentation purposes. No other combination shall be acceptable.

7.4 Cable shall be supplied in drum and negative tolerance in cable length for each drum shall not be acceptable.

7.5 1T x 1.5mm² shall be used for gas detection system. Quad cable shall be used for RTD. Single pair or two pair cable shall be used from field instruments to junction box.

7.6 Multi pair cable individual and over all shielded shall be used for all the along signals from junction box to control room and panel to panel inside the control room as applicable

7.7 Multi pair over all shielded cable shall be used for all the digital input /output signals from junction box to control room and panel to panel inside the control room as applicable.

7.8 Single Pair and quad Shielded Cable

7.8.1 Each core shall be 1.5 mm2 made of 7 stranded annealed electrolytic copper conductor. Each strand shall be 0.53 mm dia.

7.8.2 For Intrinsically safe application, primary insulation shall be low density poly ethylene (LDPE). For non- intrinsically safe application, primary insulation shall be 85°C polyvinyl chloride (PVC) as per IS5831 Type C. Thickness shall be 0.5 mm minimum.

7.8.3 A pair shall have twisted cores and number of twists shall be not less than 10 per metre. Colour of core insulation shall be black blue in pair and black, blue and brown in triad.

7.8.4 Individual pair shall be shielded. Shield shall be Aluminium backed by Mylar/polyester tape with the metallic side down helically applied with either side 25% overlap and 100% coverage. Minimum shield thickness shall be 0.05 mm. Drain wire shall be 0.5 mm2 multi-strand bare tinned annealed copper conductor. The drain wire shall be in continuous contact with Aluminium side of the shield.

7.8.5 Inner and outer jacket shall be made of extruded flame retardant 90oC PVC to IS 5831-Type ST2. Oxygen index of PVC shall be over 30%. Temperature Index shall be over 250°C. The thickness of the jacket shall be as per IS-1554 Part 1.

7.8.6 Inner jacket colour shall be black. Outer jacket colour shall be black except, for cables to be used in intrinsically safe systems it shall be light blue. A rip cord shall be provided for inner jacket.

7.8.7 Armour over inner jacket shall be galvanized steel wire as per IS-1554 Part 1.

7.9 Multipair Cable with Individual Pair Shield and Overall Shield:

7.9.1 Generally the cable shall be same as single pair shielded cable except conductor sizes shall be 0.5 mm2 made of 7 strands of annealed electrolytic copper conductor. Each strand shall be of 0.3 mm dia.

7.9.2 Overall shield shall be of Aluminium backed up by Mylar/polyester tape helically applied with the metallic side down with either side 25% overlap and 100% coverage. Minimum shield thickness shall be 0.05 mm. Drain wire shall be similar to individual pair drain wire and shall be of the overall shield.

7.9.3 A pair of communication wire shall be provided for multipair cables. Each wire shall be 0.5 mm2 of plain annealed single or multi-strand copper conductor with 0.4 mm thick 85°C PVC insulation. Insulation shall be green and red colour coded.

7.9.4 Pair identification shall be with numbers at interval of not more than 250 mm as per vendor's standard.

7.10 Multipair Cable with only Overall Shield

7.10.1 These cables shall be same as above except that the individual pair shall not have shielding.

7.11 Electrical Characteristics

7.11.1 Resistance:

Maximum DC resistance of the conductor of the completed cable shall not exceed 12.3 Ω / km at 20°C for cables with 1.5 mm^2 conductors and 39.7 Ω / km at 20°C for cables with 0.5 mm^2 conductors.

7.11.2 Capacitance:

Mutual Capacitance:

The mutual capacitance of the pairs or adjacent cores shall not exceed a maximum of 250 pF / m at a frequency of 1 kHz.

Capacitance between any core or screen:

The capacitance between any core or screen shall not exceed a maximum of 400 pF / m at a frequency of 1kHz.

L/R ratio of adjacent core shall not exceed 40 µH / Ω for cables with 1.5 mm2 conductors and 25 µH / Ω for cables with 0.5 mm2 conductors.

The drain wire resistance including shield shall not exceed 30 Ω

/ km. Electrostatic noise rejection ratio shall be over 76 dB.

7.12 INSPECTION AND TESTING

OWNER reserves the right to test and inspect all the items at the manufacture's works.

Manufacturer shall furnish documents such as test certificates to prove the quality and composition of the materials used for manufacturing the cable to the satisfaction of OWNER/OWNER's Representative during expediting and inspection.

7.12.1 Type Test:

a) Type Certificates shall be furnished.
b) Cable shall be flame retardant to IEC 332-3 Part 3 Cat A.

7.12.2 Routine Tests:

a) These tests shall be carried out by manufacturer during various stages of manufacturing. OWNER shall review the related documents.
b) Insulation and Sheaths: All tests as per IS-5831 except insulation resistance, voltage and spark test shall be as per BS-5308 Part 2.
c) Armour test as per IS-3975.
d) Conductor resistance.
e) Cable capacitance, L/R ratio.

7.12.3 Acceptance Test:

These tests shall be carried out in the presence of OWNER / OWNER's Representative.

7.12.4 Continuity test:

a) Voltage test as per BS-5308 Part 2.
b) Conductor resistance and drain wire resistance.
c) Cable capacitance and L/R ratio test.
d) Electrostatic noise rejection test, type wise for each lot.
e) Tests for uniformity of galvanization of armour as per IS-2633.
f) Oxygen index test as per ASTM D 2863, temp. index test, smoke density rating test, acid gas generation test and flammability test.
g) Dimensional check for overall diameter and under armour/over armour diameter.
h) Overall finish check. In case of any lump purchaser shall have the right to cut outer sheath for lump portion and reject the cable.
i) Check of Drum length and overall length tolerances.

Immediately after completion of electrical tests, the ends of the cable shall be sealed to prevent ingress of moisture with suitable PVC/Rubber caps.

7.13 CABLE GLANDS

- Cable gland shall be provided for all the above mentioned cables both at field instrument, junction boxes and local control panel.
- Instrument cable gland shall be ½" NPTM insulating glands double compression type, weather proof (WP) IP 65 in field instrument side only for underground instruments tapping to protect the CP current drainage.
- Except that, all other shall be standard metallic gland. All cables glands shall be of nickel-plated brass WP IP65 and they shall be double compression type suitable for armoured cables.
- Flame proof Ex (d) glands in hazardous area shall be supplied and along with Ex (d) certification.

- Cable gland shall have PVC shroud.
- Reducer/adapter & plug shall be supplied as per requirement. These shall be Nickel plated brass, Weather proof and Flame proof as require.

7.14 CABLE TRAYS AND CABLE DUCTS

- All branch cables/trench cable shall run on cable trays.
- These cable trays shall be made out of galvanized iron-perforated type of 2.5 mm thickness. These trays are supported with suitable clamps shall be supplied for binding the cables/tubes at every 500 mm interval. All the cable/tubes will be laid in trench, false flooring/ ceiling trays, instrument support structures and supported with 50 mm x 50 mm angles as a minimum.
- Maximum width of the cable tray shall be 600mm and height 50mm, 75mm or 100mm as applicable. 25% spare capacity shall be provided in cable trays.
- The above ground outdoor field cables shall be laid in durable, non-corrosive hot dipped galvanized perforated cable trays of suitable sizes shall be provided for cable routing between junction boxes/ instruments and buried trench in the station/unit facilities. The cable trays shall be supported at regular intervals.
- Contractor shall submit details of cable trays including size, layout drawings etc. during detailed engineering stage. Supply, installation and fixing of Prefabricated hot dipped galvanized perforated cable trays of width 50 mm / 100 mm / 150 / 300 mm as per site requirement for laying of cables. The work includes cutting to size, fixing with all accessories on concrete / wall / structures etc.
- The proper NEMA strength classification trays shall be used in accordance with loading requirements. The tray shall be installed with standard vendor/contractor components and shall be covered with perforated covers (of same material) after laying cables.
- Cable tray shall be rigidly supported to carry the weight of the cables laid within, as well as any vibrations which may be experienced in normal operation of work. At no time shall the cable tray be used to sit or stand on, nor shall tools or pipe be placed on the tray.
- Cable trays and supporting steel structure etc. to be painted as per standard procedures of painting to meet the corrosive area requirement. Proper color shall be provided in the cable trays. Epoxy based paint is to be applied on the all MS structures including support structures. Cable trays shall be installed with cabling etc as per site requirements. Cable laid in horizontal trays shall be fixed to the trays by means of suitable detachable type, non-corrosive straps at intervals not exceeding 500 mm.
- Cable trays shall be supported at each 2500 mm or less of horizontal run and shall be so routed that there is no danger of mechanical damage. Routing shall follow major structure axis.
- Cable trays for Hydrocarbon detectors cabling etc as per site requirement.

7.15 JUNCTION BOXES

- Junction boxes shall be provided for intrinsically safe and non-intrinsically safe instruments also as required for packages such as gas detection system, fire detection system etc.
- For non-intrinsic safe signals, junction box shall be explosion proof to Exd. IIA/IIB, T3 and weather proof to IP 65 and made up of dia cast aluminium.

- For intrinsic safe signals, junction box shall be weather proof to IP 65 made up of di-cast aluminium.
- Enclosure: Cast in corrosion resistant light aluminium alloy (LM-6) suitable for Group C & D gases. The construction shall comply to IS: 2148 - 1981 and relevant international standard (IEC - 79.1), BS: 229 - 1957). The enclosure shall have ample space for proper termination of cables as per summary of requirement attached and as mentioned in these specifications.
- In addition, the enclosure shall be totally dust, vermin and weather proof suitable for outdoor installation without any canopy. Degree of protection should be minimum IP-65 as per IS/IEC: 60529 – 2001.
- Terminals: Junction boxes shall be provided with vibration proof terminals (as per vendor list) clip on type 2.5 sq.mm suitable for 500 VAC working voltage. Arrangement of fixing terminals strip shall be made such that cable connections can be made easily.
- Earthing: External and internal earthing terminals complete with set of washers shall be provided.
- Mounting: The junction boxes shall be suitable for field mounting on M.S supporting structures.
- Painting: Junction boxes shall be pre-treated by first coat of epoxy zinc chromate primer followed by anti-corrosive industrial epoxy grey paint shade IS 631.
- Cable entries: The junction boxes shall have bottom entry and should be of NPT threads only.

ELECTRONIC VOLUME CORRECTOR (EVC)

UNITS: Flow<-> Liquid- m*3/hr Gas- Sm*3/hr Steam- kg/hr Pressure-> kg/cm*2 G Temperature<-> oC Level/Length<-> mm

1	Tag No.:	*
2	Type:	Microprocessor based battery operated Volume corrector with integral smart Pressure and temperature sensor suitable for mounting in the field location and applicable for custody transfer
3	Model No.:	*
4	Mounting:	EVC can be integral or external to the meter, directly mounted on the meter body. Necessary clamps/ fixtures shall be provided in case the EVC is external
5	Hazardous area classification:	Suitable for installation in hazardous area Zone – I, GRIIA / IIB,T3 and IP65
6	Power Supply:	Battery operated. Battery life shall be minimum 5 year considering polling twice in a month through GPRS modem
7	Input:	a Pulse output from RPD Flow Meter for flow.
		b Temperature signal from RTD element with an accuracy of + 0.2% of measured value with thermowell. All interconnecting cable shall be screened and armored. The RTD with Thermowell, Cable and cabling accessories to be supplied by the Supplier.
		c **Pressure signal 4-20mA from built-in Pressure Transmitter with an accuracy of +/- 0.1 % of measure value and a range of 0-10 Kg/cm2 g. Pressure sensors to be individually calibrated and characteristics stored within the volume corrector. The tubing and tube fitting accessories to be supplied by Supplier.
		d min digital input is required (two SSV limit switch + one number PGD+ spare)
8	Output:	Corrected flow rate in standard cubic meter per hour (SCMH), Corrected totalized volume (Sm3), Temperature, Pressure, Actual Volume, Correction Factor, Uncorrected flow rate, Un-corrected Total Volume (m3), Yesterday Flow (SCM), Today's Flow (SCM), etc.
9	Isolation:	All inputs, outputs and power supply shall be individually isolated.(by using analog and digital barriers)
10	Display	2 line 16 large character LCD display with selectable decimal, Displaying all units, messages, alarms (Battery Low, Pressure out of range, Temp. out of range, flow over range, fault in measurement) etc shall be in English.
11	Units of display	Corrected flow rate : SCMH, Corrected Totalized volume : Sm^3, Pressure : Kg/cm^2 (g) or bar (g), Temperature : °C, Actual Volume : M^3
12	Battery:	Lithium Battery with suitable capacity, battery life should be minimum 5 years. Battery should be capable of working in hazardous area. No setup data should be lost while changing battery. It should be possible to change battery in field.
13	Calculations Standard	Compressibility : AGA 8 (Latest)
14	Accuracy	Maximum gross error of flow calculation should be better than (+/-) 0.5 percent of measured value
15	Ambient Temperature	0 to 60 Deg. C
16	Accessories	1 set of connecting cable, required software CDs (Licensed copy) for communication of Laptop with EVC
17	Features	a Built in diagnostics to detect proper functioning
		b EVC should be supplied with single SIM GSM/GPRS modem. Modem shall be powered by EVC battery/solar/UPS. Polling frequency shall be as per AMR requirement. Vendor shall consider life of EVC battery accordingly. GPRS modem shall be 3G/4G/LTE/Latest and upcoming technology compatible. This shall be an intelligent and running 24x7. IPsec encrypted VPN shall be supported.
		c EVC shall be capable of continuing with flow measurement even when downloading / uploading of data is going on
		d Data security through password, key-lock facility and volume conversion and configuration to be sealed.
		e Parameters and programmed constants shall be stored in EEPROM / non-volatile memory
		f Facility for entry and accessing live and stored data through Keypad / Laptop / SCADA system.
		g Must have facility to store at least 180 days data (on hourly basis) for pressure, temperature, corrected and uncorrected flows with date and 120 Event log.
		h The stored data above shall be retrievable by using Laptops. Suitable dedicated port shall be available on the EVC for Laptops connection. Software required shall be supplied without any additional charges.
		i Gas composition can be entered from key board, Laptop & GPRS (Remotely)
		j Base parameters for calculation of corrected gas flow shall be as under or configurable Pressure: 1.03323Kg/cm2, Temperature: 15.56 Deg. C
		k EVC should have provision to enter correction factor for compensating any error found in calibration of gas flow meter / Auto correction feature required
		l Ports- One port for connection of GSM/ GPRS modem, One spare port (RS 232/485) for future connection to scada, One optical port for laptop for accessing EVC data with laptop. Required optical cables with connectors/convertors shall be supplied with each EVC.

NOTES : * : Vendor to furnish

1 Process parameters shall be as per appendix-2 of PTS

2 Vendor must indicate power consumption for the system.

3 Keylock shall be provided for prevention of unauthorized data entry in EVC

4 Vendor must give demo for checking communication with GSM/GPRS modem by inserting sim card before dispatch of the skid.

**If pressure transmitter is a integral part of EVC, then 4-20 mA signal transmission not required. Accuracy of PT shall be as given in data sheet.

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ROTARY POSITIVE DISPLACEMENT FLOW METER

UNITS: Flow<-> Liquid- m*3/hr Gas- Sum*3/hr Steam- kg/hr Pressure-> kg/cm*2 G Temperature<-> oC Level/Length<-> mm

General	1	Tag No.			As per P&ID	
	2	Quantity			as per MR/SOR	
	3	Line No.			As per P&ID	
	4	Line Size & Schedule			As per P&ID	
	5	Service			Natural Gas	
Meter	6	Type of Element			Rotary Vane Type.	
	7	Size			Vendor to provide	
	8	Design			As per EN 12480	
	9	End Connection			Flange	
	10	Rating & Facing			Note-5/RF	
	11	Temp. & Press. Rating			Note 4	
	12	Totalized Units			Vendor to provide	
	13	Enclousure Class			IP65	
	14	Power supply			Vendor to provide	
	15	Material :				
		Body			Cast Aluminum alloy (Tamper proof & corrosion resistant)	
		Rotating Element			Note-1	
		Shaft			Note-1	
		Blades			Note-1	
	16	Bearings : Type & Material			Note-1	
	17	Rangeability			1:100 or better	
	18	Type of Coupling			Magnetic	
	19	Meter Accuracy			+/- 2% Qmin to 0.1 Qmax, +/-1% 0.1Qmax to Qmax	
	20	DP Across Meter			Vendor to provide	
	21	Repeatibility			+/- 0.2 percent or better.	
Counter	22	Local Counter			Required	
	23	Register type			Required	
	24	Totalizer			8 digit mechanical index non-resettable.	
	25	Reset			Non-resettable.	
	26	Capacity				
	27	Set- Stop			Not required	
	28					
Options	29	Temp. Compensator			Required	
	30	Pressure Compensator			Required	
	31	Meter Output			LF Pulse	
	32	Hazardous duty version			Yes	
	33	Nameplate			Tag number, Services engraved in stainless steel tag plate	
	34	Air Eliminater			Vendor to advice	
	35	Strainer: Size & Mesh			NA	
Process Data	36	Fluid and State			Natural gas	
	37	Flow	Normal	Design	Note - 2	
	38	Temp.	Normal	Design	Note - 2	
	39	Pressure	Normal	Design	Note - 2	14.06.22
	40	Molecular Wt.	Specific Gravity			
	41	Viscosity (cP)				
	42	Area Classification			Hazardous Zone 1 Group IIA /IIB T3 as per IEC	
	43	Model No.	Meter		Vendor to provide	
	44	Make			Vendor to provide	
	45	Dimensions of the meter			Vendor to provide	
	46	Lubrication pump with 5 times fill lubricator			Required	

Notes:

'*' : 1. Vendor to specify.
2. Process Data shall as per appendix-2 of PTS
3. As per attached P&IDs.
4. As per piping Specification.
5. RPD meter rating shall be as per P&ID

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APPENDIX 1	PTS-IPUA/IGL/ET2/CP/CP18160	
Sheet 02 of 09	CLIENT:	Indraprashta Gas Limited (IGL)
	PROJECT:	MRS skid for CGD Projects
	CONTRACTOR:	
	VENDOR:	

JUNCTION BOX

General	1	Tag No.	Quantity	*	*
	2	Application		For Instrumentation IS/Non-IS cables(Note-5)	
	3	Area Classification		Zone 1, Gr. IIA / IIB, T4	
	4	Enclosure		WP to IP 65 & EExd IIA/IIB T4 as per IEC 60079 / IS 2148/	
	5	Material of Construction		Die cast aluminium (LM6 alloy)	
	6	Overall Dimension		*	
	7	Cover		Screwed	
	8	Painting		Surface : Opaline Green & Inside : White	
	9				
Single Cable	10	No. of Entry	Left Side	6 nos. - 1/2" NPT(F)	
	11		Right Side	6 nos. - 1/2" NPT(F)	
	12		Top Side	-	
	13		Bottom Side	-	
	14		Other	-	
	15	Cable	Type	Double compression, Ni plated brass & WP to IP 65 & EExd IIB T4 as per IEC 60079 / IS 2148	
	16	Gland	Size	1/2" NPT(M)	
	17				
	18				
	19				
Multi Cable	20	Entry		2nos.	
	21	Cable	Type	Double compression, Ni plated brass & WP to IP 65 & EExd IIB T4 as per IEC 60079 / IS 2148	
	22	Gland	Size	1 1/2" NPT(M)	
	23				
	24				
Terminals	25	Type		Spring loaded, antiloosening & vibration-proof	
	26	Quantity		48 Nos.	
	27	No. of Rows		2 Nos.	
	28	Numbering System		Terminal strips & terminals shall be suitably numbered	
	29	Size		2.5 mm2	
	30	Make		*	
	31				
Options	32	Telephone Socket & Plugs		Required	
	33	Plug		1/2" NPT(M) & 11/2" NPT(M)	
	34	Ground Busbar		Required	
	35	Rail(s) for terminals		Required	
	36	PVC hood alongwith Cable gland		Required	
	37	Hinges		Required	
	38	Nameplate Fixture		Required	
	39	Gasket		Neoprene Rubber	
	40	Hardware			
	41	Mounting			
Others	42	Manufacturer			
	43	Model		* 14.06.22	
	44				
	45				
	46				
	47				

NOTES:

1. * : Contractor to furnish
2. Ex d Junction boxes shall have detachable cover which is fixed to the box by means of cadmium plated triangular head / hexagonal head screws.
3. Ex d Junction boxes shall have a warning engraved / integrally cast on the cover as "ISOLATE POWER SUPPLY ELSEWHERE BEFORE OPENING".
4. Quantity and size of Cable glands & plugs shall be as per requirement.
5. At the time of approval of DS, supplier shall furnish DS with catalogues
6. For Non IS signals, Ex"d" JB shall be used and for IS signals WP JB shall be used
7. WP Junction boxes shall have doors which shall be hinged type and these shall be fixed by plated countersunk screws.

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APPENDIX 1	PTS-IPUA/IGL/ET2/CP/CP18160	
Sheet 03 of 09		
	CLIENT:	Indraprashta Gas Limited (IGL)
	PROJECT:	MRS skid for CGD Projects
	CONTRACTOR:	

DIFFERENTIAL PRESSURE GAUGE

UNITS: Flow<-> Liquid- m*3/hr Gas- Sm*3/hr Steam- kg/hr Pressure->kg/cm2 g Temperature<-> °C Level/Length<-> mm

1	Type:-	Direct	
2	Mounting:-	Local	
3	Dial Size:-	150 mm	
	Colour:-	White with black inscriptions	
4	Case Material:-	SS316	
5	Bezel Ring:-	Screwed	
6	Window Material:-	Shatterproof glass	
7	Enclosure:-	WP to IP 65 as per IEC 60529/IS 13947	
8	Pressure Element:-	Diaphragm/bellows/Piston	
9	Element Material:-	SS316	
10	Socket Material	SS316	
11	Accuracy:-	+/-2% of FSD	
12	Zero adjustment:-	Micropointer	
13	Connection:-	1/2" NPT(F)	
	Connection Location:-	Side / Bottom	
14	Movement:-	SS316	
15	SWITCH	--	NA
	Type:-	--	
	Microswitch	--	
	Set Point	--	
	Terminal Block	--	
	Rating	--	
16	Over Range Protection:-	Maximum Static Pressure	
17	Blow Out Protection:-	Yes	
18	Options :-	a) Snubber	
	b) Syphon	c) Gauge Saver	
	d) Liquid Filled casing	e) Vaccum Protection	
	f) 5 valve manifold		
19	Quantity :-		

SL. NO.	TAG NO.	RANGE	PRESSURE			TEMPERATURE			SERVICE	OPTIONS
			OP.	MAX.	DES.	OP.	MAX.	DES.		
*	*	*	*	*	*	*	*	*	Across filter of Natural Gas Filtration	f

NOTES:

14.06.22

*: Vendor to furnish

1 Accuracy includes the combined effect of repeatability, linearity, hysteresis etc.

2 Process Data shall be as per Appendix 2 of PTS

☐ DEVIATION ☐ NO DEVIATION ☐ VENDOR'S SIGNATURE WITH SEAL

APPENDIX 1	PTS-IPUA/IGL/ET2/CP/CP18160	
Sheet 04 of 09	CLIENT:	Indraprashta Gas Limited (IGL)
	PROJECT:	MRS skid for CGD Projects
	CONTRACTOR:	
	VENDOR:	

PRESSURE SAFETY VALVE

UNITS: Flow<-> Liquid- m*3/hr Gas- Sm*3/hr Steam- kg/hr | Pressure-> kg/cm*2 G | Temperature<-> oC Level/Length<-> mm

General	1	Tag No.	Quantity	*		*
	2	Line No.	Schedule	*		*
	3	Vessel No.		*		
	4	Safety / Relief		Safety relief		
Valve	5	Full Nozzle Full Lift/Mod. Nozzle		Full nozzle full lift		
	6	Bonnet type		Closed		
	7	Conv./Bellows/Pilot Operated		Conventional		
	8	Inlet Conn. Size & Rating		*		
	9	Facing & Finish		*		
	10	Outlet Conn. Size & Rating		*		
	11	Facing & Finish		*		
	12	Cap Over Adj. Bolt		Yes		
	13	Screwed / Bolted		Bolted		
	14	Lifting Gear - Type				
	15	Test Gag		Yes		
	16					
	17					
Material	18	Body and Bonnet		ASTM A352 LCB/ASTM A 216 WCB		
	19	Nozzle and Disc		SS316		
	20	Spring		SS304		
	21	Bellows		--		
	22					
	23					
	24	Resilient Seat Seal		--		
Options	25					
	26					
Basis	27	Code		API		
	28					
	29					
Service conditions	30	Fluid	State	Natural Gas		Gas
	31	Corrosive Constituent				
	32	Required Flow Capacity				
	33	Mol.Wt.	S.G. at Rel. Temp			
	34	Oper. Pressure	Normal			
	35	Oper. Temp.	Rel. Temp.			
	36	Valve Discharges to		Atmosphere		
	37	Back Press. Const. Or Variable		Variable		
	38	Set Pressure				
	39	Cold Bend Test Pressure				
	40	% Over Pressure	% Blow Down	20%		*
	41	Cp/Cv	Compressibility Factor			
	42	Viscosity @ Rel. Temp. mPas(cP)				
	43	Vess. Wall Temp.	Surf.Area-m2	* 14.06.22		*
	44					
Orifice	45	Calculated Area cm2		*		
	46	Sel. Area cm2	Orifice Design	*		*
	47	No. of Valves Reqd. for capacity		*		
	48	Tota Area - cm2		*		
	49	Actual Flow Capacity		*		
	50					
	51	Model No.		*		
	52	IBR Certification		No		
	53					
	54					

NOTES:

'*' : Venodr to furnish

1 Process Data shall be as per Appendix 2 of PTS .

☐ DEVIATION ☐ NO DEVIATION ☐ VENDOR'S SIGNATURE WITH SEAL

APPENDIX 1	PTS-IPUA/IGL/ET2/CP/CP18160	
Sheet 05 of 09	CLIENT:	Indraprashta Gas Limited (IGL)
	PROJECT:	MRS skid for CGD Projects
	CONTRACTOR:	
	VENDOR:	

PRESSURE REGULATED VALVE (ACTIVE & MONITOR)

UNITS: Flow<-> Liquid- m*3/hr Gas- Sm*3/hr Steam- kg/hr Pressure->kg/cm2 g Temperature<-> °C Level/Length<-> mm

General	1	Tag No.	Quantity	*	*
	2	Inlet Line No.		* As per P&ID	
	3	Outlet Line No.		* As per P&ID	
	4	Service		Natural Gas	
	5	Line Size		*	
	6	Inlet Line I.D.	Outlet Line I.D.	As per ANSI B 36.10	As per ANSI B 36.10
Body	7	Type of Body		*	
	8	Body Size	Port Size	*	*
	9	Guiding	No. of Ports	*	*
	10	End Conn:Flgd.Size, Rating & Material		*	
	11	Facing & Finish		*	
	12	Body Material		ASTM A 350 LF2/ASTM A 352 LCB/ASTM A 352 LCC / ASTM A 216 WCB	
	13	Bonnet Type		*	
	14	Packing Material		PTFE	
	15	Lubricator	Isol. Valve	*	*
	16	Type of Regulator		As per Letdown skid P&ID and PTS	
	17	Trim Mat.Plug/Disc./Ball & Seat		SS316	
	18	Other Wetted Parts		SS316	
	19	Soft Seating	Material	-	-
	20	ANSI Leakage Class		VI	
Actuator	21	Type		Self actuated Pilot Operated	
	22	Close At	Open At	*	*
	23	Failure Position		As per P&ID	
	24	Handwheel		-	
Positioner	25	Air Supply Pressure		-	
	26	Input	Output	-	-
	27	Bypass	Gauges	-	-
Options	28	Solenoid Valve		-	
	29	I/P Converter		-	
	30	Filter With Gauge		-	
	31	Limit Switch		-	
Service conditions	32	Fluid	State	Natural Gas	Gas
	33	Flow Liquid-Min / Normal / Max.		*	
	34	Flow Gas-Min / Normal / Max.		*	
	35	Flow Water-Min / Normal / Max.		*	
	36	Inlet Pressure		*	
	37	Set Pressure		*	
	38	D.P. Shut Off		*	
	39	Shut off class		*	
	40	IGETD Class shall be 13		*	
	41	Type Of PRS either working monitor or wide open		*	
	42	Temperature - Oper.	Max.	*	*
	43	Oper. S.G.	Mol. Wt.	* 14.06.22	
	44	Cp/Cv	Compress.Factor	*	
	45	Flash%	Visc.mPas (oper)	*	
	46	Deg. of Superheat	% Solids	*	
	47	Vapour Pr.	Critical Pr.	*	
Valve Data	48	Cv Min.	Cv Max.	*	*
	49	Cv Nor.	Selected Cv	*	*
	50	Predicted Sound Level dBA		< 85dBA	
	51	Inlet Velocity m/s		As per PNGRB guidlines	
Make	52	Valve	Actuator	*	*
Model no.	53	Positioner	Solenoid Valve	*	*
	54				
	55	IBR Certification		-	
	56	Radiography		Required	

NOTES:

'*' : Contractor to furnish

1 Accuracy of the regulator shall be better than 1% of set pressure.
2 Contractor must furnish sizing calculation along with the offer.
3 Process Data shall as per appendix-2 of PTS
4 At the time of approval of DS, supplier shall furnish DS with catalogues
5 Function and sizing calculation for the outlet pressure to be furnished by the supplier
6 Lock up Zone of regulatot shall be maximum 5 %
7 Impulse connection shall be external and SS316 Tubing connection shall be 1/2" NPT
8 Set points of the regulators shall be adjustable.
9 Monitor valve shall be wide opening

☐ DEVIATION ☐ NO DEVIATION ☐ CONTRACTOR'S SIGNATURES WITH SEAL

APPENDIX 1	PTS-IPUA/IGL/ET2/CP/CP18160	
Sheet 06 of 09	CLIENT:	Indraprashta Gas Limited (IGL)
	PROJECT:	MRS skid for CGD Projects
	CONTRACTOR:	
	VENDOR:	

PRESSURE GAUGE

UNITS: Flow<-> Liquid- m*3/hr Gas- Sm*3/hr Steam- kg/hr Pressure-> kg/cm*2 G Temperature<-> oC Level/Length<-> mm

1 Type:- Direct

2 Mounting:- Local

3 Dial Size:- 150 mm

Colour:- White with black inscriptions

4 Case Material:- SS316

5 Bezel Ring:- Bayonet type SS316

6 Window Material:- Shatterproof glass

7 Enclosure:- WP to IP 65 as per IEC 60529 / IS 2147

8 Pressure Element:- Bourdon

9 Element Material:-

10 Socket Material SS316

11 Accuracy:- +/-1% of FSD

12 Zero adjustment:- Micropointer

13 Connection:- 1/2" NPT(M)

Connection Location:- Bottom

14 Movement:- SS304

15 Diaphargm Seal:- --

Type:- --

Wetted Parts Material:- --

Others Material:- --

Process Connection: Size & Rating -- Facing &

Finish:- --

Capillary Material:- --

Armour - Flexible Material:- --

Capillary Length:- --

Flushing/Filling connection with:- --

16 Over Range Protection:- 130% of FSD

17 Blow Out Protection:- Yes

18 Options :- a) Snubber

b) Syphon c) Gauge Saver

d) Liquid Filled casing e) Vaccum Protection

f) Solid front g) 2 valve manifold 19

Quantity :- *

SL. NO.	TAG NO.	RANGE	PRESSURE			TEMPERATURE			SERVICE	OPTIONS
			OP.	MAX.	DES.		MAX.	DES.		
*	*	*	*	*	*	*	*	*	Natural Gas	g

NOTES:

*: Venodr to furnish

1 Process Data shall be as per Appendix 2 of PTS .

14.06.22

☐ DEVIATION ☐ NO DEVIATION ☐ VENDOR'S SIGNATURE WITH SEAL

APPENDIX 1	PTS-IPUA/IGL/ET2/CP/CP18160	
Sheet 07 of 09	CLIENT:	Indraprashta Gas Limited (IGL)
	PROJECT:	MRS skid for CGD Projects
	CONTRACTOR:	
	VENDOR:	

SLAM SHUT OFF VALVE

UNITS: Flow<-> Liquid- m*3/hr Gas- Sm*3/hr Steam- kg/hr Pressure->kg/cm2 g Temperature<-> °C Level/Length<-> mm

General	1	Tag No.	Quantity	*	*
	2	Inlet Line No.		*	
	3	Outlet Line No.		*	
	4	Service		Natural Gas	
	5	Line Size		*	
	6	Inlet Line I.D.	Outlet Line I.D.	As per ANSI B 36.10	As per ANSI B 36.10
Body	7	Type of Body		Slam Shut	
	8	Body Size	Port Size	*	*
	9	Guiding	No. of Ports	*	*
	10	End Conn:Flgd.Size, Rating & Material		Flange/*	
	11	Facing & Finish		*	
	12	Body Material		ASTM A 216 Gr WCB or equivalent	
	13	Bonnet Type		Plain	
	14	Packing Material		PTFE	
	15	Lubricator	Isol. Valve	*	
	16	Type of Regulator		*	
	17	Trim Mat.Plug/Disc./Ball & Seat		SS316	
	18	Other Wetted Parts		SS316	
	19	Soft Seating	Material	*	*
	20	ANSI Leakage Class		VI	
Actuator	21	Type		Self Pneumatic	
	22	Close At	Open At	*	*
	23	Failure Position		FC	
	24	Handwheel		Manual rest and opening	
Positioner	25	Pneumatic Supply Pressure		NA	
	26	Input	Output	NA	*
	27	Bypass	Gauges	NA	*
Options	28	Solenoid Valve		NA	
	29	I/P Converter		NA	
	30	Filter With Gauge		Yes	
	31	Limit Switch		Yes (For ON-OFF both)	
Service conditions	32	Fluid	State	Natural Gas	Gas
	33	Flow Liquid-Min / Normal / Max.		*	
	34	Flow Gas-Min / Normal / Max.		*	
	35	Flow Water-Min / Normal / Max.		*	
	36	Inlet Pressure		*	
	37	Set Pressure		*	
	38	D.P. Shut Off		*	
	39	Temperature - Oper.	Max.	*	*
	40	Oper. S.G.	Mol. Wt.	*	
	41	Cp/Cv	Compress.Factor	*	
	42	Flash%	Visc.mPas (oper)	*	
	43	Deg. of Superheat	% Solids	* 14.06.22	
	44	Vapour Pr.	Critical Pr.	*	
Valve Data	45	Cv Min.	Cv Max.	*	*
	46	Cv Nor.	Selected Cv	*	*
	47	Predicted Sound Level dBA		<85dBA	
	48	Type of reset		Manual	
	49	Closing time		Less than 2 seconds	
	50	Accuracy		+/- 1% over the whole operating range	
	51	UPSO & OPSO requirement		Required	
	52	Inlet Velocity m/s		*	
Make	53	Valve	Actuator	*	*
Model no.	54	Positioner	Solenoid Valve		*
	55	Limit Switches		*	
	56	IBR Certification		-	
	57				
	58				

NOTES:

'*' : Venodr to furnish

1 Process Data shall be as per Appendix 2 of PTS.
2 Vendor must furnish sizing calculation along with datasheet for approval.
3 Two nos. (one for open and one for close) Snap acting micro switch (SPDT) shall be provided for each slam shut valve.
4 Limit switch enclosure shall be WP to IP 65 & EExd Zone 1 IIA / IIB T3 as per IEC 60079 / IS 2148
5 SSV shall be designed as per EN-14382 or equivalent standard.

☐ DEVIATION ☐ NO DEVIATION ☐ VENDOR'S SIGNATURES WITH SEAL

APPENDIX 1	PTS-IPUA/IGL/ET2/CP/CP18160	
Sheet 08 of 09	CLIENT:	Indraprashta Gas Limited (IGL)
	PROJECT:	MRS skid for CGD Projects
	CONTRACTOR:	
	VENDOR:	

DATA SHEET - CONVENSION TYPE POINT GAS DETECTOR

1	GENERAL	**Tag No.**	*	
2		**Sensor Type**	Infrared Absorption	
3		**Model**	*	
4		**Make**	As per Recommended vendor list	
5	GAS DETECTOR	**Operating Voltage**	24V DC	
6		**Range**	0-100 % LEL (Low Explosive Limit)	
7		**Repeatability**	Better than +/-3% of Full Scale	
9		**Response Time**	T 90 < 15 second or better	
10		**Temperature Range**	0 deg C to 50 Deg C	
11		**Humidity range**	0 to 99 % RH	
12		**Power Consumption**	Vendor to indicate	
13		**Digital Signal Outputs**	required	
14		**Current Signal Outputs**	4-20 mA	
15		**Ingress Protection**	IP 65 or better NEMA 4X	
16		**Housing Material**	SS 316	
17		**Dimension**	*	
18		**Cable Entry**	Two entries,inch NPT (F), for one spare cable entry stop plug shall be provided	
19		**Electrical Area Classification**	Zone-1,2, Gr. II A & II B, T3 or better	
20		**Enclosure Class**	Explosion proof EEx'd' / Intrinsically Safe EEx'ia'	
21		**Alarm at**	20 % & 40% of Range	
22		**Accuracy ***	± 2% FSD or better	
23				
24	OTHER	**Accessories**	required	

NOTE :

1	" * " Indicate Vendor to fill data
2	Detectors shall be located on the downwind side of the prevailing wind direction
3	Electrical input protection shall be provided against surges and spikes and Instrument shall be protected against Electromagnetic Interference (EMI) .
4	Detectors shall be approved by ATEX, IECEX, CCOE etc.
5	All the detectors shall be provided with dust guard and splashguard
6	Gas detectors shall be provided at suitable strategic location to monitor the leakage of failure prone equipment patrs, accessories, valve and pipe depending upon the wind direction and gas density.

Appendix 1	PTS-IPUA/IGL/ET2/CP/CP18160		
Sheet 09 of 09	CLIENT:	Indraprashta Gas Limited (IGL)	
	PROJECT:	MRS skid for CGD Projects	
	VENDOR:		

APPENDIX 2 - PROCESS PARAMETERS

A. MRS-750 SCMH

Skid (Refer Typical P&ID)	Flow (SCMH) Min/Max	Inlet operating pressure bar(g)	Inlet pressure range bar(g) Min/max	Outlet operating pressure bar(g)	Outlet pressure range bar(g) Min/max	Temp (design) Deg C	Temp (working) Deg C	Design pressure bar(g)	Design Class BPR/APR	Allowable Pressure drop across skid Bar(g) Max (Note 1)
Filter (single stream with bypass) PRS (Dual stream) Meter (single stream with bypass)	50 to 750	3	3 To 4	2	1 to 2	-29 To 65	3 To 48	19	150#/150#	1.5

B. MRS-1500 SCMH

Skid (Refer Typical P&ID)	Flow (SCMH) Min/Max	Inlet operating pressure bar(g)	Inlet pressure range bar(g) Min/max	Outlet operating pressure bar(g)	Outlet pressure range bar(g) Min/max	Temp (design) Deg C	Temp (working) Deg C	Design pressure bar(g)	Design Class BPR/APR	Allowable Pressure drop across skid Bar(g) Max (Note 1)
Filter (single stream with bypass) PRS (Dual stream) Meter (single stream with bypass)	50 to 1500	3	3 To 4	2	1 to 2	-29 To 65	3 To 48	19	150#/150#	1.5

C. MRS-2000 SCMH

Skid (Refer Typical P&ID)	Flow (SCMH) Min/Max	Inlet operating pressure bar(g)	Inlet pressure range bar(g) Min/max	Outlet operating pressure bar(g)	Outlet pressure range bar(g) Min/max	Temp (design) Deg C	Temp (working) Deg C	Design pressure bar(g)	Design Class BPR/APR	Allowable Pressure drop across skid Bar(g) Max (Note 1)
Filter (single stream with bypass) PRS (Dual stream) Meter (single stream with bypass)	50 to 2000	3	3 To 4	2	1 to 2	-29 To 65	3 To 48	19	150#/150#	1.5

D. MRS-3000 SCMH

Skid (Refer Typical P&ID)	Flow (SCMH) Min/Max	Inlet operating pressure bar(g)	Inlet pressure range bar(g) Min/max	Outlet operating pressure bar(g)	Outlet pressure range bar(g) Min/max	Temp (design) Deg C	Temp (working) Deg C	Design pressure bar(g)	Design Class BPR/APR	Allowable Pressure drop across skid Bar(g) Max (Note 1)
Filter (single stream with bypass) PRS (Dual stream) Meter (single stream with bypass)	50 to 3000	3	3 To 4	2	1 to 2	-29 To 65	3 To 48	19	150#/150#	1.5

Humidity : 25-99% R.H

Note

1. Vendor shall consider the pressure drop across the skid as per the requirement of outlet pressure. Given pressure drop is maximum.
2. The maximum permitted velocity shall be 20 m/s at Inlet & outlet of skid and 30m/s velocity inside the skid for filtered natural gas.
3. Skid to be supplied with Nitrogen pre-filled at 1 bar pressure.
4. BPRS-Before pressure reduction and APR-After pressure reduction
5. Designing shall be done considering minimum pressure, maximum temperature and maximum flow.
6. Min Flow for Meter sizing is tentative will be verified on vender firm data.

GAS COMPOSITION:

GAS COMPOSITION		
Component	**Natural Gas Composition**	**Design Gas Composition**
C1	82.43-99.10	89.45
C2	7.27-0.90	4.58
C3	3.47-0.00	0.83
I-C4	0.65-0.00	0.07
N-butane	0.78-0.00	0.06
I-pentane	0.17-0.00	0.09
N-pentane	0.13-0.00	0.28
C6	0.10-0.00	0.17
Carbon dioxide	4.93-0.00	4.38
Nitrogen	0.06-0.00	0.10
H2O	0.01-0.00	0.00
TOTAL	**100.00**	

APPENDIX 3

SOLAR POWER SYSTEM

TABLE OF CONTENTS

* * *

1.0	**AMBIENT CONDITIONS**		
1.1	Max. Temp.	:	50°C
1.2	Min. Temp.	:	4°C
1.3	Design Temp.	:	60°C
1.4	Relative Humidity	:	90%
1.5	Location	:	Out door

2.0 **TESTS**

: Functional Tests

3.0 **SUPPLY**

- Photovoltaic solar cell array (solar panels)
- Module Mounting Structure
- Junction Box
- Solar Charge Controller
- DC – DC Converter
- Ni-Cd DC Battery
- Inter connecting cable
- Installation Kit
- Earthing Kit

4.0 **SUPPLY, ERECTION, TESTING & COMMISSIONING**

: YES

8.1	Rated Power	:	VTA
8.2	Voltage	:	12V/24V ± 1%
8.3	No. of phases and wire	:	2W
8.5	Solar Charger Efficiency	:	> 95%
8.6	Protection	:	Over Current
		:	Over Voltage
		:	Under Voltage
		:	Short Circuit
		:	Over Discharge
		:	Under Voltage
8.7	Indications	:	Charging
		:	Low Battery
		:	Full Charge

5.0 **BATTERY**

: Ni - Cd Battery, fibre plate type

6.0 **BATTERY SPECIFICATIONS**

6.1	Nominal system voltage	:	12V/24 V
6.2	Number of cells / batteries	:	To be furnished by vendor
6.3	Battery nominal voltage	:	1.2 Volts/Cell
6.4	Duty cycle	:	Continuous
6.5	Ampere Hour capacity at 10 hours rate	:	As per Requirement
6.6	End cell voltage	:	1.14 Volts

6.7	Mounting and two tier or two rows and two tier.	:	Steel racks, preferably single row
6.8	Area of battery room	:	To be indicated by Vendor
6.9	Battery back up	:	72 Hours

7.0 **PAINTING TYPE & SHADE** : Epoxy, 631 of IS.5

8.0 **SYSTEM EARTHING** : Yes

9.0 **SPECIFIC REQUIREMENTS**

The solar power system system will be designed as follows:

12.1 Each solar power system is sized for 100% full load continuously.

12.2 Ni-Cd battery shall have the battery backup of 72 Hours.

12.3 Vendor to submit the detailed battery and charger sizing calculations.

12.4 Contractor shall carry out the full load test of solar power system at works & site.

12.5 Supply of all interconnecting cables between main array junction box and solar charge controller, solar charge controller and battery, solar charge controller and DC-DC converter and DC-DC converter to DC distribution Board will be in contractor's scope.

12.6 Supply of RS-232 serial communication port for transfer of solar power system status to SCADA/AMR.

12.7 All meters shall be digital.

APPENDIX 4

DATA HOSTING SERVICES

TABLE OF CONTENTS

1.0 INTRODUCTION

This specification covers the basic requirements for data hosting and associated services for Meter Regulating Stations (MRS) with RPD Meters, EVC with GSM/GPRS Modem.

2.0 BRIEF SCOPE

2.1 Data logging & transmission by GSM/GPRS modem

2.2 OPC compliant Hardware Server / Cloud Server

2.3 Data uses charges including SIM card charge.

2.4 Correct and accurate mapping of the Business Partner (BP) No. / Contract Agreement (CA) No / Asset ID No., as provided by IGL for an individual Customer / Meter.

2.5 Supplier shall establish and demonstrate the signal communication between MRS and Supplier's cloud server to IGL' s server.

2.6 Supplier must ensure 100% availability of meter reading as IGL specified Billing cycle i.e., on 1st and 16th of every month,

2.7 Supplier shall be responsible for hosting of meter reading data in Supplier's server for five years from the date of LOI.

2.8 Hourly log of data from each MRS and uploading to IGL's server once in a day. Historical data shall be maintained in Supplier server for at least six months for 180 readouts.

2.9 AMR system should be provided with different viewer. Data through Analysis viewer shall provide both tabular and geographical interfaces to display site communication status and data verification.

2.10 Supplier to provide data analytics access through dash boards to IGL personnel via secured platforms through web services using https protocols.

2.11 Supplier shall provide access to immediate visualisation of sites, status, communications and performance through Dashboard to IGL.

2.12 Commission the MRS within 5 days after IGL's intimation of completion of meter installation.

2.13 All type for Software /firm ware updates as when required for AMR system shall be installed without any cost.

2.14 Supply of consumables, commissioning and spares for installation is in scope of supplier.

2.15 Supplier shall provide 10 no. user ID and password for logging on to supplier's server as desired by IGL.

2.16 In case of failure of AMR / loss of data in IGL Dashboard, skid data shall be collected manually from site for submission to IGL as per billing cycle.

2.17 Providing training to IGL's personnel pertaining to installation, programming, trouble shooting and analysis of Data & software.

2.18 Incase of relocation of MRS Supplier shall be Re-Commission AMR system and ensure data availability without any cost.

2.19 AMR system shall be suitable to add or delete consumers as per IGL intimation. The

changes required for addition/deletion in software/system shall be done by the Supplier as required by IGL with any cost.

2.20 Supplier shall also specify and include the hardware / software which are not specially mentioned but are required to complete the commissioning / functioning of the AMR system

Note: Installation & Commissioning of AMR cost to be included in the MRS supply cost, no separate cost is envisaged for commissioning & data hosting.

3.0 TECHNICAL REQUIRMENT

3.1 Automatic meter reading (AMR) is envisages for automatically collecting consumption, diagnostic, and status data from EVC and transferring that data to a central database for billing, troubleshooting, and analyzing.

3.2 All data shall be collected in real-time and is stored in a database. The customer can view the data via a web application and can analyze the data using to verify their utility bill.

3.3 AMR component should have an inbuilt RTC. The RTC time should be set in the factory before dispatch. The RTC time will be calibrated through a downlink message from Application Server.

3.4 AMR should have 2 modes of operations which is configurable through a downlink message from Application Server.

Mode 1: Instantaneous Gas Consumption Data: Total Gas Consumption Count

Mode 2: Hourly Gas Consumption Data (Batch Mode): Hourly Differential Values for Gas Consumption.

Mode 1 data should be transmitted as per the periodic interval set in the device while Mode 2 data is transmitted once in 24 Hrs. In this case each packet should contain hourly differential readings of last 24 hrs.

3.5 The AMR should have in built memory to store aprox. 120 data packets in the non-volatile memory in FIFO (First In First Out) manner. The Application server will send a downlink message to AMR to recover the lost data.

3.6 The system will generate an alarm for any tamper of the AMR installed on the site, and for volumes registered by the gas meter above and below the preset threshold values, and for any missing data in the hourly readings.

3.7 Supplier to provide real time alarms in case of any malfunction / tampering to IGL. The alarm SMS shall be sent to 3 IGL designated phone number and simultaneously email to 3 designated email IDs;

3.8 Supplier shall provide statistical access to data through dash boards to IGL personnel via secured and encrypted platforms through web services using https protocols. Supplier shall provide facility/ tools for viewing and extracting reports according to IGL's format.

3.9 Supplier shall carryout server audit as per ISO 27001 by third party once in a year witnessed by IGL.IGL may call for random witness of Supplier's server in each financial year.

3.10 Data security is prime and hence the data must be encrypted to global AES128 standards. Data security includes password protection and hardware sealing.

3.11 AMR system equipment shall have type approval from concerned authorities like wireless planning & co- ordination wing WPC/WEEE/ROHS shall be provided.

3.12 AMR system's module at field shall be suitable for site condition 0°C to 50°C, 95 % humidity, Area classification Zone 1, Gr. IIA / IIB, T4. Encloser protect category shall be IP65 or better.

4.0 FUNCTIONAL REQUIRMENT / DATA ANALYTICS

AMR system shall support 10 Nos concurrent user. Dashboard will contain Hourly consumption, Daily training, Fortnightly report, Monthly report

Data to be monitored

1. Pressure
2. Temperature
3. Uncorrected volume
4. Corrected volume
5. Yesterday's corrected volume (6:00AM to 6:00AM)
6. Total corrected volume
7. Conversion factor
8. Time/Date

Reports:

1. Hourly, weekly, monthly reports as per IGL requirement.
2. Daily exception report.
3. Zero consumption report on daily basis.
4. The software shall be capable of generating trends, alarms and graphics.
5. Any updation/modification in reports/formats as per IGL requirement should be done by Vendor without any cost implication.

Alarms:

1. Tampering of the gas meters.
3. No flow
4. Zero consumption for 5 consecutive days
5. Communication failure
6. Low battery

5.0 TRAINING

Supplier shall provide training session at site / office as per IGL's Discretion for at least 20 IGL's personal ever year during the contract without any cost. Training shall pertain to handling AMR component, operation and analysis of software.

6.0 ENGINEERING AND DESIGN DOCUMENTS & DRAWINGS

The documents and drawings to be prepared by the CONTRACTOR are listed hereunder. These shall be submitted for Owner/Owner's Engineer's approval during engineering stage.

Data sheets, Product Catalogue, wiring diagram, Installation drawing, Power consumption & Certification pertain to Safety.

SECTION 7

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

PTS – PIPELINE VALVES

(DOC No.-PTS-PV/IGL/ET2/CP/CP18160)

TABLE OF CONTENT

1. SCOPE

The present Specification shall be read in conjunction with General Technical Specification 70000/740/GTS/404 (the GTS) & API 6D/ISO 14313 which it amends and/or complements.
The present specification can confirm, complete or modify certain sections/paragraphs of said «General Technical Specification».
Whenever there is a conflict/contradiction over specifications, PTS shall have precedence. Part ii – Amendments to GTS 70000/740/GTS/402 & API 6D/ISO 14313

2. DEFINITION

ADD:

GTS:	means «General Technical Specification 70000/740/GTS/404
PTS:	means the present «Particular Technical Specification and all its appendices, if any.
TPIA:	means the Third Party Inspection Agency

3. INSTRUCTION

REPLACE BY FOLLOWING:

- 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 Owner / Owner'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.
- The specifications of the steel used the material Manufacturer and all potential subcontractors will be described in the offer. After order, no change will be accepted except for justified "force majeure". In that case, the changes shall be supported by a technical file submitted to the Owner / Owner's Representative for approval.
- The Manufacturer shall provide a technical description of the manufacturing method that might influence the quality of the material.
- When the order is placed, the Manufacturer shall promptly inform the Owner / Owner's Representative about his subcontractor's names, addresses, phone numbers as well as sub-order numbers, extent and delivery terms. On this basis, the Manufacturer shall send a general planning including at least the raw material supply, the manufacturing stages (machining, welding, part assembly,), testing, painting, packing and despatch. This planning shall be updated by the Manufacturer at least every month unless otherwise provided in the purchase order. A Despatcher/Inspector delegated by the Owner / Owner's Representative is entitled to follow, examine and verify the planning's' relevance and effectiveness.
- The Owner / Owner's Representative keeps the right to audit the Manufacturers and subcontractor's manufacturing process and control methods. All costs form such an audit shall be borne by the Manufacturer except the wages and travel expenditures of the auditor(s) supported by the Owner / Owner's Representative.
- The manufacturing processes and the laboratories, in which welding tests, destructive and non destructive tests are carried out, shall be approved by the Owner / Owner's Representative.
- The Owner / Owner's Representative shall have, at any time, free access to all parts of the Manufacturer's facilities and to those of all his subcontractors involved in the order manufacturing. All being manufactured in accordance

with this specification. All tests and inspections required in this specification shall be carried out, prior to shipment, in the Manufacturer's plant (or subcontractor's plant) and at the Manufacturer's expenses, unless otherwise provided in the order. The Owner / Owner's Representative shall try not to interfere unnecessarily with other Manufacturer's works when running these tests and inspection.

- A valid copy of the ISO 9001 certificate shall be included in the offer.
- A valid copy of the API 6D certificate shall be included in the offer.
- For any control, test or examination required under the supervision of the Third Party Inspection Agency (LOFC intervention points included), the latter shall be informed in writing One (1) Week in advance by the Manufacturer about place and time with a copy to the Owner / Owner's Representative.
- If manufacturing is to be carried out under LOFC concept, the Manufacturer shall send for approval a List of Operation in Manufacturing and Control to the Third Party Inspection Agency and Owner / Owner's Representative, One (1) week 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.
- Material, even released by the TPIA and in which injurious defects are found after delivery, shall be rejected. The Manufacturer shall be notified and the material replaced: all costs involved, including wages and travel expenditure of the TPIA, Owner & Owner's Representative shall be borne by the Manufacturer.
- An approval of documents can never be considered as an acceptance of deviations or relaxation to requirements. A deviation is only possible after specific request to the Owner / Owner's Representative.
- 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 production certain problem arises, the Owner/ Owner's Representative may demand supplementary tests.

5.0 VALVE TYPES AND CONFIGURATION (API-6D)

Clause 5.1.1, 5.1.4 not applicable for present work.

5.2 Valve Configuration (API-6D) As defined in data sheet

ADD:

5.2.3 Body Construction

Valve body shall be fully welded or bolted as specified in data sheet. Valve body joint with threads are not permitted.
Body shall be of 2 piece construction in case of bolted design.

6.1 **PRESSURE - TEMPERATURE RATING (GTS)**

Modify last bullet as below:

All valves under this specification shall be designed to withstand a field hydrostatic test pressure with non corrosive water, after installation, during 24 hours when the ball is partially or fully open at a pressure level P = 1.5xMOP, where :

P = hydrostatic test pressure, bar

MOP = maximum operating pressure rating at 38°C (100°F) gauged by the ASME B1 6.34 (for relevant rating and material), bar.

During this test the closure element shall not be moved.

ADD:

Hydrostatic tests shall be made as evidence of the adequacy to the design references. Records of design or successful proof test shall be available at the facility for inspection by the Owner / Owner's Representative and copy shall be added to the CMTR.

6.6 PIGGING

Deleted

6.9 Design Features:

ADD:

Ball mounting shall be as indicated in data sheet.

- **Double piston effect –** Not applicable.

REPLACE:

Auxiliary connections

- Above Ground Valves

6.11 Locking Devices

ADD:

Valves shall have the locking devices to lock the valve either in full open (LO) or full closed (LC) positions. Locking devices shall be permanently attached to the valve operator and shall not interfere with operation of valve.

6.22 DESIGN DOCUMENT REVIEW

ADD:

Vendor shall submit detail drawings, data sheet, BOM, Calculations to Owner / Owner's Representative for approval.

7.1 Material Specification

ADD:

Material for major components of the valves shall be as indicated in valve data sheet. Other component shall be as per manufacturer's standard which will be subject to approval by Owner / Purchaser.

8.1.3 Heat Treatment (GTS)

If applicable

8.2.1.2 Impact Testing (GTS)

REPLACE: First paragraph by
Impact test shall be carried out at 0o C for all heat and base material which are the pressure containing part.

The minimum average absorbed energy per set of three specimens shall be 27 J with an individual minimum per specimen of 21.6 J. No. specimen shall exhibit less than 80 percent shear area.

10.3 HYDROSTATIC SHELL TEST:

REPLACE:

- Hydrotest pressure shall be 1.5 times of the design pressure and test duration shall be as per API 6D.
- Shell test shall be conducted with the valve in a partially open position and with the valve ends closed.
- *Drain lines and valves*
  - Shall be either included in the hydrostatic shell test, or tested separately.
- Visual leakage or harmful inelastic deformations are not accepted.

10.4 HYDROSTATIC SEAT TEST:

DELETE:

Each valve shall be given a hydrostatic seat test at the gauge pressure not less than 1.1 times the 38°C rating gauged by ASME B16.34, rounded off to the next higher 1 bar increment.

ADD:

Hydrostatic seat test pressure shall be 1.1 times of the design pressure and test duration shall be as per API 6D.

10.4.1.1 Air Seat Test (GTS)

REPLACE:

- Each valve shall be given an air seat test at 6 barg.
- This test shall be performed in the same manner as hydrostatic seat test.
- The duration of this test shall not be less than 15 minutes for each end.
- No signs of leakage are accepted.

Procedure:

Procedure of all pressure tests shall be included in the offer.

10.4.1.2 After Test
VISUAL AND DIMENSIONAL EXAMINATION

REPLACED:
All valves shall be visually and dimensionally examined, according to API 6D & MSS – SP – 55.

11.1.1 Body Markings

ADD:
Marking shall be as per API 6D.

12.1 Painting

Above ground Valves

REPLACE: First paragraph by

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 consist of a primer coating (30 - 40 µm) and a finish coating (30 - 40 µm). Final paint DFT shall be 300 µm (min.). Final colour shall be Grey. Refer Painting system & colour code for Final layer.

Paint shall be used of standard brand name such as:

- Asian Paints (India) Ltd.
- Bombay Paints
- Berger Paints India Ltd.
- Goodlass Nerolac Paints Ltd.
- Jenson & Nicholson
- Shalimar Paints

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 Purchaser/Engineer's specifications.

Painting and coating procedures shall be submitted for approval before manufacturing to the Control Authority and to the purchaser/engineer.

13 DOCUMENTATION

ADD:
At the time of bidding, Manufacturer shall submit the following documents:

- General arrangement / assembly drawings showing all features and relative positions and sizes of vents, drains, gear operator / actuator, painting, coating and other external parts together with overall dimensions.
- Sectional drawing showing major parts with reference numbers and material specification. In particular, a blow – up drawing of ball-seat assembly shall be furnished.
- Reference list of similar ball valves manufactured and supplied in last five years indicating all relevant details including project, year, client, location, size rating, service etc.

- Torque curves for the power actuated valves along with the break torque an maximum allowable stem torque. In addition, sizing criteria and torque calculations shall also be submitted for power actuated valves.
- Descriptive technical catalogues of the Manufacturer.
- Installation, Operational and Maintenance Manual.
- Copy of valid API 6D certificate, wherever applicable.
- Quality Assurance Plan enclosed with this tender duly signed, stamped and accepted.

The drawings to be submitted alongwith the bid shall be in total compliance with the requirement of technical specification and data sheets of the valves with no exception & deviation.

14.4 Repair

Body material repair is not acceptable however the welding can be repaired through repair procedure.

FIGURE 2 ON

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DELETED

4. GUARANTEE

- Manufacturer shall guarantee that the materials and machining of valves and fittings comply with the requirements in this specification and in the Purchase Order.
- Manufacturer is bound to replace or repair all valve parts which should result defective due to inadequate engineering or to the quality of materials and machining.
- If valve defect or malfunctioning cannot be eliminated, Manufacturer shall replace the valve without delay.
- Any defect occurring during the period of Guarantee shall be attended to be making all necessary modifications and repair of defective parts free of charge to be Purchaser as per the relevant clause of the bid document.
- All expenses shall be borne by the Manufacturer.

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 9.3).

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),
- Third Party Inspection Agency,
- the Owner / Owner's Representative,

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 Third Party Inspection Agency and the Owner / Owner's Representative 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.

f. One column to be provided for report or record numbers (points marked R) and one for the review of these documents by the Third Party Inspection Agency.

g. 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.

SECTION 8

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

PTS – FITTINGS & FLANGES

(DOC No.-PTS-F&F/IGL/ET2/CP/CP18160)

TABLE OF CONTENTS

1.0 GENERAL

INDRAPRASHTA GAS LIMITED (IGL) to the particular specification: Codes, Norms and standards (latest revision); but not limited to:

Standard	Code Description
ANSI B16.5	Pipe flanges and flanged fittings
ANSI B16.9	Factory-made wrought steel butt welding fittings
ANSI B16.11	Forged steel fittings
ANSI B16.25	Butt welding ends
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
ASTM A 105 / A 105M	Forging, carbon steel, for piping components
ASTM A 203	Pressure vessel plates, alloy steel, nickel
ASTM A 234 / A 234M	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 350M	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 420M	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 44	Specification for steel pipeline flanges
MSS SP 55	Quality standard for steel castings for valves, flanges, fittings, and other piping components (visual method)
MSS SP 75	Specification for high-test wrought butt welding fittings

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 / Owner Representative. 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/ Owner Representative.

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/ Owner Representative before eventual order to the Manufacturer. The latter is responsible and shall indemnify the Client/ Owner 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 Client/ Owner Representative.

1.0 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
Client/Owner's Representative	designates the individual or legal entity to which the Client has entrusted various tasks in relation with the carrying out of his project.

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, nippolet, 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 Owner representative 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:

$$P\ (adj.) = P \times \frac{S(act.)}{S}$$

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/mm^2

S (act.) = the actual tensile strength of the material of the test fitting (determined on specimen representative of the test fitting), N/mm^2

The computed proof test pressure shall be determined as follows:

Which refers to the pipe which the fitting's marking identifies and, where

$$P = \frac{20S.t}{D}$$

Where

P = Computed bursting pressure of the pipe, bar

S = Minimum specified tensile strength

of the pipe, N/mm^2 t =

Nominal pipe wall thickness, mm

D = Specified outside diameter of pipe, mm

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 Certificate shall be reviewed by TPIA (3.1 Certificate).

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.**

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:

$$C.E. = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

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 center 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

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 normalizing. 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. $\leq$ 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 then 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/ Owner Representative.

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/ Owner Representative 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 his number specified in the purchase order.

The monogram of the Owner/Counsultant. 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/ Owner Representative 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/ Owner Representative 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.

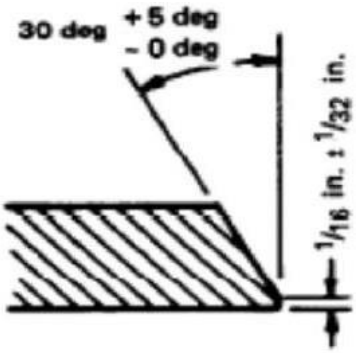
In any case, for unintentional additions, the following limitations shall be respected :

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 %.

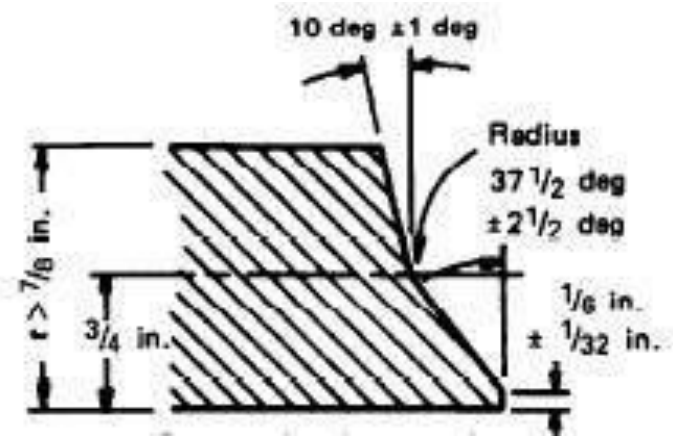
For each reduction of 0.01 % below the maximum carbon content, an increase of 0.05 % manganese above the specified maximum is permissible, up to a maximum of 1.70 %.

FIG. 1



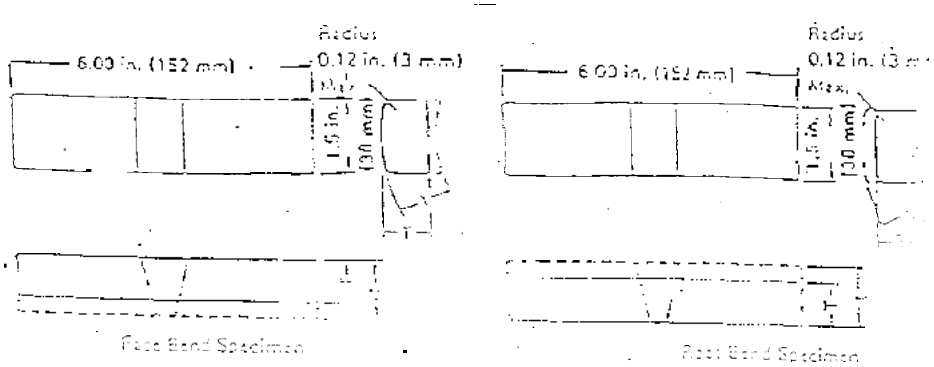
Fitting size 24" and smaller may be furnished with 37° ½ bevel at manufacturer's option. Recommended bevel for wall thickness (t) at end of fitting: 20 mm or less.

FIG. 2



Recommended bevel for wall thickness (t) at end of fitting, greater than 20 mm

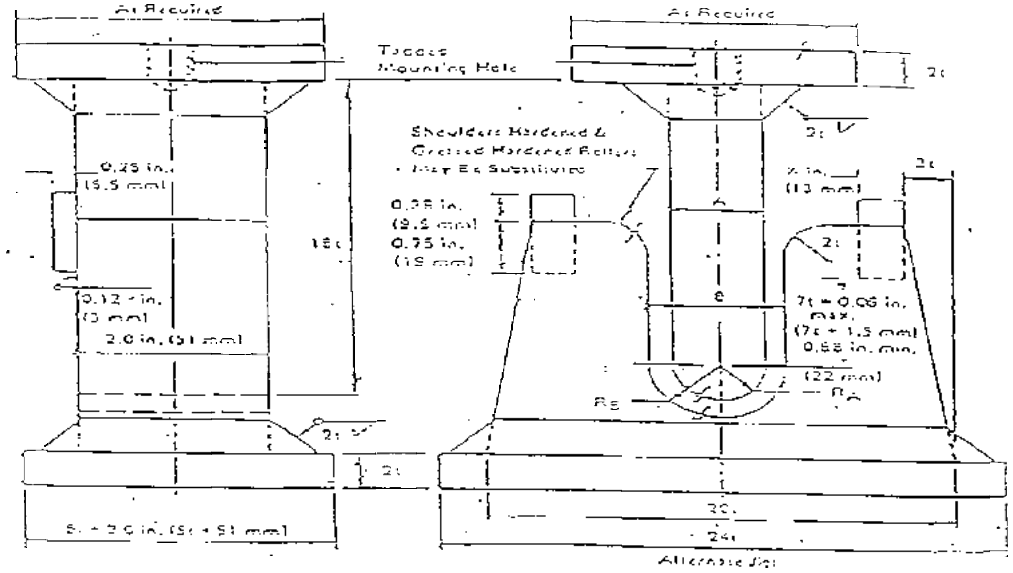
FIG. 3



TRANSVERSE FACE AND ROOT BEND TEST SPECIMENS

FIG 5

GUIDED-BEND
TEST JIG
DIMENSIONS



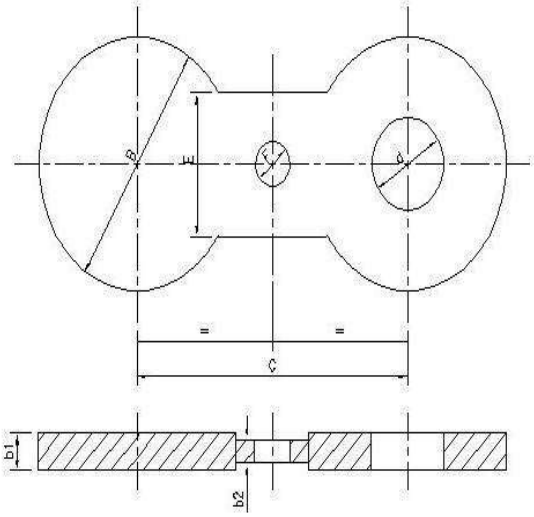
Radius of male member R_A Radius of female member R_B Width of male member, A	CLASS OF STEEL			
	Y52 and low-grade	**Y56**	**Y60**	**Y70**
	½A	½A	½A	½A
Width of groove in female member, B	½B	½B	½B	½B

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	9.5	6	19
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	50	9.5	6	19
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	9.5	6	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	9.5	6	16
2 1/2"	120	66.5	140	50	6.5	4	19	127	66.5	149	35	6.5	4	23	127	63.5	149	35	12.5	8	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	16.0	10	23
3 1/2"	159	92.0	178	45	6.5	4	19	162	92.0	184	45	9.5	6	23	159	92.0	184	45	16.0	10	23
4"	171	108.0	191	50	6.5	4	19	178	108.0	200	50	12.5	8	23	190	105.0	216	55	16.0	10	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	16	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	36	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	438.0	578	70	25.5	14	32	587	438.0	629	45	41.5	24	23	609	438.0	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"	762	641.5	806	70	51.0	32	35	822	641.5	876	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	692.2	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	1080	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

SECTION 9

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

PTS – PIPING SPECIFICATIONS

(DOC No.-PTS-PS/IGL/ET2/CP/CP18160)

	PIPING SPECIFICATION	SPECIFICATION NO. PTS-PSICL/IGL/ET2/CP/CP18160
		SHEET 1 OF 6

BASIC PIPING SPECIFICATION DATAS		MAXIMUM DESIGN CONDITIONS			
		TEMPERATURE °C		PRESSURE bar(g)	
PRIMARY FLANGE RATING	150#-RF	Carbon Steel	0 to 65	Carbon Steel	19.00
		LTCS	- 20 to 65	LTCS	19.00
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

			PIPING SPECIFICATIONS				SPECIFICATION NO. PTS-PSICL/IGL/ET2/CP/CP18160 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" 3" - 12"	PE, Seamless BE-ANSI B16.25	80 40	ANSI B36.10 ANSI B36.10	ASTM A 106 Gr. B ASTM A 106 Gr. B	SEAMLESS (Station piping) SEAMLESS (Station piping)
ELBOWS 90 LR	**E**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
ELBOWS 45 LR	**E45**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
ELBOWS 30 LR	**E30**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
ELBOWS 22.5 LR	**E22.5**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
ELBOWS 15 LR	**E15**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
REDUCERS CONCENTRIC	**RC**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
REDUCERS ECCENTRIC	**RE**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
TEES EQUAL	**T**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
TEES RED	**TR**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
SOCKOLET	**SW**	1/2"-3/4"	BE-ANSI B16.11	6000#	MSS-SP-97	ASTM A 105	The size inicated in this table refers to Mainline size. For Branch Size of Sockolet, Please refer to the Chart given in Sheet 6 of this Document
		1"-1 1/2"	BE-ANSI B16.11	3000#	MSS-SP-97	ASTM A 105	
WELDOLETS	**WEL**	1 1/2'-18"	BW - ANSI B16.25		MANUFACTURER	ASTM A 105	The size inicated in this table refers to Mainline size. For Branch Size of Sockolet, Please refer to the Chart given in Sheet 6 of this Document
CAPS	**C**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
NIPPLES	**NBEP** **NOET** **NBET**	1/2" - 1.1/2" 1/2" - 1.1/2" 1/2" - 1.1/2"	BOTH ENDS PLAIN ONE END THRD-MNPT OTH ENDS THRD-MNP	160 160 160	ANSI B36.10 ANSI B36.10 ANSI B36.10	ASTM A 106 Gr. B ASTM A 106 Gr. B ASTM A 106 Gr. B	SEAMLESS-LG=100mm SEAMLESS-LG=100mm 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. PTS-PSICL/IGL/ET2/CP/CP18160 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"- 1 1/2"		150# RF or Above	ANSI B16-5	ASTM A 105	
		2" -12"		150# RF		ASTM A 105	Always to be welded on ICL pipe
ORIFICE FLANGES	FO	1/2"- 1 1/2"		150# RF or Above	ANSI B16-5	ASTM A 105	COMPLETE WITH GASKET BOLTS, NUTS JACK-SCREWS AND PLUGS
		2" -12"		150# RF		ASTM A 105	
BLIND FLANGES	FB	1/2"- 1 1/2"		150# RF or Above	ANSI B16-5	ASTM A 105	
		2" -12"		150# RF		ASTM A 105	
DRIP RINGS	DR	1/2"- 1 1/2"		Above	ANSI B16-5	ASTM A 105	3/4" FNPT OUTLET CONNECTION
		2" -12"		150# RF		ASTM A 105	
SPECTACLE BLINDS	SB	1/2"- 1 1/2"		150# RF or above	ANSI B16-5	ASTM A 515 GR 70	
		2" - 12"		150# RF	ANSI B16-5	ASTM A 515 GR 70	
RESTRICTION ORIFICES	RO	1/2"- 1 1/2"		150# RF or above	ANSI B16-5	ASTM A240 GR 304	
		2" - 12"		150# RF	ANSI B16-5	ASTM A240 GR 304	
MONOLITHIC INSULATING JOINTS	IJ	2"	BW - ANSI B16-25	150#	ANSI B16-5	PIPE PUPS:Same as pipe Material Forged Ring - ASTM A 105	REFER DATA SHEET
		4" - 18"	BW - ANSI B16-25	150#	API 5L	PIPE PUPS:API 5L X 52/56 Forged Ring - ASTM A 694 F52	REFER DATA SHEET
			BW - ANSI B16-25	150#	API 5L	PIPE PUPS:API 5L X 52/56 Forged Ring - ASTM A 694 F52	REFER DATA SHEET
			BW - ANSI B16-25	150#	API 5L	PIPE PUPS:API 5L X 52/56 Forged Ring - ASTM A 694 F52	REFER DATA SHEET
STUD BOLTS	B	1/2" - 18"		150# 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"		150# RF	API 601 MSS SP 44	WINDING SS 316, FILLING PURE GRAPHITE, OUTER RING CS, INNER RING SS 316	4.5 mm THK

			PIPING SPECIFICATIONS				SPECIFICATION NO. PTS-PSICL/IGL/ET2/CP/CP18160 SHEET 4 OF 6
ITEM	**SHORT CODE**	**SIZE FROM-THRU**	**END CONNECTION**	**RATING AND/OR SCHED.**	**DIMENSION STANDARD**	**MATERIAL**	**REMARKS**
BALL	**VBA**	1/2" - 11/2"	FLGD RF:ANSI B16-5		ANSI B16-10	BODY:	FULL BORE
VALVES			or BW :ANSI B16.25	150# or above		ASTM A 105	WRENCH OPERATED.
						BALL:	FIRE SAFE
						SS 316	
		2"- 4"	FLGD RF:ANSI B16-5	150#	ANSI B16-10	BODY:	FULL BORE / REDUCED BORE AS INDICATED IN DATA SHEET
			or BW :ANSI B16.25			ASTM A 105/ASTM A 216 WCB	DOUBLE BLOCK & BLEED
						BALL:	WRENCH OPERATED.
							FIRE SAFE
						SS 316	
		6"- 18"	FLGD RF:ANSI B16-5	150#	ANSI B16-10	BODY:	FULL BORE / REDUCED BORE AS INDICATED DATA SHEET
			or BW :ANSI B16.25			ASTM A 216 WCB/A234 WPB	DOUBLE BLOCK & BLEED
						BALL:	GEAR OPERATED./ACTUATED (AS PER MR/Spec.)
						SS 316	FIRE SAFE
GLOBE	**VGL**	1/2"-1 1/2"	FLGD RF:ANSI B16-5		ANSI B16-10	BODY:	HANDWHEEL
VALVES			or BW :ANSI B16.25	150# or above		ASTM A 105	FIRE SAFE
						TRIM:	
						SS 316	
		2" - 18"	FLGD RF:ANSI B16-5	150#	ANSI B16-10	BODY:	HANDWHEEL
			or BW :ANSI B16.25			ASTM A 105 / ASTM A216 Gr. WCB	FIRE SAFE
						TRIM:	
						SS 316	
SWING CHECK	**VCH**	1/2" - 11/2"	FLGD RF:ANSI B16-5		ANSI B16-10	BODY:	HORIZONTAL INSTALLATION
VALVES			or BW :ANSI B16.25	150# or above		ASTM A 105	VERTICAL INSTALLATION FLOW UPWARDS
						TRIM:	
						SS 316	
		2" - 18"	FLGD RF:ANSI B16-5	150#	ANSI B16-10	BODY: ASTM A 105 / ASTM A216 Gr. WCB	HORIZONTAL INSTALLATION VERTICAL INSTALLATION FLOW UPWARDS
						TRIM:	
						SS 316	

REDUCERS CHART

SMALL SIZE

LARGE SIZE	1/2"	3/4"	1"	1.1/2"	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"
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"													X	X	X

LEGEND

X :CONCENTRIC AND ECCENTRIC REDUCERS-BW

BRANCH CHART

BRANCH SIZE

HEADER SIZE	1/2"	3/4"	1"	1.1/2"	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"
1/2"	T															
3/4"	TR	T														
1"	TR	TR	T													
1.1/2"	SW	TR	TR	T												
2"	SW	SW	TR	TR	T											
3"	SW	SW	SW	TR	TR	T										
4"	SW	SW	SW	SW	TR	TR	T									
6"	SW	SW	SW	SW	W	TR	TR	T								
8"	SW	SW	SW	SW	W	TR	TR	TR	T							
10"	SW	SW	SW	SW	W	W	TR	TR	TR	T						
12"	SW	SW	SW	SW	W	W	BW*	TR	TR	TR	T					
14"	SW	SW	SW	SW	W	W	BW*	BW*	TR	TR	TR	T				
16"	SW	SW	SW	SW	W	W	BW*	BW*	BW*	TR	TR	TR	T			
18"	SW	SW	SW	SW	W	W	BW*	BW*	BW*	BW*	TR	TR	TR	T		
20"	SW	SW	SW	SW	W	W	BW*	BW*	BW*	BW*	BW*	TR	TR	TR	T	
24"	SW	SW	SW	SW	W	W	BW*	BW*	BW*	BW*	BW*	BW*	TR	TR	TR	T

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
SW : SOCKOLET

***NOTE : IN PLACE OF BRANCH -WELD, EXTRUDED TEE, CONFORMING TO ASME B 16.9 SPECIFICATION, MAY BE USED, SUBJECT TO AVAILABILITY**

	PIPING SPECIFICATION				SPECIFICATION NO. PTS-PS3CL/IGL/ET2/CP/CP18160
					SHEET 1 OF 6

BASIC PIPING SPECIFICATION DATAS		MAXIMUM DESIGN CONDITIONS			
		TEMPERATURE °C		PRESSURE bar(g)	
PRIMARY FLANGE RATING	300#-RF	**Carbon Steel**	**0 to 60**	**Carbon Steel**	**49.00**
		LTCS	**- 20 to 65**	**LTCS**	**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**

			PIPING SPECIFICATIONS				SPECIFICATION NO PTS-PS3CL/IGL/ET2/CP/CP18160 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" 3" - 12"	PE, Seamless BE-ANSI B16.25	80 40	ANSI B36.10 ANSI B36.10	ASTM A 106 Gr. B ASTM A 106 Gr. B	SEAMLESS (Station piping) SEAMLESS (Station piping)
ELBOWS 90 LR	**E**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
ELBOWS 45 LR		1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
ELBOWS 30 LR	**E30**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
ELBOWS 22.5 LR	**E22.5**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
ELBOWS 15 LR	**E15**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
REDUCERS CONCENTRIC	**RC**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
REDUCERS ECCENTRIC	**RE**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
TEES EQUAL	**T**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
TEES RED	**TR**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
SOCKOLET	**SW**	1/2"-3/4"	BE-ANSI B16.11	6000#	MSS-SP-97	ASTM A 105	The size inicated in this table refers to Mainline size. For Branch Size of Sockolet, Please refer to the Chart given in Sheet 6 of this Document
		1"-1 1/2"	BE-ANSI B16.11	3000#	MSS-SP-97	ASTM A 105	
WELDOLETS	**WEL**	1 1/2'-18"	BW - ANSI B16.25		MANUFACTURER	ASTM A 105	The size inicated in this table refers to Mainline size. For Branch Size of Sockolet, Please refer to the Chart given in Sheet 6 of this Document
CAPS	**C**	1/2"- 1 1/2"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 105	
		2" - 12"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	ASTM A 234 WPB	
NIPPLES	**NBEP** **NOET** **NBET**	1/2" - 1.1/2" 1/2" - 1.1/2" 1/2" - 1.1/2"	BOTH ENDS PLAIN ONE END THRD-MNPT OTH ENDS THRD-MNP	80 80 80	ANSI B36.10 ANSI B36.10 ANSI B36.10	ASTM A 106 Gr. B ASTM A 106 Gr. B	SEAMLESS-LG=100mm SEAMLESS-LG=100mm SEAMLESS-LG=100mm

						ASTM A 106 Gr. B	
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 PTS-PS3CL/IGL/ET2/CP/CP18160** **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"- 1 1/2"		300# RF or above	ANSI B16-5	ASTM A 105	Pressure rating of the flange shall be matching with connecting flange
		2" - 12"		300# RF		ASTM A 105	Always to be welded on 3CL pipe
ORIFICE FLANGES	**FO**	1/2"- 1 1/2"		300# RF or	ANSI B16-5	ASTM A 105	COMPLETE WITH GASKET BOLTS, NUTS JACK-SCREWS AND PLUGS
		2" - 12"		300# RF		ASTM A 105	
BLIND FLANGES	**FB**	1/2"- 1 1/2"		300# RF or	ANSI B16-5	ASTM A 105	
		2" - 12"		300# RF		ASTM A 105	
DRIP RINGS	**DR**	1/2"- 1 1/2"		300# RF or	ANSI B16-5	ASTM A 105	3/4" FNPT OUTLET CONNECTION
		2" - 12"		300# RF		ASTM A 105	
SPECTACLE BLINDS	**SB**	1/2"- 1 1/2"		300# RF or	ANSI B16-5	ASTM A 515 GR 70	
		2" - 12"		300# RF	ANSI B16-5	ASTM A 515 GR 70	
RESTRICTION ORIFICES	**RO**	1" - 2"		600# RF	ANSI B16-5	ASTM A240 GR 304	
		2" - 12"		300# RF	ANSI B16-5	ASTM A240 GR 304	
MONOLITHIC INSULATING JOINTS	**IJ**	2"	BW - ANSI B16-25	300#	ANSI B16-5	PIPE PUPS:Same as pipe Material Forged Ring - ASTM A	REFER DATA SHEET
		4" - 18"	BW - ANSI B16-25	300#	API 5L	PIPE PUPS:API 5L X 52/56 Forged Ring - ASTM A	REFER DATA SHEET
			BW - ANSI B16-25	300#	API 5L	PIPE PUPS:API 5L X 52/56 Forged Ring - ASTM A	REFER DATA SHEET
			BW - ANSI B16-25	300#	API 5L	PIPE PUPS:API 5L X 52/56 Forged Ring - ASTM A	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 SS 316, FILLING PURE GRAPHITE, OUTER RING CS, INNER RING SS 316	4.5 mm THK

			PIPING SPECIFICATIONS				**SPECIFICATION NO PTS-PS3CL/IGL/ET2/CP/CP18160**
							SHEET 4 OF 6
ITEM	**SHORT CODE**	**SIZE FROM - THRU**	**END CONNECTION**	**RATING AND/OR SCHED.**	**DIMENSION STANDARD**	**MATERIAL**	**REMARKS**
BALL	**VBA**	1/2" - 11/2"	FLGD RF:ANSI B16-5		ANSI B16-10	BODY:	FULL BORE
VALVES			or BW :ANSI B16.25	300# or above		ASTM A 105	WRENCH OPERATED.
						BALL:	FIRE SAFE
						SS 316	
		2"- 4"	FLGD RF:ANSI B16-5	300#	ANSI B16-10	BODY:	FULL BORE / REDUCED BORE AS INDICATED IN DATA SHEET
			or BW :ANSI B16.25			ASTM A 105 / ASTM A 216 WCB	DOUBLE BLOCK & BLEED
						BALL:	WRENCH OPERATED.
						SS 316	FIRE SAFE
		6"- 18"	FLGD RF:ANSI B16-5	300#	ANSI B16-10	BODY:	FULL BORE / REDUCED BORE AS INDICATED DATA SHEET
			or BW :ANSI B16.25			ASTM A 105 / ASTM A 216 WCB	DOUBLE BLOCK & BLEED
						BALL:	GEAR OPERATED./ACTUATED (AS PER MR/Spec.)
						SS 316	FIRE SAFE
GLOBE	**VGL**	1/2"-1 1/2"	FLGD RF:ANSI B16-5		ANSI B16-10	BODY:	HANDWHEEL
VALVES			or BW :ANSI B16.25	300# or above		ASTM A 105	FIRE SAFE
						TRIM:	
						SS 316	
		2" - 18"	FLGD RF:ANSI B16-5	300#	ANSI B16-10	BODY:	HANDWHEEL
			or BW :ANSI B16.25			ASTM A 105 / ASTM A216 Gr. WCB	FIRE SAFE
						TRIM:	
						SS 316	
SWING CHECK	**VCH**	1/2" - 11/2"	FLGD RF:ANSI B16-5		ANSI B16-10	BODY:	HORIZONTAL INSTALLATION
VALVES			or BW :ANSI B16.25	300# or above		ASTM A 105	VERTICAL INSTALLATION FLOW UPWARDS
						TRIM:	

						SS 316	
		2" - 18"	FLGD RF:ANSI B16-5	300#	ANSI B16-10	BODY: ASTM A 105 / ASTM A216 Gr. WCB	HORIZONTAL INSTALLATION VERTICAL INSTALLATION FLOW UPWARDS
						TRIM:	
						SS 316	

REDUCERS CHART

SMALL SIZE

LARGE SIZE

	1/2"	3/4"	1"	1.1/2"	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"
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"													X	X	X

LEGEND

X :CONCENTRIC AND ECCENTRIC REDUCERS-BW

BRANCH CHART

BRANCH SIZE

HEADER SIZE

	1/2"	3/4"	1"	1.1/2"	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"
1/2"	T															
3/4"	TR	T														
1"	TR	TR	T													
1.1/2"	SW	TR	TR	T												
2"	SW	SW	TR	TR	T											
3"	SW	SW	SW	TR	TR	T										
4"	SW	SW	SW	SW	TR	TR	T									
6"	SW	SW	SW	SW	W	TR	TR	T								
8"	SW	SW	SW	SW	W	TR	TR	TR	T							
10"	SW	SW	SW	SW	W	W	TR	TR	TR	T						
12"	SW	SW	SW	SW	W	W	BW*	TR	TR	TR	T					
14"	SW	SW	SW	SW	W	W	BW*	BW*	TR	TR	TR	T				
16"	SW	SW	SW	SW	W	W	BW*	BW*	BW*	TR	TR	TR	T			
18"	SW	SW	SW	SW	W	W	BW*	BW*	BW*	BW*	TR	TR	TR	T		
20"	SW	SW	SW	SW	W	W	BW*	BW*	BW*	BW*	BW*	TR	TR	TR	T	
24"	SW	SW	SW	SW	W	W	BW*	BW*	BW*	BW*	BW*	BW*	TR	TR	TR	T

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

SW : SOCKOLET

SECTION 10

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

PAINTING SYSTEM & COLOUR CODE FOR FINAL LAYER

(DOC No.-PTS-PS&CC/IGL/ET2/CP/CP18160)

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
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 A5 of ISO 12944 – 5 Standard

Table A.5 — Paint systems for low-alloy carbon steel for corrosivity categories C5-I and C5-M

Substrate: Low-alloy carbon steel

Surface preparation: For Sa 2½, from rust grade A, B or C only (see ISO 8501-1)

System No.	Priming coat(s)				Subsequent coat(s)	Paint system		Expected durability		
	Binder	Type of primer [a]	No. of coats	NDFT [b] in µm	Binder type	No. of coats	NDFT [b] in µm	Low	Med	High
C5-I										
A5I.01	EP, PUR	Misc.	1-2	120	AY, CR, PVC [c]	3-4	200			
A5I.02	EP, PUR	Misc.	1	80	EP, PUR	3-4	320			
A5I.03	EP, PUR	Misc.	1	150	EP, PUR	2	300			
A5I.04	EP, PUR, ESI [d]	Zn (R)	1	60 [e]	EP, PUR	3-4	240			
A5I.05	EP, PUR, ESI [d]	Zn (R)	1	60 [e]	EP, PUR	3-5	320			
A5I.06	EP, PUR, ESI [d]	Zn (R)	1	60 [e]	AY, CR, PVC [c]	4-5	320			
C5-M										
A5M.01	EP, PUR	Misc.	1	150	EP, PUR	2	300			
A5M.02	EP, PUR	Misc.	1	80	EP, PUR	3-4	320			
A5M.03	EP, PUR	Misc.	1	400	—	1	400			
A5M.04	EP, PUR	Misc.	1	250	EP, PUR	2	500			
A5M.05	EP, PUR, ESI [d]	Zn (R)	1	60 [e]	EP, PUR	4	240			
A5M.06	EP, PUR, ESI [d]	Zn (R)	1	60 [e]	EP, PUR	4-5	320			
A5M.07	EP, PUR, ESI [d]	Zn (R)	1	60 [e]	EPC	3-4	400			
A5M.08	EPC	Misc.	1	100	EPC	3	300			

Binder for priming coat(s)	Type	Water-borne possible	Binder for subsequent coat(s)	Type	Water-borne possible
EP = Epoxy	2-pack	X	EP = Epoxy	2-pack	X
EPC = Epoxy combination	2-pack		EPC = Epoxy combination	2-pack	
ESI = Ethyl silicate	1- or 2-pack	X	PUR = Polyurethane, aliphatic	1- or 2-pack	X
PUR = Polyurethane, aromatic or aliphatic	1- or 2-pack	X	CR = Chlorinated rubber	1-pack	
			AY = Acrylic	1-pack	X
			PVC = Poly(vinyl chloride)	1-pack	

[a] Zn (R) = Zinc-rich primer, see 5.2. Misc. = Primers with miscellaneous types of anticorrosive pigments.

[b] NDFT = Nominal dry film thickness. See 5.4 for further details.

[c] It is recommended that compatibility be checked with the paint manufacturer.

[d] It is recommended for ESI primers that one of the subsequent coats be used as a tie coat.

[e] It is also possible to work with an NDFT from 40 µm up to 80 µm provided the zinc-rich primer chosen is suitable for such an NDFT.

SECTION 11

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

DATASHEET- CARTRIDGE / DRY GAS FILTER

(Doc. No.- DATASHEET-FC/IGL/ET2/CP/CP18160)

	DATA SHEET CARTRIDGE FILTER	DATA SHEET NO. DATASHEET-FC/IGL/ET2/CP/CP18160

1 GENERAL		
1.1 Tag No.	As per P&ID	
1.2 Service	Natural Gas	
1.3 Line No.	As per P&ID	
1.4 P&ID No.	-	
1.5 Quantity	As per P&ID	
1.6 Location	As per P&ID	
1.7 Reference Drg. No.	-	
2 OPERATING CONDITIONS		
2.1 Pressure maximum	49 bar(g)	
2.2 Fluid / State	Natural Gas	Gaseous
2.3 Flow Rate - Maximum.	As per Operating Condition	
2.4 Design Temp. Min / Max	0°C to 60°C	
2.5 SP. Gravity / MOL / WT>	-	
2.6 Vapor Press / Critical Press	Vendor to furnish	
2.7 Pressure Drop (Max. Allowable)	0.5 Barg	
2.8 Gas Operating Temperature	25 deg C	
2.9 Suspended Solids		
2.10 Filtration efficiency	99.9%, Removing liquid and solid particle of size >5 micron	
3 DESING / CONSTRUCTION DATA		
3.1 Filter make / model	Vendor to furnish	
3.2 Type of Filter	Cartridge filter	
3.3 Number of elements	Vendor to furnish	
3.4 Design Code / Standards	ASME VIII DIV I	
- Piping Welding Code	ASME Sec IX	
- NDE Code	ASME B 31.3, ASME Sec V	
3.5 Size of Vessel		
- Shell dia	Vendor to furnish	
- Length	Vendor to furnish	
- Height Total	Vendor to furnish	
- Type of Dish end	2:1	
- Top cover	With Quick opening closure as per ASME Sec VIII	
- Lifting lugs	Yes, to be Provided	
3.6 Material of Construction		
- Shell	SA - 516 Gr. 60 / ASTM - A106 Gr. B	
- Heads	SA - 516 Gr. 60 / ASTM - A106 Gr. B	
- Filter element	Fiber glass	
- Filter element holder (van box)	SS-304	
- Top cover ring (Pressure and Segment)	SA 350 LF2 / A 105	
- Name Plate	SS 304	

	DATA SHEET CARTRIDGE FILTER	DATA SHEET NO. P.016162-G-11087-M706

-	Filter frame	SA - 516 Gr. 60 / ASTM - A106 Gr. B
	Supports (Skirts)	SA - 516 Gr. 60 / ASTM - A106 Gr. B
	Flanges (shell + nozzle + cover)	ASTM - A 105
	- Rating	ANSI 16.5, 300#
	- Gasket	Spiral Bound SS 316 + PTFE Filled
	Nozzle Necks	ASTM A106 Gr. B(Seamless Pipe)
	Internal fittings	SS 304 / 316
	Bolts / nuts / Washer	SA 320 Gr. 7 or ASTM A 193 B7 / ASTM - 194 Gr. 7 or Gr 2H
	Structural attachments	
	Internal	SA 516 Gr. 70
	External	SA 516 Gr. 70
	Insulation	NIL
	Vent pipe	ASTM A106 Gr. B(Seamless Pipe)
	Base plate	IS:2062 Gr. A
	Cover flanges	ASTM - A 105
3.7	Add in Design Data	
-	Joint efficiency	1.00
	PWHT	YES
	Radiography	Full (100%), UT/MPI/DPT shall also be carried out as per technical specification & code requirement.
	Hydro test Pressure	1.5 X Design Pressure
	Corrosion Allowance	3 mm
	Impact Test	@ 0ºC & at temperature as per material requirement(for base material & after heat treatment)
3.8	Total Erection weight of filter assembly	Vendor to provide
3.9	Painting	Vendor shall submit painting detail for approval as per specification for PAINTING SYSTEM & COLOUR CODE FOR FINAL LAYER enclosed with tender document.
4	Accessories (As applicable)	1. QOC 2. Anchor bolts and nuts 3. Vessel supports 4. Ladder and platform 5. Lifting Lugs 6. Davit arm As applicable

NOTES:

1 Vendor to prepare detailed QAP and submit for Owner's approval
2 Vendor to submit GAD and fabrication drawing for Owner's approval.

REV	DATE	PRE	CHKD	APPD

SECTION 12

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

DATASHEET- BALL VALVES (1CI)

(Doc. No.- DATASHEET-BVICL/IGL/ET2/CP/CP18160)

DATASHEET BALL VALVES (1CI)		
I. PROCESS DATA		
FLUID	:	Natural Gas
FLUID SYMBOL	:	NG
INSTALLATION		Above Ground (A/G)
DESIGN CONDITION	:	
TEMPERATURE (°C)		Refer Appendix -2
PRESSURE (Barg)		19
OPERATING CONDITION	:	
TEMPERATURE (°C)		Refer Appendix -2
PRESSURE (Barg)		
II. VALVE DATA		
APPLICABLE SPECIFICATION	:	Refer PTS valves
CONSTRUCTION DESIGN	:	Above 2" - API 6D, 2" and Below - BS 5351
PIPE CLASS	:	ICL
RATING	:	150#

TYPE	:	**4" & Below - A/G**	**above 4"- A/G**
VALVE BORE		FULL BORE	FULL BORE
BODY		FULLY WELDED/BOLTED CONSTRUCTION	FULLY WELDED/BOLTED CONSTRUCTION
SEAT		FLOATING TYPE	TRUNION MOUNTED DOUBLE BLOCK AND BLEED
END CONNECTION	:	SOCKET WELDED AND FLANGED (RF) ANSI B 16.5	

BODY MATERIAL	:	**Below 2"**	**2" & above**
		ASTM 105	ASTM 105 or ASTM A 216 Gr WCB

BALL MATERIAL		SS 316
STEM		SS 316
SEAT & SEAL		SS 316
Primary seat		PTFE
Secondary Seat		Metal to Metal
Fire Safe		YES (Bidder to submit documentry proof)
Antistatic		YES
ANTI-BLOW OUT		YES
Extension stem		NO

Operator		Wrench for below 4" and Gear for 4" & above
Painting (refer annexure -II of PTS)		
Surface Preparation		SA 2.5
Primer		30-40 µm
Finish		30-40 µm
Final Paint DFT		300 µm (min.)
Insulation		NO
III TEST		
HYDROSTATIC SHELL TEST :		
Test pressure		1.5 x Design Pressure
Test Duration		As per API 6D
HYDROSTATIC SEAT TEST :		
Test pressure		1.1 x Design Pressure
Test Duration		As per API 6D
PNEUMATIC SEAT TEST :		
Test pressure		Above 2" - API 6D, Above 2" - API 6D
FUNCTIONAL TEST :		
Test pressure		Atm. & maximum differential pressure
LEAK TEST		API 598
DOUBLE BLOCK & BLEED TEST		Yes
TORQUE TEST	:	API 6D
ANTISTATIC TEST	:	BS - 5351 / API 598
FIRE TEST	:	API 6FA
VISUAL AND DIMENSIONAL EXAMINATION TEST	:	MSS-SP-55 / API 1104
IV QUALITY CONTROL	:	Note : Vendor to provide QAP of valve for Approval
MATERIAL CERTIFICATES		EN 10204-3.1 Latest Edition
ALL TEST CERTIFICATES		TEST CERTIFICATES INCLUDING, FIRE SAFE, ANTISTATIC, PHYSICAL IMPACT, CHEMICAL, PAINTING ETC.

SECTION 13

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

DATASHEET- BALL VALVES (3CI)

(Doc. No.- DATASHEET-BV3CL/IGL/ET2/CP/CP18160)

DATASHEET BALL VALVES (3CI)		
I. PROCESS DATA		
FLUID	**:**	**Natural Gas**
FLUID SYMBOL	:	NG
INSTALLATION		Above Ground (A/G)
DESIGN CONDITION	:	
TEMPERATURE (˚C)		65
PRESSURE (Barg)		49
OPERATING CONDITION	:	
TEMPERATURE (˚C)		Refer Appendix -2
PRESSURE (Barg)		
II. VALVE DATA		
APPLICABLE SPECIFICATION	:	Refer PTS valves
CONSTRUCTION DESIGN	:	Above 2" - API 6D, 2" and Below - BS 5351
PIPE CLASS	:	3CL
RATING	:	300#

TYPE	:	**4" & Below - A/G**	**above 4"- A/G**
VALVE BORE		FULL BORE	FULL BORE
BODY		FULLY WELDED/BOLTED CONSTRUCTION	FULLY WELDED/BOLTED CONSTRUCTION
SEAT		FLOATING TYPE	TRUNION MOUNTED DOUBLE BLOCK AND BLEED
END CONNECTION	:	FLANGED (RF), ANSI B 16.5	
BODY MATERIAL	:	**Below 2"**	**2" & above**
		ASTM 105	ASTM 105 or ASTM A 216 Gr WCB

BALL MATERIAL		SS 316
STEM		SS 316
SEAT & SEAL		SS 316
Primary seat		PTFE
Secondary Seat		Metal to Metal
Fire Safe		YES (Bidder to submit documentry proof)
Antistatic		YES
ANTI-BLOW OUT		YES
Extension stem		NO
Operator		Wrench for below 4" and Gear for 4" & above
Painting (refer annexure -II of PTS)		

Surface Preparation		SA 2.5
Primer		30-40 µm
Finish		30-40 µm
Final Paint DFT		300 µm (min.)
Insulation		NO
III TEST		
HYDROSTATIC SHELL TEST :		
Test pressure		1.5 x Design Pressure
Test Duration		As per API 6D
HYDROSTATIC SEAT TEST :		
Test pressure		1.1 x Design Pressure
Test Duration		As per API 6D
PNEUMATIC SEAT TEST :		
Test pressure		6 (barg)
FUNCTIONAL TEST :		
Test pressure		Atm. & maximum differential pressure
LEAK TEST		API 598
DOUBLE BLOCK & BLEED TEST		Yes
TORQUE TEST	:	API 6D
ANTISTATIC TEST	:	BS - 5351 / API 598
FIRE TEST	:	API 6FA
VISUAL AND DIMENSIONAL EXAMINATION TEST	:	MSS-SP-55 / API 1104
IV QUALITY CONTROL	:	Note : Vendor to provide QAP of valve for Approval
MATERIAL CERTIFICATES		EN 10204-3.1 Latest Edition
ALL TEST CERTIFICATES		TEST CERTIFICATES INCLUDING, FIRE SAFE, ANTISTATIC, PHYSICAL IMPACT, CHEMICAL, PAINTING ETC.

SECTION 14

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

DATASHEET- ABOVE GROUND GLOBE VALVES (1CI)

(Doc. No.- DATASHEET-AGGVICL/IGL/ET2/CP/CP18160)

MANUAL GLOBE VALVES ABOVEGROUND SERVICE DATASHEET (1Cl)		
I. PROCESS DATA		
PIPE CLASS	:	ICL
FLUID	:	Natural Gas
FLUID SYMBOL	:	NG
INSTALLATION		Above Ground (A/G)
DESIGN CONDITION	:	
TEMPERATURE (°C)		Refer Appendix -2
PRESSURE (Barg)		19
OPERATING CONDITION	:	
TEMPERATURE (°C)		Refer Appendix -2
PRESSURE (Barg)		
II. VALVE DATA		
CONSTRUCTION DESIGN	:	below 2 " : BS 5352, 2" & above : BS 1873
PIPE CLASS	:	ICL

TYPE	:	High resistance to vibrations and high differential pressure, Unidirectional Gland Type-Bolted Bonnet, Non Rotating Stem Pattern; Straight Through Globe
FACE To FACE		ANSI B 16.10
END CONNECTION	:	FLANGED (RF) ANSI B 16.5, 150#

BODY MATERIAL	:	**Below 2"**	**2" & above**
		ASTM 105	ASTM 105 or ASTM A 216 Gr WCB

DISC MATERIAL		SS 316
STEM		SS 316
SEAT & SEAT RING		SS 316
GASKET		Graphite
PACKAGING		Graphite
Extension stem		NO
Operator		Wrench for below 4" and Gear for 4" & above
Painting (refer annexure -II of PTS)		
Surface Preparation		SA 2.5
Primer		30-40 µm
Finish		30-40 µm
Final Paint DFT		300 µm (min.)
Insulation		NO
III. VALVE INSPECTION AND TEST		

SHELL TEST		SEE API 598
BACKSEAT TEST		SEE API 598
LOW -PRESSURE CLOSURE TEST		SEE API 598
HIGH-PRESSURE CLOSURE TEST		SEE API 598
VISUAL EXAMINATION OF CASTINGS		SEE API 598
HIGH-PRESSURE PNEUMATIC SHELL TEST		SEE API 598
FIRE SAFE TEST	:	NA
IV QUALITY CONTROL	:	Note : Vendor to provide QAP of valve for Approval
MATERIAL CERTIFICATES		EN 10204-3.1 Latest Edition
ALL TEST CERTIFICATES		TEST CERTIFICATES INCLUDING, FIRE SAFE, ANTISTATIC, PHYSICAL IMPACT, CHEMICAL, PAINTING ETC.

SECTION 15

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

DATASHEET- ABOVE GROUND GLOBE VALVES (3CI)

(Doc. No.- DATASHEET-AGGV3CL/IGL/ET2/CP/CP18160)

MANUAL GLOBE VALVES ABOVEGROUND SERVICE DATASHEET (3Cl)		
I. PROCESS DATA		
PIPE CLASS	:	3CL
FLUID	:	Natural Gas
FLUID SYMBOL	:	NG
INSTALLATION		Above Ground (A/G)
DESIGN CONDITION	:	
TEMPERATURE (˚C)		70
PRESSURE (Barg)		49
OPERATING CONDITION	:	
TEMPERATURE (˚C)		Refer Appendix -2
PRESSURE (Barg)		
II. VALVE DATA		
CONSTRUCTION DESIGN	:	below 2 " : BS 5352, 2" & above : BS 1873

TYPE	:	High resistance to vibrations and high differential pressure, Unidirectional Gland Type-Bolted Bonnet, Non Rotating Stem Pattern; Straight Through Globe
FACE To FACE		ANSI B 16.10
END CONNECTION	:	FLANGED (RF) ANSI B 16.5, 300#

BODY MATERIAL	:	**Below 2"**	**2" & above**
		ASTM 105	ASTM 105 or ASTM A 216 Gr WCB

DISC MATERIAL		SS 316
STEM		SS 316
SEAT & SEAT RING		SS 316
GASKET		Graphite
PACKAGING		Graphite
Extension stem		NO
Operator		Wrench for below 4" and Gear for 4" & above
Painting (refer annexure -II of PTS)		
Surface Preparation		SA 2.5
Primer		30-40 µm
Finish		30-40 µm
Final Paint DFT		300 µm (min.)
Insulation		NO
III. VALVE INSPECTION AND TEST		
SHELL TEST		SEE API 598
BACKSEAT TEST		SEE API 598

LOW -PRESSURE CLOSURE TEST		SEE API 598
HIGH-PRESSURE CLOSURE TEST		SEE API 598
VISUAL EXAMINATION OF CASTINGS		SEE API 598
HIGH-PRESSURE PNEUMATIC SHELL TEST		SEE API 598
FIRE SAFE TEST	:	NA
IV QUALITY CONTROL	:	Note : Vendor to provide QAP of valve for Approval
MATERIAL CERTIFICATES		EN 10204-3.1 Latest Edition
ALL TEST CERTIFICATES		TEST CERTIFICATES INCLUDING, FIRE SAFE, ANTISTATIC, PHYSICAL IMPACT, CHEMICAL, PAINTING ETC.

SECTION 16

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

DATASHEET- ABOVE GROUND CHECK VALVES 1CI

(Doc. No.- DATASHEET-AGCVICL/IGL/ET2/CP/CP18160)

CHECK VALVES ABOVEGROUND SERVICE DATASHEET		
I. PROCESS DATA		
PIPE CLASS	:	ICL
FLUID	:	Natural Gas
FLUID SYMBOL	:	NG
INSTALLATION		Above Ground (A/G)
DESIGN CONDITION	:	
TEMPERATURE (˚C)		Refer Appendix -2
PRESSURE (Barg)		19
OPERATING CONDITION	:	
TEMPERATURE (˚C)		Refer Appendix -2
PRESSURE (Barg)		
II. VALVE DATA		
APPLICABLE SPECIFICATION		API 6D
CONSTRUCTION DESIGN	:	Pressure Rating; ASME B16.34, ASME B16.5
DIMENSIONAL STANDARD		API 6D
TYPE	:	SWING CHECK
END CONNECTION	:	FLANGED (RF) ANSI B 16.5, 150#
BODY MATERIAL		ASTM 105 or ASTM A 216 Gr WCB
WEDGE & DISC MATERIAL		SS 316
HINGE & HINGE PIN		ASTM A276 TP 410 OR ASTM A216 Gr. WCB
GASKET		Graphite
Painting (refer annexure -II of PTS)		
Surface Preparation		SA 2.5
Primer		Refer painting system and color code for final layer
Finish		
Final Paint DFT		
Insulation		NO
III TEST		
HYDROSTATIC SHELL TEST :		
Test pressure		1.5 x Design Pressure
Test Medium		Water
HYDROSTATIC SEAT TEST :		
Test pressure		1.1 x Design Pressure
Test Medium		Water
AIR SEAT TEST :		
Test pressure		NA
Test Medium		NA
LEAK TEST	:	Yes

VISUAL AND DIMENSIONAL EXAMINATION TEST	:	Yes
IV QUALITY CONTROL	:	Note : Vendor to provide QAP of valve for Approval
MATERIAL CERTIFICATES		EN 10204-3.1 Latest Edition
ALL TEST CERTIFICATES		All test certificates related to chemical, physical, NDT, testing and Painting etc.

SECTION 17

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

DATASHEET- ABOVE GROUND CHECK VALVES 3CI

(Doc. No.- DATASHEET-AGCV3CL/IGL/ET2/CP/CP18160)

CHECK VALVES ABOVEGROUND SERVICE DATASHEET		
I. PROCESS DATA		
PIPE CLASS	:	3CL
FLUID	:	Natural Gas
FLUID SYMBOL	:	NG
INSTALLATION		Above Ground (A/G)
DESIGN CONDITION	:	
TEMPERATURE (°C)		70
PRESSURE (Barg)		49
OPERATING CONDITION	:	
TEMPERATURE (°C)		Refer Appendix -2
PRESSURE (Barg)		
II. VALVE DATA		
APPLICABLE SPECIFICATION		API 6D
CONSTRUCTION DESIGN	:	Pressure Rating; ASME B16.34, ASME B16.5
DIMENSIONAL STANDARD		API 6D
TYPE	:	SWING CHECK
END CONNECTION	:	FLANGED (RF) ANSI B 16.5, 300#
BODY MATERIAL		ASTM 105 or ASTM A 216 Gr WCB
WEDGE & DISC MATERIAL		SS 316
HINGE & HINGE PIN		ASTM A276 TP 410 OR ASTM A216 Gr. WCB
GASKET		Graphite
Painting (refer annexure -II of PTS)		
Surface Preparation		SA 2.5
Primer		Refer painting system and colour code for final layer
Finish		
Final Paint DFT		
Insulation		NO
III TEST		
HYDROSTATIC SHELL TEST :		
Test pressure		1.5 x Design Pressure
Test Medium		Water
HYDROSTATIC SEAT TEST :		
Test pressure		1.1 x Design Pressure
Test Medium		Water
AIR SEAT TEST :		
Test pressure		NA
Test Medium		NA
LEAK TEST	:	Yes

VISUAL AND DIMENSIONAL EXAMINATION TEST	:	Yes
IV QUALITY CONTROL	:	Note : Vendor to provide QAP of valve for Approval
MATERIAL CERTIFICATES		EN 10204-3.1 Latest Edition
ALL TEST CERTIFICATES		All test certificates related to chemical, physical, NDT, testing and Painting etc.

SECTION 18

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

QAP- PRESSURE, LEVEL & DIFF. PRESSURE TRANSMITTER

(Doc. No.- QAP-P,L,DPT /IGL/ET2/CP/CP18160)

QUALITY ASSURANCE PLAN PRESSURE, LEVEL, DIFF. PRESSURE TRANSMITTER

QAP No	: QAP-P,L,DPT /IGL/ET2/CP/CP18160
Prepared by	: Checked By:
Approved by	:

Sr.No.	Description	Characteristic	Class	Type of Check	Quantum of Check	Reference Document	Doc. / Quality Assurance Plan for Level Gauge	Format Of Records	Inspection By				Remarks
									M	VENDOR	TPI	Client	
1	**INTERNAL TEST / INSPECTION**	General Finish Verification of - Model No. - Serial No. - Calibration Range - Material of construction - Customer Tag - Certification Label - Process connection - Accessories - Calibration	Major Critical	Visual Electrical	100%	Job Card & Product Data Sheet Calibration Procedure & Job Card	Job Card Calibration Procedure & Job Card		P	R	W	R	
2	**Witness Test / Inspection**	- Calibration / Accuracy / Range - Load Variation Test - Power Supply Variation Test - Reverse Plo…..Test	Critical	Electrical	100%	Calibration Procedure & Job Card	Calibration Procedure & Job Card	Test & Calibration Report	P	R	W	R	
		- Accessories	Major	Visual		As per Model	As per Model						
		- Communication with H……. Communicator - Verification of Model & Tag No	Critical	Electrical	100%	Procedure & Job Card	Procedure & Job Card	Compliance Report	P	R	W	R	
		- Ov…..Pressure Test	Critical	Visual	100%	Product Data Sheet	Product Data Sheet						

Legend

M	Manufacturer	P	Perform			
C	Client	R	Review			
TPI	Third Party Inspection Agency	W	Witness			
A	For Approval	W/R	Witness of Test / Review of Certificates & Documents as per QAP			

SECTION 19

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

QAP- SLAM SHUT VALVES & REGULATORS

(Doc. No.- QAP-SSV&PRV /IGL/ET2/CP/CP18160)

	QUALITY ASSURANCE PLAN SLAM SHUT VALVES & REGULATORS							QAP No	:QAP-SSV&PRV /IGL/ET2/CP/CP18160				
								Prepared by	: Checked By:				
								Approved by	:				
Sr. No.	**Description**	**Characteristic**	**Class**	**Type of Check**	**Quantum of Check**	**Reference Document**	**Acceptance Norms**	**Format Of Records**	**Inspection By**				**Remarks**
									M	**VENDOR**	**TPI**	**Client**	
1	**Bought Out Components**	Test Certificate	Major	Review	100%	Applicable Standard / Product Datasheet	Applicable Standard / Product Datasheet	Job Card	P	R	R	R	
		Visual	Major	Visual	100%								
		Dimensional	Major	Dimensional	100%								
2	**In process Inspection**	Dimensional	Major	Dimensional	100%	Applicable Standard / Product Datasheet	Applicable Standard / Product Datasheet	Job Card	P	R	W	R	
		Functional	Major	Accuracy	100%								
		Hydro Test	Major	Strength	100%								
3	**Final Inspection**	Dimensional	Major	Dimensional	100%	Customer Data Product Data Sheet & Job Card	Customer Data Product Data Sheet & Job Card	Job Card	P	W/R	W	R	
		Functional											
		a) Pneumatic Test	Major	Leakage	100%								
		b) Set Point Test	Major	Accuracy	100%								

1) Pneumatic Test of Body & Other Parts assembly shall be Carried out at 1.5 times max. operating pressure.
2) Set Point Test shall be carried out at specified pressure.
3) Seat tightness test for PCVs, Slam shut valves (shall be conducted at manufacturer's shop and certificates shall be submitted)

M	Manufacturer
C	Client
TPI	Third Party Inspection Agency
A	For Approval

P: Perform
R: Review
W: Witness
W/R: Witness of Test / Review of Certificates & Documents as per QAP

NOTE

1) Integration & Hookup SS Tubing
2) Testing with N2 shall be done to Check proper tubing arrangement.
3) Sr. No.3 Final Inspection shall be done at Manufacturer's works.

SECTION 20

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

QAP- PRESSURE GAUGE

(Doc. No.- QAP-PG /IGL/ET2/CP/CP18160)

QUALITY ASSURANCE PLAN FOR PRESSURE GAUGE

QAP No : QAP-PG /IGL/ET2/CP/CP18160

Prepared by : **Checked by :**
Approved by :

Sr. No.	Component Operation	Characteristics Checked	Category	Type/Method of Check	Extent of Check		Reference Document	Acceptance Norm	Format of Plan	Agency			Remarks
					P	W				M	TPIA	C	
1	Raw Material	a) Dimensions	MA	Mechanical	100%	100%	PO approved	PO approved	TC	P	R	W/R	
		b) Chemical Analysis	MA	Chemical	Sample	_	Spec/ Drg.	Spec/ Drg.	TC	P	R	W/R	
		c) Marking, Tagging	MA	Visual	100%	100%	Approved Spec/PO	Approved Spec/PO	TC	P	W	W/R	
2	Routine test	Accuracy Hysteresis Repeatability	CR	Measurement 5 Points	100%	100%	EN 837-1	EN 837-1	Calibration Report	P	W	W/R	
		Over range protection	CR	Visual	100%	100%	EN 837-1	EN 837-1	Test Report	P	W	W/R	
3	IRN										P	R	

Note: 1) Material and Type shall be as per tender specification / datasheet.

Category: CR - Characteristics affecting safety of equipment and personnel MA - Characteristics affecting safety of Performance
MT - Characteristics affecting safety of Appearance

M-Manufacturer
TPIA-Third Party Inspection
Agency C-Client

P-Perform, W-Witness, R-Review, W/R- Witness of Test / Review of Certificates & Documents as per QAP

SECTION 21

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

QAP- RTD AND THERMOWELL

(Doc. No.- QAP-RTD&TW /IGL/ET2/CP/CP18160)

QUALITY ASSURANCE PLAN FOR RTD AND THERMOWELL

QAP No :QAP-RTD&TW /IGL/ET2/CP/CP18160
Prepared by: Checked by :
Approved by:

Sr. No.	Component Operation	Characteristics Checked	Category	Type/ Method of check	Extent of check		Reference document	Acceptance norm	Format of plan	Agency			Remarks
					Vendor	TPIA/C				M	TPIA	C	
RTD Assemblies													
1	RTD assemblies	a) Accuracy Test	MA	Testing	100%	10%	IEC751/DIN43760	IEC751/DIN43760	LOG BOOK/Computerized	P	W	W/R	No leakage at 40 kg/cm2
		b) IR at AMB & at 500VDC	*	*	100%	10%	STD	TO STD	LOG BOOK/Computerized	P	R	W/R	
		c) Hot IR at 320 Deg c & 500 VDC	*	*	100%	_	STD	TO STD	LOG BOOK/Computerized	P	R	W/R	
		d) N2 Test	*	*	100%	10%	STD	TO STD	LOG BOOK/Computerized	P	R	W/R	
		e) Response Time test	*	*	10%	10%	STD	TO STD	Test Reports	P	R	W/R	
		f) Dimensions/Connection	*	Measurement	100%	100%	Applicable Specification/ Drawing	Applicable Specification/Drawings	Design	P	R	W/R	
		g)Weather proof ness test	MA/CR	Testing	Sample of design		IP 65 IS 13947	IP 65 IS 13947	Testing certificates	P	R	W/R	
Thermowell													
1	Raw materials of thermowell	Chemical Composition	MA	analysis	_	_	Applicable Specification	To applicable specifications	Test Reports	P	R	W/R	The results logged in the log book would be issued in the form of test certificates as per DIN
2	thermowell	a) dimension	MA	measuring	100%	10%	Applicable Specification		Log book test report	P	W	W/R	
		b) hydro test	MA	testing	100%	10%	Applicable Specification	No leakage	Log book test report	P	W	W/R	
		c) bore concentricity test	MA/CR	go- no gauge	100%	_			Log book	P	W	W/R	
		d)visual	MA/MT	observation	100%	_	Co. Std.	To Co. Std.	Log Book	P	W	W/R	
		e)workmanship/finish	MA/MT	observation	100%	_	Co. Std.	To Co. Std.	Log Book	P	W	W/R	
		f) Spec/ tagging	MA	visual	100%	_	Applicable Specification/ Drawing	to Applicable Specification/Drawings	Log book	P	W	W/R	
		g) threading	MA	thread gauge	100%	_	STD	TO STD	Log book	P	W	W/R	
		h) surface finish	MT	visual	100%	_	STD	TO STD	Log book	P	W	W/R	
3	IRN										P	R	

Note:

1) Material and Type shall be as per tender specification / datasheet.

Note:

M-Manufacturer P-Perform
TPIA-Third Party Inspection Agency R-Review
C-Client W-Witness

SECTION 22

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

QAP- SKID FABRICATION

(Doc. No.- QAP-SKID/IGL/ET2/CP/CP18160)

	QUALITY ASSURANCE PLAN SKID FABRICAITON	QAP No : QAP-SKID/IGL/ET2/CP/CP18160 Date Prepared by Checked by Approved by

Sr.No	Description	Characteristic	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norms	Format Of Records	Inspection By			Remarks
									M	TPIA	Client	
1	**Incoming Material for skid spool fabrication**											
1.1	Pipe	As per Specification	Major	laboratory + Dimensional	1 piece per pipe size	ASTM A106 Gr. B (Seamless)	ASTM A106 Gr. B (Seamless)	Mfr / lab cert.	P	R	R/W	
1.2	Pipe Fittings	As per Specification	Minor	laboratory	Per heat	ASTM A105	ASTM A105	Mfr / lab cert.	P	R	R/W	
			Major	laboratory	Per heat	ASTM A105	ASTM A105	Mfr / lab cert.	P	R	R/W	
			Minor	Visual	10%	ANSI B16.9	ANSI B16.9	Mfr cert.	P	R	R/W	
1.3	Flanges	As per Specification	Minor	laboratory	100%	ASTM A105	ASTM A105	lab cert.	P	R	R/W	
			Major	laboratory	Per heat	ASTM A105	ASTM A105	Mfr / lab cert.	P	R	R/W	
			Minor	Visual	10%	ANSI 16.5	ANSI 16.5	Mfr cert.	P	R	R/W	
1.4	Stud and Bolts/ gaskets	Chemical, physical and impact test	Minor	Visual +10% Dimensional	Random selection one piece/size	ASME Sec II and ANSI B1.1	ASME Sec II and ANSI B1.1	Mfr cert.	P	R	R/W	
1.5	Structure	Dimensional	Minor	Visual + Dimensional	100%	as per IS 2062	as per IS 2062	Mfr cert.	P	R	R/W	Fabricator W/S
2	**Welding, NDT & Testing for skid Piping fabrication**											
2.1	WPS/WQP/PQR	Welders Qualification & Welding Procedure	Major	Welders Qualification & Welding Procedure	100%	Approved WPS/WQR/PQR	ASME Sec.IX	WPS/WQP/PQR	P	R	R	
2.2	UT or DPTof Non Radiography for Joints	DPT after Final Welding	Major	DPT on other than butweld joints + UT Report	100%	DPT Report + UT Report	ASME + Sec. V	DPT Report + UT Report	P	10%W	R/W	UT / DPT Report 100% Review

2.3	Radiography Test	Radiography after Final Welding	Major	100% Process Piping	100%	Radiography Report	ASME Sec.VIII/ Div.1 & ASME Sec. V	Radiography Report	P	* R	R	* Film to be Reviewed
2.4	Hydro Test for Interconnecting Pipe spools (with 0.2% Inhibitor)	Hydro Test at 1.4 times the Design Pressure	Major	Strength	100%	GA Drawing and hydro test procedure	ASME B 31.8, IGE/TD/13. No Leakage	Hydro Test Report	P	W	R/W	
2.5	Internal Cleaning of Pipe Spools after Hydro Test.	Internal Surface Finish	Major	Visual	100%	Internal Report	Internal Report	Internal Report	P	R	R/W	
2.6	Surface Preparation and Painting of Skid	Surface Preparation and Painting	Major	Visual + DFT Measurement	100%	Approved Painting Specification	Approved Painting Specification	Inspection Report	P	W	R	Random DFT Measurement Witness
2.7	Pneumatic Leak Test for skid	Pneumatic Leak Test at 7.7 Bar for 30 min.	Major	leakage	100%	GA Drawing and Pneumatic test procedure attached	ASME B 31.8, IGE/TD/13. No Leakage	Pneumatic Report	P	W	R/W	
2.8	Final Inspection of Assembled Skid with all Instruments	Tender Specs.	Major	Visual	100%	GA Drawing + P&ID	Approved Specification	Internal Report	P	W	R/W	
2.9	Skid Preservation with N2 purging	N2 Purging - 2Kg/cm2g Preservation- 0.3Kg/cm2g	Major	Visual	100%	GA & N2 Drg.+Preservation Procedure	No Leakage	Internal Report	P	R	R	
2.10	Necessary Protection during Transportation		Major	Visual	100%	Protection Procedure	Protection Procedure	Internal Report	P	R	R	

	QUALITY ASSURANCE PLAN SKID FABRICAITON						QAP No : QAP-SKID/IGL/ET2/CP/CP18160 Date Prepared by: Checked by: Approved by:				
Sr.No	Description	Characteristic	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norms	Format Of Records	Inspection By M	Inspection By TPIA	Inspection By Client	Remarks
3	**Incoming Material Identification of Bought out Items**											
3.1	Ball Valve	As per specifications	Major	As per specifications	As per specifications	As per specifications	Approved Specification	MFR's TC	P	R	R	
3.2	Globe Valve / Check valve	As per specifications	Major	As per specifications	As per specifications	As per specifications	Approved Data Sheet	MFR's TC	P	R	R	
3.3	Pressure Safety Valve	As per attached QAP	Major	As per attached QAP	100%	As per attached QAP	Approved Data Sheet	MFR's TC	P	R	R	
3.4	Pressure &Temperature Transmitter/Level Gauge, DPT,LT etc	As per attached QAP	Major	As per attached QAP	As per attached QAP	Vendor's QAP	Approved Data Sheet	MFR's TC	P	R	R	
3.5	Mass Flow Meter/RPD Flow meter and USM/Turbine meter with meter run & flow profiler.	Dimensional Drawing	Major	Dimensional, Visual, Model Operation of Orifice Assembly	100%	Vendor's Manual	Approved Data Sheet	MFR's TC	P	R	R	
3.6	Panel / FC /EVC	Physical / Electrical	Major	Continuity check	100%	Loop Diagram, Panel GA	Approved Data Sheet	MFR's TC	P	R	R	
3.7	Natural Gas Filter	As per specifications	Major	As per specifications	As per specifications	As per specifications	Approved Data Sheet	MFR's TC	P	R	R	
3.8	Slam Shut Valve + Regulators	As per attached QAP	Major	As per attached QAP	As per attached QAP	As per attached QAP	Approved Data Sheet	MFR's TC	P	R	R	
3.9	SS Fittings	As per specifications	Major	As per specifications	As per specifications	As per specifications	Approved Data Sheet	MFR's TC	P	R	R	
3.10	Pressure Gauge/Temperature Gauge/DPG	As per attached QAP	Major	Calibration, Dimensional, Range Model & Visual	100%	Approved Data Sheet	Approved Data Sheet	MFR's TC	P	R	R	
3.11	Cable	Test Reports	Major	MTC, Visual & Dimensional	100%	MTC's, tender Specification	Approved Data Sheet	MFR's TC	P	R	R	
3.12	Junction Box & Cable Gland	Visual & Dimensional Review of Certificates	Major	Visual & Dimensional	100%	Approved P&ID and GA Drawing	Approved P&ID and GA Drawing	MFR's TC	P	R	R	

	QUALITY ASSURANCE PLAN SKID FABRICAITON						QAP No : QAP-SKID/IGL/ET2/CP/CP18160 Date Prepared by: Checked by: Approved by:				
Sr. No	**Description**	**Characteristic**	**Class**	**Type of Check**	**Quantum of Check**	**Reference Document**	**Acceptance Norms**	**Format Of Records**	**Inspection By**			**Remarks**
									M	**TPIA**	**Owner**	
4	**Final Inspection**											
4.1	Factory Acceptance Test (Panel)	FAT as per Submitted FAT Manual	Major	FAT Procedure	100%	Approved FAT Manual	Approved FAT Manual	Inspection Report	P	W	W/R	
4.2	Completeness + Inspection Release Certificate (IRC)	---	Major	Visual + Dimensions	100%	Approved Bill of Material	Approved Bill of Material	Inspection Report	P	W	W/R	
5	**Packing and Shipping Control**											
5.1	Dispatch	---	Major	Verification of Documentation	100%	Verification of Documentation	Verification of Documentation	Dispatch Clearance by Client	---	R	W/R	
5.2	Name Plate Verification	Name Plate Verification	---	Name Plate Verification	100%	Approved Drawing	Approved Drawing	Approved Drawing	---	R	W/R	
6	**Site Acceptance Test**											
6.1	Pneumatic Leak Test for Skid Assembly	Pneumatic Leak Test at 7.7 Bar for 30 min.	Major	Strength	100%	Approved P&ID and GA Drawing	No Leakage	Inspection Report	---	W	W/R	
6.2	Site Acceptance Test	SAT as per submitted SAT Manual	Major	SAT Procedure	100%	Approved SAT Manual & FDS	Approved SAT Manual & FDS	Inspection Report	---	W	W/R	
7	**Final Documentation**											
7.1	Design and Calculation, Material TC, Calibration, Inspection and Test Report, As Built GA Drawing and P&ID	As per Tender Copy	Major	Verification of Documentation	100%	Approved Specification & As per Tender Doc.	Approved Specification & As per Tender Doc.	Vendor Document Report	---	R	W/R	

Legend

M	Manufacturer	P	Perform
C	Client/Owner	R	Review
TPIA	Third Party Inspection Agency appointed by bidder.	W	Witness
		W/R	Witness of Test & Review of Certificates & Documents as per QAP

Bought-out items may be procured under 3.1 certification. However, TPIA carrying out the final inspection of the skid will review all 3.1 certification of bought-out items and include the details in the final inspection report.

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.
3. TPIA will have Right to Inspect minimum 10% of all manufacturing activities on each day or as specified above.
4. TPIA along with Owner/Owner's representative shall review/approve all the documents related to QAP/Quality manuals/Drawings etc. Submitted by supplier.
5. Review of existing WPS/PQR by TPIA for suitabling . If not suitable, Testing has to be carried out under witness of TPIA
6. Pressure Regulators and Slam shut valve shall be witnessed by TPIA for functionality check at Manufacturer's work.

SECTION 23

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

QAP- PRESSURE SAFETY VALVE

(Doc. No.- QAP- PSV /IGL/ET2/CP/CP18160)

	QUALITY ASSURANCE PLAN PRESSURE SAFETY VALVES	QAP No : QAP- PSV Rev. /IGL/ET2/CP/CP18160 Prepared by : 0 Approved by Checked by:

Sr.No.	Description	Characteristic	Class	Type of Check	Quantam of Check	Reference Document	Acceptance Norms	Format Of Records	Inspection By			Remarks
									M	TPI	Client	
1	**Raw Material**											
1.1	Castings/Forgings for Body,Bonnet & Nozzle	Review of mfgr.s Test Certificates	Major	Visual		Mat.speci.as per P. O.	Mat.speci.as per data sheet	Mfr cert.	H	R	W/R	
1.2	Rods for Nozzles & Discs	Physical/Chemical per Rod	Major	Visual, Laboratory		Mat.speci.as per P. O.	Mat.speci.as per data sheet	Mfr / lab cert.	H	R	W/R	
1.3	Finished bought out components(Bellows & Springs)	Review of mfgr.s Test Certificates	Minor	Visual, Dimensional		Mat.speci.as per P. O.	Mat.speci.as per P. O.	Mfr cert.	H	R	W/R	
2	**Hydro test for Body & Nozzle**	Shell Test	Major	Strength, Laboratory	100%	ANSI B 16.34 For test pressure	No Leakage	Hydro Test Report	H	W	W/R	
3	**Functional Test**											
3.1	Cold bench set pr.	Popping at required cold bench set pr.	Major	Accuracy, Laboratory	100%	As per P. O.	As per P. O./API 526 ASME Std.VIII(Div.-1)	Mfr / lab cert.	H	W	W/R	
3.2	Seat tightness test	Hydro/Airtest as per flow media	Major	Accuracy, Laboratory	100%	API 527	As per P. O. & API 527	Mfr / lab cert.	H	W	W/R	
3.3	Back pressure test	Air leak test	Major	Leakage, Laboratory	100%	ASME Sect. VIII Div.1/API 520	No leakage at 6.0 Kg/cm2(G)	Mfr / lab cert.	H	W	W/R	
3.4	Shell Pneumatic Test	Functional	Major	Leakage, Laboratory	100%		100 psig	Pneumatic Test Report	H	W	W/R	

4	**Visual Examination**	Surface Quality	Minor	Visual	100%	Material speci.	Free from surface defects	Mfr cert.	H	W	W/R	
5	**Dimensional Check up**	Dimensions	Major	Dimensional	100%	ANSI B 16.5/ API 526	ANSI B 16.5/ API 526	Mfr cert.	H	W	W/R	
6	**Painting applicable**	All Valves shall be painting with SM Grey	Minor	Visual	100%	--	--	Mfr cert.	H	R	W/R	Painting not applicable for S.S Valve.

Legend

M	Manufacturer	P	Perform
H	Hold	R	Review
CA	Control Authority (Owner / Owner's representative)	W	Witness
TPI	Third Party Inspection Agency	W/R	Witness of Test / Review of Certificates & Documents as per QAP

outlet flange rating , '- for Nozzle as per inlet flange rating
- for S-15 model Valves for Body & Nozzles - 1.5 times of set pr. & Rounded off to pressure corresponding to nearest ANSI Class

'- Cold set pressure = Set pr. - Back Pr. + Recommended Temp. correction
Recommended temp. corrections are
67 to 120 - 1.0 % 121 to 200 - 2.0 %
316 to 430 - 4.0 % 431 to 450 - 5.0 %
In case of Bellow effect of Back Pressure is negligible.

'- Seat tightness pr. = 90% of Cold bench set pressure for set pressure above 3.5Kg/cm2 (G)
= Less 0.35 of cold bench set pressure if set pressure is below 3.5 Kg/cm2 (G)

SECTION 24

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

QAP- BALL VALVES

(Doc. No.- QAP-BV/IGL/ET2/CP/CP18160)

	QUALITY CONTROL TABLE BALL VALVE	QCT No.: QAP-BV/IGL/ET2/CP/CP18160 Rev. 0 Prepared by: Checked by: Approved by:

SR. No.	COMPONENTS & OPERATIONS	ACTIVITIES	QUANTAM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	INSPECTION		
							VENDOR	TPIA	Remarks
1	**RAW MATERIAL**								
1.1	BODY & SIDE PIECE	CHEM. TEST	PER HEAT	As per Tender doc.	As per Tender doc.	FOUNDRY T.C. 3.1 CERT	R	R	
		PHY. TEST	PER HEAT	As per Tender doc.	As per Tender doc.	FOUNDRY T.C. 3.1 CERT	P	R	
		VISUAL	100%	API 1104/MSS-SP-55	API 1104/MSS-SP-55	CERTIFICATION AS PER EN 10204, 3.1	P	R	
		IMPACT TEST (at 0° C)	PER HEAT	AS PER TENDER	27 / 22 JOULE	INSPECTION REPORT, 3.1 CERT	P	R	
		Radiography	3 sample<=6" 100% for >6"	ASME SEC VIII DIV I /ASME V	ASME SEC VIII DIV I /ASME V	INSPECTION REPORT, 3.1 CERT	P	R	TPI to review RT films.
		MPT of Butt ends	100%	ASME SEC VIII DIV I /ASME V	ASME SEC VIII DIV I /ASME V	INSPECTION REPORT, 3.1 CERT	P	R	
1.2	BALL & SEAT RING	CHEM. TEST	PER HEAT	Tender doc.	Tender doc.	CERTIFICATION AS PER EN 10204, 3.1	R	R	
		PHY. TEST	PER HEAT	Tender doc.	Tender doc.	CERTIFICATION AS PER EN 10204, 3.1	P	R	
		VISUAL	100%	API 1104/MSS-SP-55	MSS-SP-55/API 1104	CERTIFICATION AS PER EN 10204, 3.1	P	R	
		IMPACT TEST @ 0ºC	PER HEAT	AS PER TENDER	27 / 22JOULE	INSPECTION REPORT, 3.1 CERT	P	R	
		UT & DP	100%	ASME SEC VIII DIV I /ASME V	ASME SEC VIII DIV I /ASME V	INSPECTION REPORT, 3.1 CERT	P	R	
2	**INTERMEDIATE INSPECTION**								
2.1	BODY & SIDE PIECE	TRANSFER OF HEAT NO.	100%	-	-	PROCESS CARD	100% W	R	
		DIMENSIONS	100%	APPVD. DRG	APPVD. DRG	CERTIFICATION AS PER EN 10204, 3.1	W	R	
2.2	BALL & SEAT RING	TRANSFER OF HEAT NO.	100%	APPVD. DRG	APPVD. DRG	CERTIFICATION AS PER EN 10204, 3.1	W	R	
2.3	STEM	TRANSFER OF HEAT NO.	100%	-	-	PROCESS CARD	100% W	R	
		DIMENSIONS	100%	APPVD. DRG	APPVD. DRG	CERTIFICATION AS PER EN 10204, 3.1	W	R	
3	**BOUGHT OUT ITEMS**								
3.1	FASTENERS	CHEMICAL	PER LOT	ASTM A 193 B 7 & A 194 GR. 2H	ASTM A 193 B 7 & A 194 GR. 2H	SUPPLIER T.C. 3.1 CERT	R	R	
3.2		PHYSICAL	PER LOT	ASTM A 193 B 7 & A 194 GR. 2H	ASTM A 193 B 7 & A 194 GR. 2H	SUPPLIER T.C. 3.1 CERT	P	R	
3.3		DIMENSIONS	10%	-	-	-	P	R	
3.4		IMPACT TEST (0° C)	PER LOT	ASTM A 193 B 7 & A 194 GR. 2H	AS PER TENDER DOC.	SUPPLIER T.C. 3.1 CERT	P	R	
3.5		HEAT TREATMENT	100%	ASTM A 370	AS PER CODE	CERTIFICATION AS PER EN 10204, 3.1	P	R	

QUALITY CONTROL TABLE
BALL VALVE

QCT No.: QAP-BV/IGL/ET2/CP/CP18160 Rev. 0
Prepared by: Checked by:
Approved by:

SR. No.	COMPONENTS & OPERATIONS	ACTIVITIES	QUANTAM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	INSPECTION		
							VENDOR	TPIA	Remarks
4	**FINAL INSPECTION**								
4.1	Assembled Valves	VISUAL	100%	-	MSS-SP-55/API 1104	CERTIFICATION AS PER EN 10204, 3.1	P	R	
4.2		DIMENSIONS	100%	APPVD. DRG. / TENDR DOC.	APPVD. DRG.	INSPECTION REPORT 3.1 CERT.	P	R	
4.3		HYD. BODY TEST	100%	APPVD. DRG. / DATA SHEET / TENDER DOC. / API 6D	APPVD. DRG. / DATA SHEET / API 6D	CERTIFICATION AS PER EN 10204, 3.1	P	R	
4.4		HYD. SEAT TEST	100%	APPVD. DRG. / DATA SHEET / TENDER DOC. / API 6D	APPVD. DRG. / DATA SHEET / API 6D	CERTIFICATION AS PER EN 10204, 3.1	P	R	
4.5		AIR SEAT TEST	100%	APPVD. DRG. / DATA SHEET / TENDER DOC. / API 6D	APPVD. DRG. / DATA SHEET / API 6D	CERTIFICATION AS PER EN 10204, 3.1	P	R	
4.6		DOUBLE BLOCK & BLEED TEST	100%	APPVD. DRG. / DATA SHEET / TENDER DOC. / API 6D	APPVD. DRG. / DATA SHEET / API 6D	CERTIFICATION AS PER EN 10204, 3.1	P	R	
4.7		PERFORMANCE TEST (FUNCTIONAL, TORQUE TEST)	100%	APPVD. DRG. / DATA SHEET / TENDER DOC. / API 6D	APPVD. DRG. / DATA SHEET / API 6D	CERTIFICATION AS PER EN 10204, 3.1	P	R	
4.8		EXTERNAL LEAK TEST	100%	@ 6 barg with soap suds to check external leak	API 598	CERTIFICATION AS PER EN 10204, 3.1	P	R	
4.9		ANTI-STATIC TEST	100%	BS 5146	BS 5147	CERTIFICATION AS PER EN 10204, 3.1	P	R	
4.10		FIRE SAFE TEST	TYPE TEST	API 6FA	API 6FA	TYPE TEST CERTIFICATE	P	R	
5	**PAINTING**								
5.1	AS PER DATA SHEET	SURFACE PREPARATION	100%	DATA SHEET	DATA SHEET	INSP. REPORT	P	R	
5.2		PRIMER COAT	MEASUREMENT OF DFT	DATA SHEET	DATA SHEET	PAINT. INSP. REPORT	P	R	
5.3		FINAL COAT	MEASUREMENT OF DFT	DATA SHEET	DATA SHEET	PAINT. INSP. REPORT	P	R	
5.4		VISUAL	10%	MSS-SP-55 / API 6D	MSS-SP-55 / API 6D	_	P	R	
6	**FINAL DOCUMENTS**	REVIEW	100%	AS PER SPEC. / APPVD. DRG.	AS PER SPEC. / APPVD. DRG.	COMPLIANCE CERT , 3.1 CERT	P	R	
6.1		MARKING / TAG DETAILS	100%	AS PER APPR. DRG / TENDER DOC.	AS PER APPR. DRG / TENDER DOC.	COMPLIANCE CERT , 3.1 CERT	P	R	

LEGENDS: **P – PERFORM,** **R – REVIEW,** **W - WITNESS,** **H - HOLD** **RW - RANDOM WITNESS** **TPIA -THIRD PARTY INSPECTION AGENCY.**

Notes: -

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 QAP prepared on the basis of above / Technical specification for approval of Owner/Owner's representative.
3 Owner/Owner representative shall review/approve all the documents related to QAP/Quality manuals/Drawings etc.submitted by supplier.
4 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.
5 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.
6 Owner / Owner's representative including TPIA will have the right to inspect any activity of manufacturing at any time
7 All reference Codes/ Standards, Documents, P.O. Copies shall be arranged by vendor / supplier for reference of TPIA/Owner at the time of Inspection
8 Vendor / TPI to issue certificates as per EN 10204
9 At the time of delivery of material to stores, vendor will submit copy of all related document of inspection along with release note & MTC.

SECTION 25

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

QAP- GLOBE VALVE AND CHECK VALVES

(Doc. No.- QAP-GV&CV /IGL/ET2/CP/CP18160)

	QUALITY CONTROL TABLE GLOBE VALVE		QCT No: QAP-GV&CV /IGL/ET2/CP/CP18160 Rev: 0 Prepared By : Checked : Approved :		

Sn	INSPECTION AND TESTING	PROCEDURE	ACCEPTANCE CRITERIA AND CERTIFICATE	VENDOR	TPIA	Remarks
1	**Casts**					
	RT each piece PT each piece MT	ASME V, Art.2 100% : each type/size/rating 100% : BW ends ASME V, Art.6 - ASTM E-165 100% : each type/size/rating 100% : BW ends alternative for PT	ASME VIII-1, App.7 ASME B 31.3 (1990), table 341.3.2 A, Severe cyclic cond. ASME VIII-1, App.8 and 7 subject to approval	P	R	
	Chemical analysis	Referred API / ASTM each heat and product	Referred API / ASTM certificate EN 10204/3.1	P	R	
	Mechanical properties	Referred API / ASTM on samples taken from mill	Referred API / ASTM certificate EN 10204/3.1	P	R	
	Impact Test @ 0°c	ASTM A-370	35 J/Cm^2(Avg.) / 28 J/Cm^2(Ind.) certificate EN 10204/3.1 with impact test	P	R	
2	**Forgings**					
	PT MT on pressure retanings parts	ASME V, Art.6 10 % on Disc/ Wedge & stem after final machining ASME V, Art. 7 100% on pressure retanings parts	ASME VIII-1, App.8 ASME VIII-1, App.6	P	R	
	Chemical analysis	Referred API / ASTM each heat and product	Referred API / ASTM certificate EN 10204/3.1	P	R	
	Mechanical properties	Referred API / ASTM on samples taken from mill	Referred API / ASTM certificate EN 10204/3.1	P	R	
	Impact Test @ 0°C (2 test sets(3 test specimens constitute one test set) - 1 set oriented transversally & another one Longitudinally)	ASTM A-370	27 J/Cm^2(Avg.) / 22 J/Cm^2(Ind.) certificate EN 10204/3.1 with impact test	P	R	
3	**Bolting**					
	PT each batch HT each heat treatment batch	ASME V, Art.6 after final machining referred ASTM	ASME VIII-1, App.8 referred ASTM	P	R	
	Chemical analysis	Referred API / ASTM each heat and product	Referred API / ASTM certificate EN 10204/3.1	P	R	
	Mechanical properties	Referred API / ASTM on samples taken from mill	Referred API / ASTM certificate EN 10204/3.1	P	R	
	Impact Test @ 0°C	ASTM A-370	27 J/Cm2(Avg.) / 22 J/Cm2(Ind.) certificate EN 10204/3.1 with impact test	P	R	

	QUALITY CONTROL TABLE GLOBE VALVE	QCT No: QAP-GV&CV /IGL/ET2/CP/CP18160 Rev: 0 Prepared By : Checked : Approved :

Sn	INSPECTION AND TESTING	PROCEDURE	ACCEPTANCE CRITERIA AND CERTIFICATE	VENDOR	TPIA	Remarks
4	**BW ends** each piece	100 % RT ASME V, Art. 2	ASME B 31.3 (1990), table 341.3.2 A, Severe cyclic cond.	P	R	
5	**Welds & weld repairs** each piece	100 % RT ASME V, Art. 2 & ASME IX	ASME B 31.3 (1990), table 341.3.2 A, Severe cyclic cond.	P	R	
6	**Final inspection**					
a	**Visual and Dimentional Tests** each piece	ASME V, Art. 9	Referred ANSI dimensions	P	R	
a	**Hydrostatic test (shell & seat)** each piece	API 598 / ASTM A-530 and Data sheet	API 598 / ASTM A-530	P	R	
a	**Air Seat Test** each piece	API 598 / ASTM A-530 and Data sheet	API 598 / ASTM A-530	P	R	
a	**High Pressure Closure Test & Low Pressure Closure Test** each piece	API 598 / ASTM A-530 and Data sheet Three Openings and Closing at Atmospheric and Maximum Dififrential Pressure	API 598 / ASTM A-530	P	R	
a	**Fire safe** tested (Type Test) - For Check Valves (Certificates of previously conducted tests shall be submitted)	API 6FA / API 607 / BS 5146 / OCMA	API 6FA / API 607 / BS 5146 / OCMA	-	R	
7	**Painting**	As per Approved Procedure	As per Approved Procedure	P	R	
8	**Packing and Identification marking**	As per Approved Procedure	As per Approved Procedure	P	R	

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 ; Control Authority : Owner/Engineer or their Authorised Inspection Agency.

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.
3. Supplier shall submit Calibration certificates of all Instruments/Equipment's to be used for Inspection and Testing to TPIA with relavant procedures and updated standards for TPIA reveiew/Approval.
4. TPIA will have Right to Inspect minimum 10% of all manufacturing activities on each day or as specified above.
5. Owner/Owner representative shall review/approve all the documents related to QAP/Quality manuals/Drawings etc. Submitted by supplier.
6. TPIA shall also Review the Test certificates submitted by the Actuator manufacturer. As Applicable.
7. 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.

SECTION 26

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

QAP- FITTINGS

(Doc. No.- QAP-FITTINGS/IGL/ET2/CP/CP18160)

	QUALITY CONTROL PLAN FITTINGS	QCT No. : QAP-FITTINGS/IGL/ET2/CP/CP18160 Revision: 0
		Prepared :
		Checked :
		Approved :

S NO.	ACTIVITY	PTS Clause No.	Frequency	Applicable standard & Procedure	Acceptance criteria	Document type	Scope of Inspection		
							Manufacturer	TPIA	Client
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	Review 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	Review 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 cer	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	Review point	review report
	- Review of welders records					report	Perform	Review point	review report
	- Cosumable 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. 3.1	Perform	Review point	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. 3.1	Perform	Review point	review report

	QUALITY CONTROL PLAN FITTINGS	QCT No. : QAP-FITTINGS/IGL/ET2/CP/CP18160
		Revision: 0
		Prepared :
		Checked :
		Approved :

S NO.	ACTIVITY	PTS Clause No.	Frequency	Applicable standard & Procedure	Acceptance criteria	Document type	Scope of Inspection		
							Manufacturer	TPIA	Client
2.3	Mechanical testing (remark : marking transfer by TPIA)					certif. 3.1	Perform	Review point	review report
	- Tension test for fitting ≥ 2" (YS, UTS, YS/UTS, %EL, RA, Bend etc. as applicable)	4.2.4 & 5.1.1							
	- base material		1 per lot	ASTM A 370	PTS + E/R <= 0.85 & Mat. Spec.				
	- weld		1 per lot		PTS & Mat. Spec.				
	- Impact test for fitting ≥ 2"	4.2.4 & 5.1.2							
	- base material (Longitudinal & Transverse)		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.				
	- 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 Cl 3.10.1 & 3.10. 2	PTS & Mat. Spec.	certif. 3.1	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. 3.1	Perform	Review point	review report
					Girth welds : API 1104 section 6.0				
3.2	Ultrasonic inspection					certif. 3.1	Perform	Review point	review report
	- 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				
	- 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. 3.1	Perform	Review point	review report
3.4	- After machining					certif. 3.1	Perform	Review point	review report
	- 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.				
	- Ultrasonic inspection of 25 mm of base material (if t ≥ 6 m	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. 3.1	Perform	Review point	review report
3.6	- Dimensionnal examination	6.1.2.5	10% NPS ≤ 6"		PTS & Mat. Spec.	certif. 3.1	Perform	Review point	review report
			100% NPS > 6"						

	QUALITY CONTROL PLAN FITTINGS	QCT No. : QAP-FITTINGS/IGL/ET2/CP/CP18160 Revision: 0
		Prepared :
		Checked :
		Approved :

S NO.	ACTIVITY	PTS Clause No.	Frequency	Applicable standard & Procedure	Acceptance criteria	Document type	Scope of Inspection		
							Manufacturer	TPIA	Client
4	**FINAL INSPECTION TEST**								
4.1	Marking	8	all			certif. 3.1	Perform	Review point	reiew report
4.2	Inspector's stamp	8.1.1	all			certif. 3.1	Perform	Review point	reiew report
4.3	Documentation	9	-	PTS & P.O.	PTS & P.O.	certif. 3.1	Perform	Review 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)- 3.1 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.

SECTION 27

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

QAP- FLANGES

(Doc. No.- QAP-FLANGES /IGL/ET2/CP/CP18160)

	QUALITY CONTROL TABLE FLANGES	QCT No. : QAP-FLANGES /IGL/ET2/CP/CP18160 Revision: 0 Prepared : Checked : Approved :

S.No.	ACTIVITY	PTS chap.	Frequency	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
							Manufacturer	TPIA	Client / Owner Representative
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. 3.1	Perform	review 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. 3.1	Perform	review 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. 3.1	Perform	review point	review report
		4.3.1	1 per furnace charge			report	Perform	review report	review report
	- time temperature chart - micrographic examination	4.3.2	1 per lot*	ASTM E 112	Grain size : range 8 to 12	certif. 3.1	Perform	review point	review report
2.2.	Mechanical tests (remark : marking transfer by TPIA)					certif. 3.1	Perform	review point	review report

	QUALITY CONTROL TABLE FLANGES	QCT No. : QAP-FLANGES /IGL/ET2/CP/CP18160 Revision: 0 Prepared : Checked : Approved :

S.No.	ACTIVITY	PTS chap.	Frequency	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
							Manufacturer	TPIA	Client / Owner Representative
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. 3.1	Perform	review 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. 3.1	Perform	review 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. 3.1	Perform	review 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. 3.1	Perform	review 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. 3.1	Perform	review 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. 3.1	Perform	review 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. 3.1	Perform	review point	review report
3.5	Visual examination	6.1.2.3 & 6.1.3.1	100%		PTS	certif. 3.1	Perform	review point	review report
3.6	Dimensional examination	6.1.2.5	10% NPS ≤ 6" 100% NPS > 6"		PTS	certif. 3.1	Perform	review point	review report

	QUALITY CONTROL TABLE FLANGES	QCT No. : QAP-FLANGES /IGL/ET2/CP/CP18160 Revision: 0 Prepared : Checked : Approved :

S.No.	ACTIVITY	PTS chap.	Frequency	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
							Manufacturer	TPIA	Client / Owner Representative
4	**FINAL INSPECTION TEST**								
4.1	Marking	8	all				Perform	review point	review report
4.2	Inspector's stamp	8.1.1	all			certif. 3.1	Perform	review point	review report
4.3	Documentation	9	-	PTS & P.O.	PTS & P.O.	certif. 3.1	Perform	review 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)-3.1 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.

SECTION 28

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

QAP- COALESCING/DRY GAS FILTER

(Doc. No.- QAP-DGF/IGL/ET2/CP/CP18160)

QUALITY ASSURANCE PLAN
CARTRIDGE DRY GAS FILTER

QAP No : QAP-DGF/IGL/ET2/CP/CP18160, Rev. 0
Prepared by :
Checked: : Approved by :

Sr.No.	Description	Characteristic	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norms	Format Of Records	Inspection By			Remarks
									M	TPI	Client/Owner Representative	
1	Review of Quality Plan	Sequence of check points	Major	Review	100%	Contractual Doc/Drgs.	Contractua l Doc/Drgs.	Internal Reports	P	R	A	
		Marking of Hold /Review/Witness pts.	Major									
2	Approval of Drg. & Design Cal.	Code Requirements	Major	Review	100%	Design Code	Design Code	Internal Reports	P	R	A	
3	Review of WPS / PQR / WPQ	Code Requirements / Coverage to all weld joints.	Major	Review	100%	Design Code	Design Code	Internal Reports	P	R	R	
	Incoming Material Identification of Bought out Items											
4	Material Identification & Allocation of all Pressure Parts	Verification of TC with material spec. and Drawing	Major	Review	100%	Material Spec.	Material Spec.	Internal Reports	P	R	R	
		Correlation of TC with material	Major	Visual	100%	Test Certificate	Test Certificate	Internal Reports		R		
		Dimensions	Major	Measurement	Sample	Drawing / TC	Drawing / TC	Internal Reports		R		
		Hydro test/NDE /Impact Test of Plates/Pipes at Maker	Major	Review of TC	100%	Code/data sheet	Code	Internal Reports		R		
		Identification Stamp Transfer	Major	Visual	100%	Hard Punching	Hard Punching	Internal Reports		R		
5	Inspection of machined & formed parts (Dish ends/Shell Plates/ End Plates / Stubs / Nozzles)	Identification	Major	Visual	100%	Drawing	Drawing	Internal Reports	P	R	R	
		Dimensions / Profile	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		Min.Thickness /Ovality	Major	Template	100%	Drawing/Design	Drawing/Design	Internal Reports				
		PT of Knuckle / Edge	Major	Visual	100%	LPE01	LPE01	Internal Reports				
		Heat Treatment	Major	Chart	100%	Design Code	Design Code	Internal Reports				
	Inprocess Inspection											
6	L Seam Set up for Shells & Test Plates	Identification	Major	Visual	100%	Drawing /IR	Drawing /IR	Internal Reports	P	R	R	
		Dimensions	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		Weld Preparation	Major	Template	100%	Drawing	Drawing	Internal Reports				
		Alignment / Squareness	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		Tack Weld Soundness	Major	PT	100%	Drawing	Drawing	Internal Reports				
7	A. Welding of L Seam & Test Plates / Pipe (above parts)	Backchip & PT after 1st side welding	Major	Visual	100%	LPE01	LPE01	Internal Reports	P	R	R	Test plate to be Identified by TPI
		Weld size / finish	Major	Visual	100%	FPAS-001	FPAS-001	Internal Reports				
		Weld joint soundness of L-Seam & Test Plates	Major	RT	100%	Design Code	Design Code	Internal Reports				
		Production Test Coupon	Major	Impact Test	100%			Internal Reports				
	B. Repair : (If any) L Seam	Defect removal	Major	PT	100%	Design Code	Design Code	Internal Reports	P	R	R	
		Weld joint soundness	Major	RT	100%	Design Code	Design Code	Internal Reports				
8	Set-up of Nozzle Pipe to Flange	Squareness	Major	Measurement	100%	FPAS-001	FPAS-001	Internal Reports	P	R	R	
		Weld Preparation	Major	Template	100%	Drawing	Drawing	Internal Reports				
9	Welding of Nozzle Pipe to Flange	Weld Size / Reinforcement /Finish	Major	Template /	100%	Drawing	Drawing	Internal Reports	P	R	R	
		Weld joint soundness	Major	RT	100%	Design Code	Design Code	Internal Reports				
10	Inspection of Internals of HP Separator	Dimensions	Major	Measurement	100%	Drawing	Drawing	Internal Reports	P	R	R	
		Pickling Passivation	Major	MTC	100%	Drawing	Drawing	Internal Reports				
11	Welding of Internals to HP Separator Shell	Weld Size / Reinforcement /Finish	Major	Template / Visual	100%	Drawing	Drawing	Internal Reports	P	R	R	
		Weld Joint Soundness	Major	PT	100%	LPE01	LPE01	Internal Reports				

QUALITY ASSURANCE PLAN
CARTRIDGE DRY GAS FILTER

QAP No : QAP-DGF/IGL/ET2/CP/CP18160, Rev. 0
Prepared by :
Checked By: Approved by :

Sr.No.	Description	Characteristic	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norms	Format Of Records	Inspection By			Remarks
									M	TPI	Client/Owner Representative	
12	C Seam Set up for Shells to Dish Ends & Test Plates	Identification	Major	Visual	100%	Drawing /IR	Drawing /IR	Internal Reports	P	R	R	Test Plate To Be Impact Tested & Shall Be Witnessed By TPIA
		Dimensions	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		Weld Preparation	Major	Template	100%	Drawing	Drawing	Internal Reports				
		Alignment / Squareness	Major	Measurement	100%	Drg./FPAS001	Drg./FPAS001	Internal Reports				
		Tack Weld Soundness	Major	PT	100%	Drawing	Drawing	Internal Reports				
13	A. Welding of C Seam (above parts) & Test Plates	Backchip & PT after 1st side welding	Major	Visual	100%	LPE01	LPE01	Internal Reports	P	R	R	-- Do --
		Weld size / finish	Major	Visual	100%	FPAS-001	FPAS-001	Internal Reports				
		Weld joint soundness of C-Seam	Major	RT	100%	Design Code	Design Code	Internal Reports				
	B. Repair : (If any) C Seam	- Defect removal	Major	PT	100%	Design Code	Design Code	Internal Reports	P	R	R	Repair RT to be Reviewed by TPIA
		- Weld joint soundness	Major	RT	100%	Design Code	Design Code	Internal Reports				
14	Heat Treatment of Test Plates + EQPT As Per Code	- Time / Temperature Charts	Major	Visual	100%	Design Code	Design Code	Internal Reports	P	R	R	
								Internal Reports				
15	Testing of All Test Plates	- Mechanical / Physical Test Reports	Major	Visual	100%	Design Code	Design Code	Internal Reports	P	R	R	-NA-
								Internal Reports				
16	Inspection of Marking for Openings on Dish End / Shell	- Identification	Major	Visual	100%	IR/ Drawing	IR/ Drawing	Internal Reports	P	R	R	
		- Layout	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		- Orientation	Major	Visual	100%	Drawing	Drawing	Internal Reports				
		- Dimensions	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		- No. of holes	Major	Count	100%		Drawing	Internal Reports				
17	Inspection after opening on Shell/ Dish End	A- Earlier stage clearance review	Major	Review	100%	Acc.Inspn.Rep.	Acc.Inspn.Rep.	Internal Reports	P	R	R	
		B- Opened holes orientation Quadrantwise	Major	Visual	100%	Drawing	Drawing	Internal Reports				
		H- Hole finish	Major	Visual	100%	FPAS001	FPAS001	Internal Reports				
		I- Final Acceptance	Major	Visual	100%	Hard Stamping of Insp.	Hard Stamping of Insp.	Internal Reports				
18	Setup of studs,nozzles, sockets & connections with Shell / Dish End / Flange	Orientation	Major	Visual	100%	Drawing	Drawing	Internal Reports	P	R	R	
		Weld preparation	Major	Template	100%	Drawing/Code	Drawing/Code	Internal Reports				
		Alignment	Major	Line Thread	100%	Drg/FPAS001	Drg/FPAS001	Internal Reports				
		Squareness	Major	Right Angle	100%	Drg/FPAS001	Drg/FPAS001	Internal Reports				
		Distance between connections	Major	Measurement	100%	Drg/FPAS001	Drg/FPAS001	Internal Reports				
		Tack weld soundness	Major	PT	100%	LPE01	LPE01	Internal Reports				
19	Welding of Nozzles, & connections to Shell/DE	Weld size/ finish	Major	Visual	100%	Design Code	Design Code	Internal Reports	P	R	R	
		Weld Soundness	Major	RT/ PT	100%	Design Code	Design Code	Internal Reports				
20	Set up of of Structurals Saddles & Attachments	Dimensions	Major	Measurement	100%	Drawing	Drawing	Internal Reports	P	R	R	
		Weld Preparation	Major	Template	100%	Drawing	Drawing	Internal Reports				
		Alignment / Squareness	Major	Measurement	100%	Drg/FPAS001	Drg/FPAS001	Internal Reports				

21	Welding of Structurals Saddles & Attachments	Weld size / finish Weld soundness	Major Major	Visual PT	100% Sample	Design Code Design Code	Design Code Design Code	Internal Reports Internal Reports	P	R	R	

QAP No : QAP-DGF/IGL/ET2/CP/CP18160, Rev. 0
Prepared by : MK :
RP Approved by : HK

QUALITY ASSURANCE PLAN
CARTRIDGE DRY GAS FILTER

Sr.No.	Description	Characteristic	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norms	Format Of Records	Inspection By			Remarks
									M	TPI	Client/Owner Representative	
22	Full Welding clearance	Overall Dimensions	Major	Measurement	100%	Drawing	Drawing	Internal Reports	P	R	R	
		Squareness of Connections	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		Distance between Connections	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		RT Clearance / U.T.	Major	Review of RT Rpts	100%	Drawing	Drawing	Internal Reports				
		Code Punching Details	Major	Ruboff	100%	Design Code	Design Code	Internal Reports				
	Final Inspection							Internal Reports				
23	Hydrostatic Testing	Pressure gauge(2 no)	Major	Review	100%	Valid Cert.	Valid Cert.	Internal Reports	P	R	R	
		Calibration	Major	Visual	100%	No leakage	No leakage	Internal Reports				
		Leakages	Major		100%			Internal Reports				
24	Final Inspection	Document Review	Major	Review	100%	Design Code	Design Code	Internal Reports	P	R	R	
		Dimensions	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		Surface Preparation	Major	Visual	100%	Free from scales etc.	Free from scales etc.	Internal Reports				
25	Clearance for Assembly / Despatch (As Applicable)	Painting finish	Major	Visual	100%	Drawing	Drawing	Internal Reports	P	R	R	
		Capping / Blanking of all opening	Major	Visual	100%	All opening protected	All opening protected	Internal Reports				
		Code Punching details	Major	Visual	100%	Design Code	Design Code	Internal Reports				

Note: Vendor to furnish 3.1 Certification for filter .

Legend:

M	Manufacturer	P	Perform
NA	Not Applicable	R	Review
C	Client - GSPL	W	Witness
TPI	Third Party Inspection Agency	W/R	Witness of Test & Review of Certificates & Documents as per QAP
A	For Approval	H	Hold
CA	Control Authority	RW	Random Witness

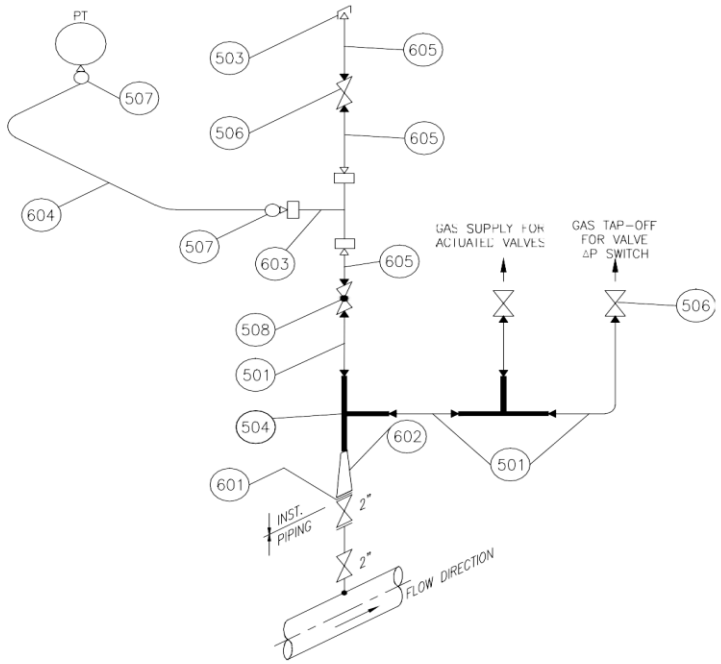
SECTION 29

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

DRAWING- FIELD INSTRUMENT HOOK-UP

(Doc. No.- DR-FIHU/IGL/ET2/CP/CP18160)

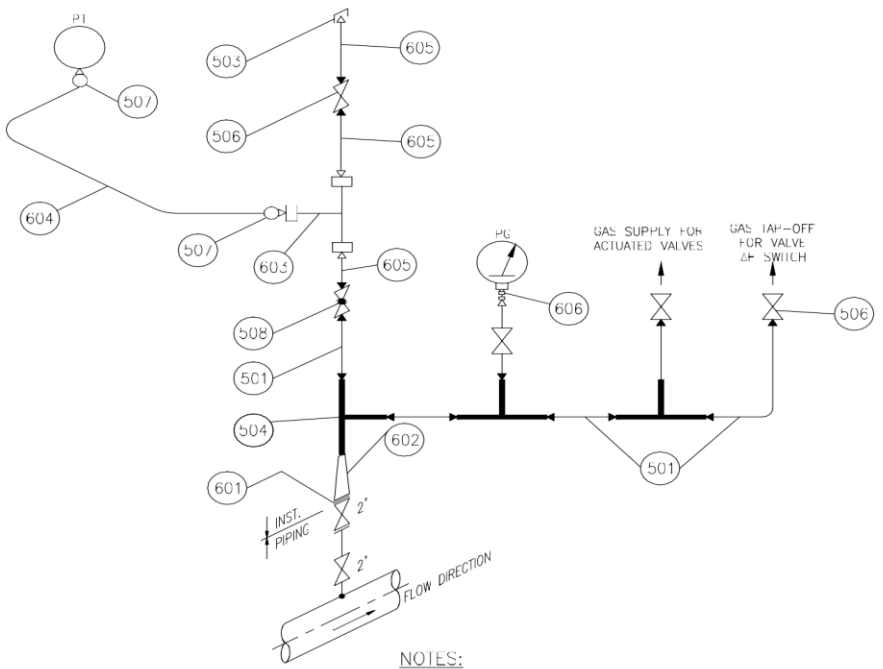
PRESSURE TRANSMITTER (GAS PIPE LINE)



BILL OF MATERIAL

ITEM NO.	SIZE	ENDS	DESCRIPTION	QTY.
601	2"	SW	FLANGE	A/R
504	1/2"	SW	EQUAL TEE	A/R
501	1/2"	PL	PIPE	A/R
503	1/2"	TH	CAP	A/R
506	1/2"	SW	GATE VALVE	A/R
507	1/2"x1/2"	TH X OD	MALE CONNECTOR	A/R
602	2"x1/2"	PL X PL	SW NIPPLE	A/R
603	1/2"	TH	EQUAL TEE	A/R
604	1/2"	OD	TUBE	A/R
605	1/2"	TH X PL	NIPPLE	A/R
606	1/2"	TH	COUPLING	A/R
508	1/2"	SW	GLOBE VALVE	A/R

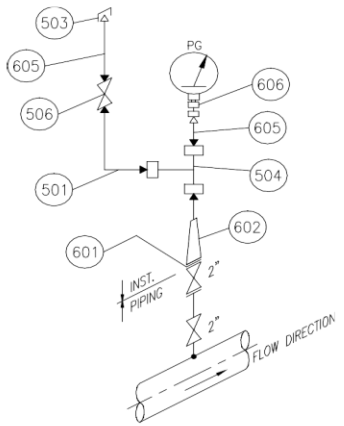
PRESSURE TRANSMITTER AND PRESSURE GAUGE FROM SINGLE TAPPING (GAS PIPE LINE)



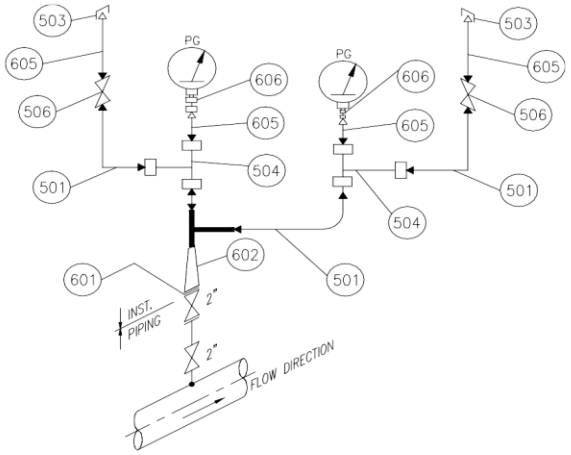
NOTES:

1. PRESSURE GAUGE AND PRESSURE TRANSMITTER SHALL BE ALONG WITH 2 VALVES MANIFOLD.
2. PRESSURE GAUGE & PRESSURE TRANSMITTER SHALL BE INSTALLED WITH FABRICATED TYPE MANIFOLD, HENCE INTEGRAL . TYPE MANIFOLD MAY NOT BE REQUIRED.
3. REFER PIPING MATERIAL SPECIFICATION DOCUMENT No. P.008776-L21-0501, FOR SPECIFICATION FOR PIPING COMPONENTS

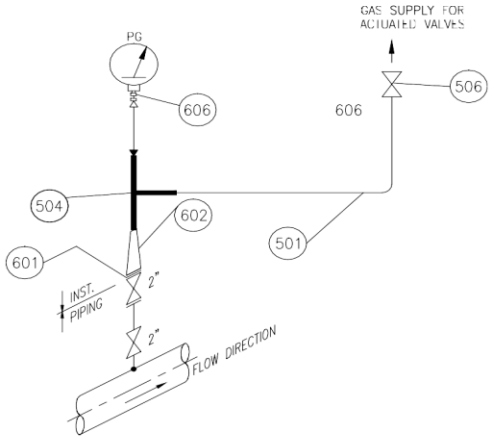
PRESSURE GAUGE ON HORIZONTAL LINE
(GAS PIPE LINE)



PRESSURE GAUGE ON HORIZONTAL LINE OR
VESSELS FROM SINGLE TAPPING
(GAS PIPE LINE)



PRESSURE GAUGE ON HORIZONTAL LINE OR
VESSELS GAS TAP OFF FOR ACTUATED VALVE
FROM SINGLE TAPPING
(GAS PIPE LINE)



BILL OF MATERIAL

ITEM NO.	SIZE	ENDS	DESCRIPTION	QTY.
601	2"	SW	FLANGE	A/R
504	1/2"	SW	EQUAL TEE	A/R
501	1/2"	PL	PIPE	A/R
503	1/2"	TH	CAP	A/R
506	1/2"	SW	GATE VALVE	A/R
507	1/2"x1/2"	TH X OD	MALE CONNECTOR	A/R
602	2"x1/2"	PL X PL	SW NIPPLE	A/R
603	1/2"	TH	EQUAL TEE	A/R
604	1/2"	OD	TUBE	A/R
605	1/2"	TH X PL	NIPPLE	A/R
606	1/2"	TH	COUPLING	A/R

NOTES:

1. PRESSURE GAUGE AND PRESSURE TRANSMITTER SHALL BE ALONG WITH 2 VALVES MANIFOLD.
2. PRESSURE GAUGE SHALL BE INSTALLED WITH FABRICATED TYPE MANIFOLD, HENCE INTEGRAL TYPE MANIFOLD MAY NOT BE REQUIRED.
3. REFER PIPING MATERIAL SPECIFICATION DOCUMENT No. P.008776-L21-0501, FOR SPECIFICATION FOR PIPING COMPONENTS

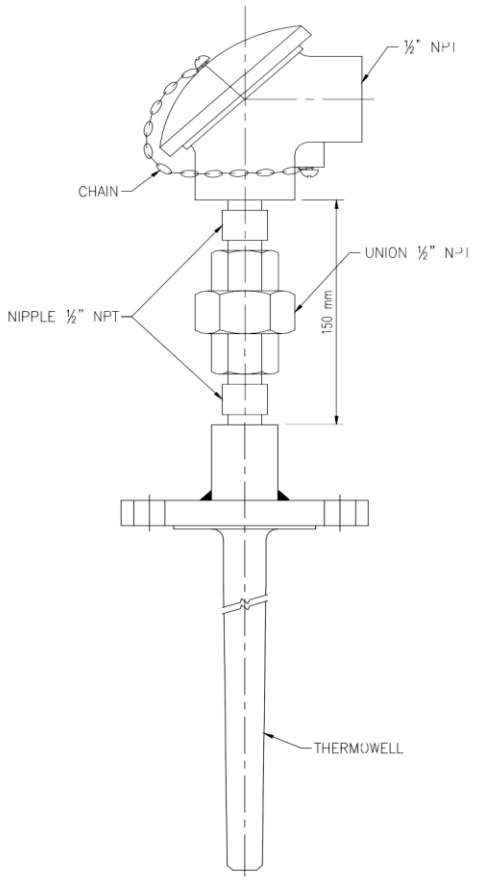
SECTION 30

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

DRAWING- THERMOCOUPLE/RTD ASSEMBLY WITH THERMOWELL

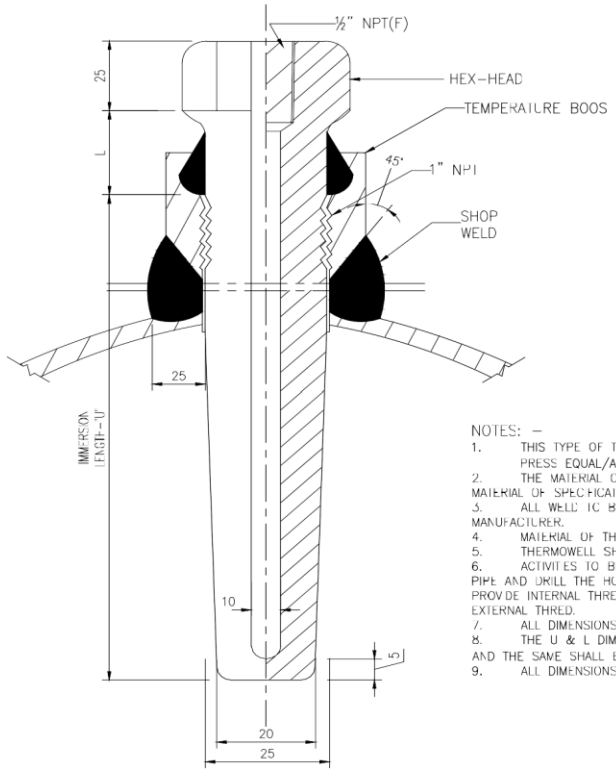
(Doc. No.- DR-TC/RTD/IGL/ET2/CP/CP18160)

THERMOCOUPLE / RTD
ASSEMBLY WITH THERMOWELL



NOTES: –
1 IN CASE OF DUPLEX THERMOCOUPLE/RTD, TWO INDEPENDENT ELECTRICAL ENTRIES SHALL BE PROVIDED.

WELDED THERMOWELL



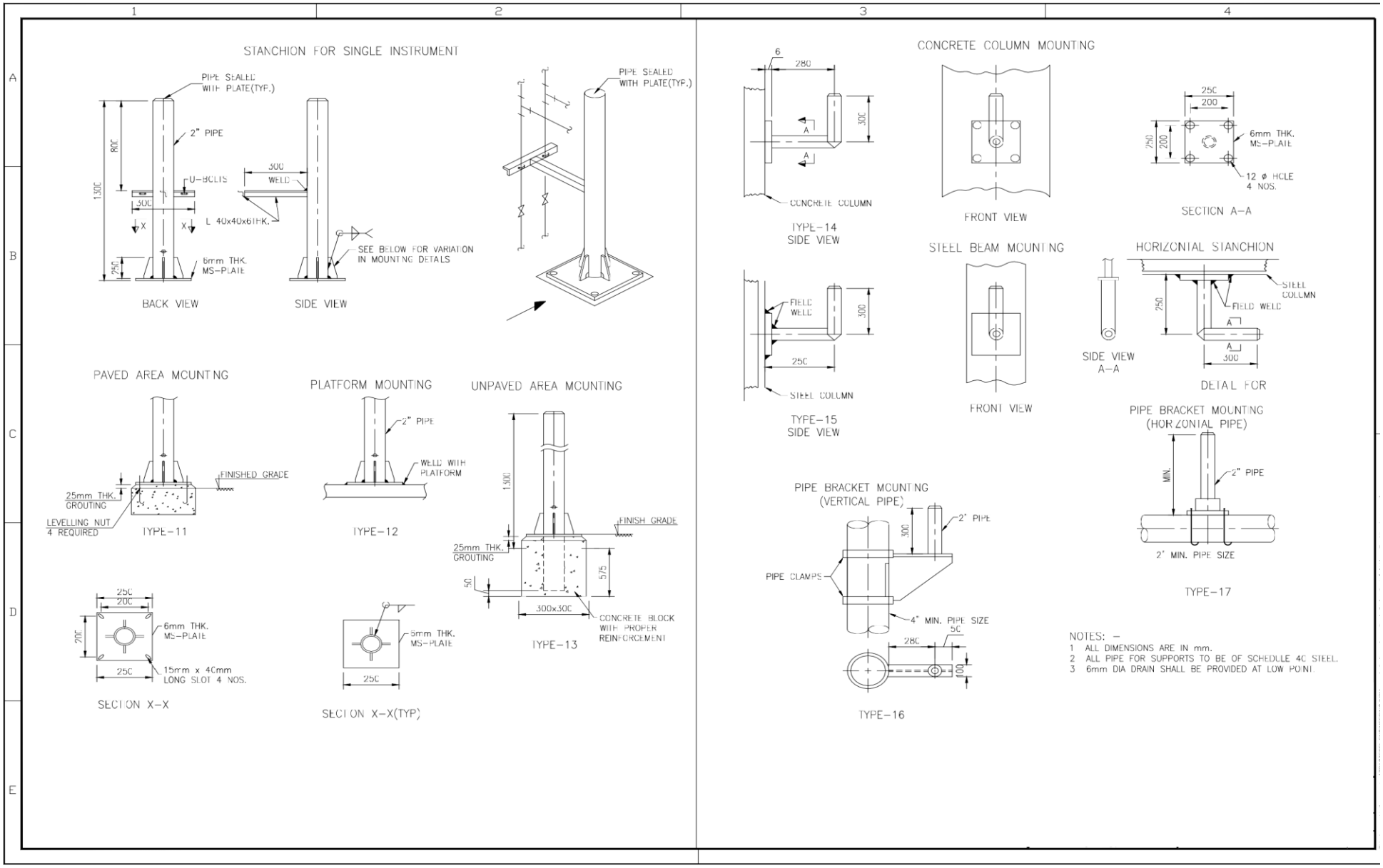
NOTES: –
1. THIS TYPE OF TEMPERATURE BOSS SHALL BE USED FOR THE PROCESS PRESS EQUAL/ABOVE 40Kg/Cm2(G).
2. THE MATERIAL OF THE BOSS SHOULD BE SIMILAR TO THAT OF PIPING MATERIAL OF SPECIFICATION.
3. ALL WELD TO BE TESTED IN ACCORDANCE WITH APPLICABLE CODES BY MANUFACTURER.
4. MATERIAL OF THE THERMOWELL SHALL BE OF 316SS.
5. THERMOWELL SHALL BE DRILLED BARSTOCK TYPE.
6. ACTIVITES TO BE COMPLETED AT THE SHOP. WELD THE BOSS ON THE PIPE AND DRILL THE HOLE IN THE PIPE IN ALLIGNMENT WITH HOLE IN THE BOSS PROVIDE INTERNAL THREAD AS PER IS;554 TO MATCH WITH THE THERMOWELL EXTERNAL THRED.
7. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
8. THE U & L DIMENSIONS SHALL BE SELECTED BASED ON PARTICULAR APPLICATION AND THE SAME SHALL BE SUBJECT TO OWNER'S APPROVAL DURING DETAILED ENGINEERING.
9. ALL DIMENSIONS ARE INDICATIVE ONLY.

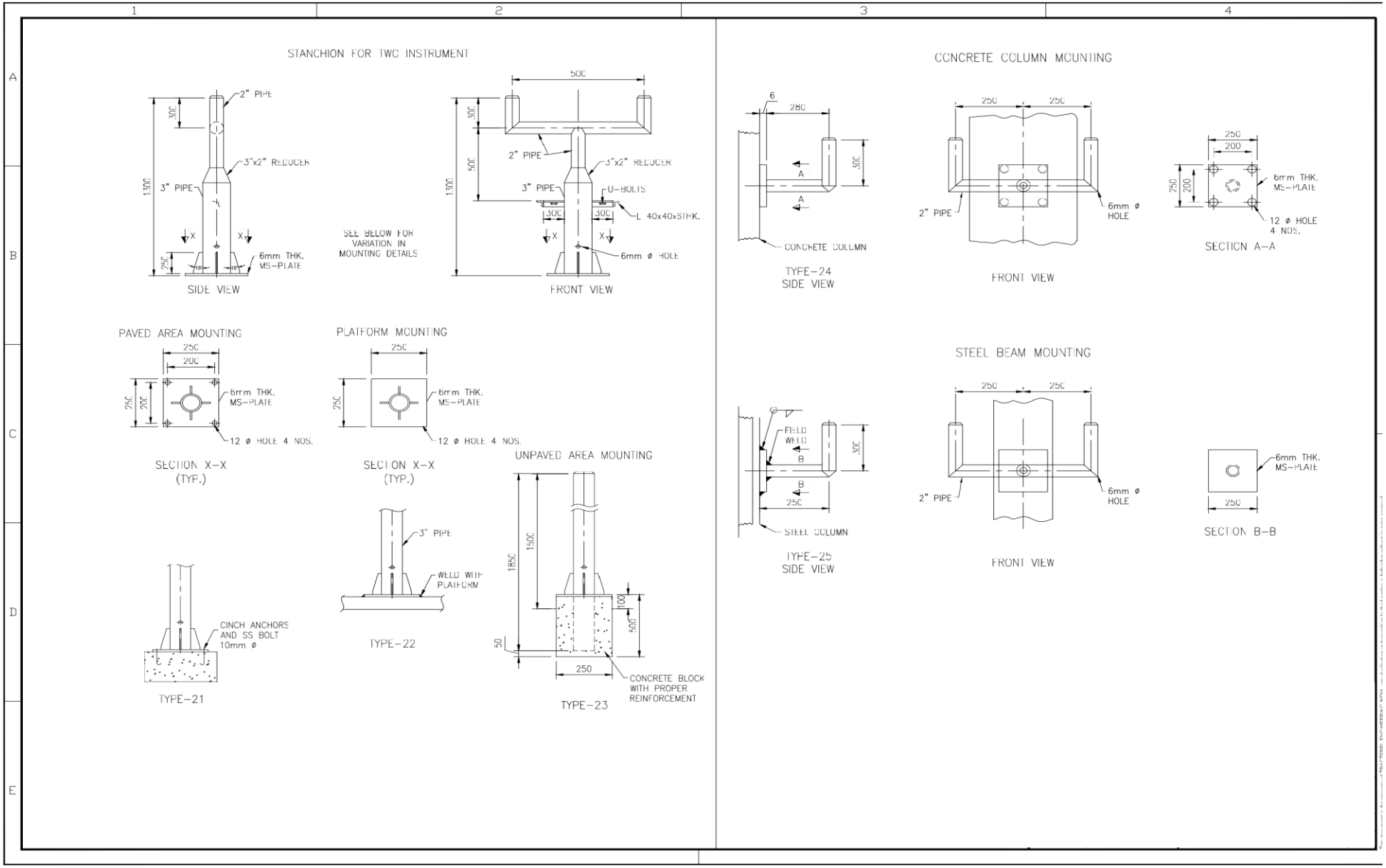
SECTION 31

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

DRAWING- INSTRUMENT SUPPORT DRAWING

(Doc. No.- DR-IS/IGL/ET2/CP/CP18160)


STANCHION FOR SINGLE INSTRUMENT
PIPE SEALED WITH PLATE(TYP.)
2" PIPE
U-BOLTS
300
WELD
L 40x40x6THK.
SEE BELOW FOR VARIATION IN MOUNTING DETAILS
6mm THK. MS-PLATE
BACK VIEW
SIDE VIEW
PIPE SEALED WITH PLATE(TYP.)
PAVED AREA MOUNTING
FINISHED GRADE
25mm THK. GROUTING
LEVELLING NUT 4 REQUIRED
TYPE-11
PLATFORM MOUNTING
2" PIPE
WELD WITH PLATFORM
TYPE-12
UNPAVED AREA MOUNTING
1500
FINISH GRADE
25mm THK. GROUTING
300x300
CONCRETE BLOCK WITH PROPER REINFORCEMENT
TYPE-13
6mm THK. MS-PLATE
15mm x 40mm LONG SLOT 4 NOS.
SECTION X-X
8mm THK. MS-PLATE
SECTION X-X(TYP)
CONCRETE COLUMN MOUNTING
CONCRETE COLUMN
TYPE-14 SIDE VIEW
FRONT VIEW
6mm THK. MS-PLATE
12 ø HOLE 4 NOS.
SECTION A-A
STEEL COLUMN
TYPE-15 SIDE VIEW
STEEL BEAM MOUNTING
FRONT VIEW
HORIZONTAL STANCHION
STEEL COLUMN
FIELD WELD
SIDE VIEW A-A
DETAL FOR
PIPE BRACKET MOUNTING (HORIZONTAL PIPE)
2" PIPE
2" MIN. PIPE SIZE
TYPE-17
PIPE BRACKET MOUNTING (VERTICAL PIPE)
2" PIPE
PIPE CLAMPS
4" MIN. PIPE SIZE
TYPE-16
NOTES: -
1 ALL DIMENSIONS ARE IN mm.
2 ALL PIPE FOR SUPPORTS TO BE OF SCHEDULE 40 STEEL.
3 6mm DIA DRAIN SHALL BE PROVIDED AT LOW POINT.

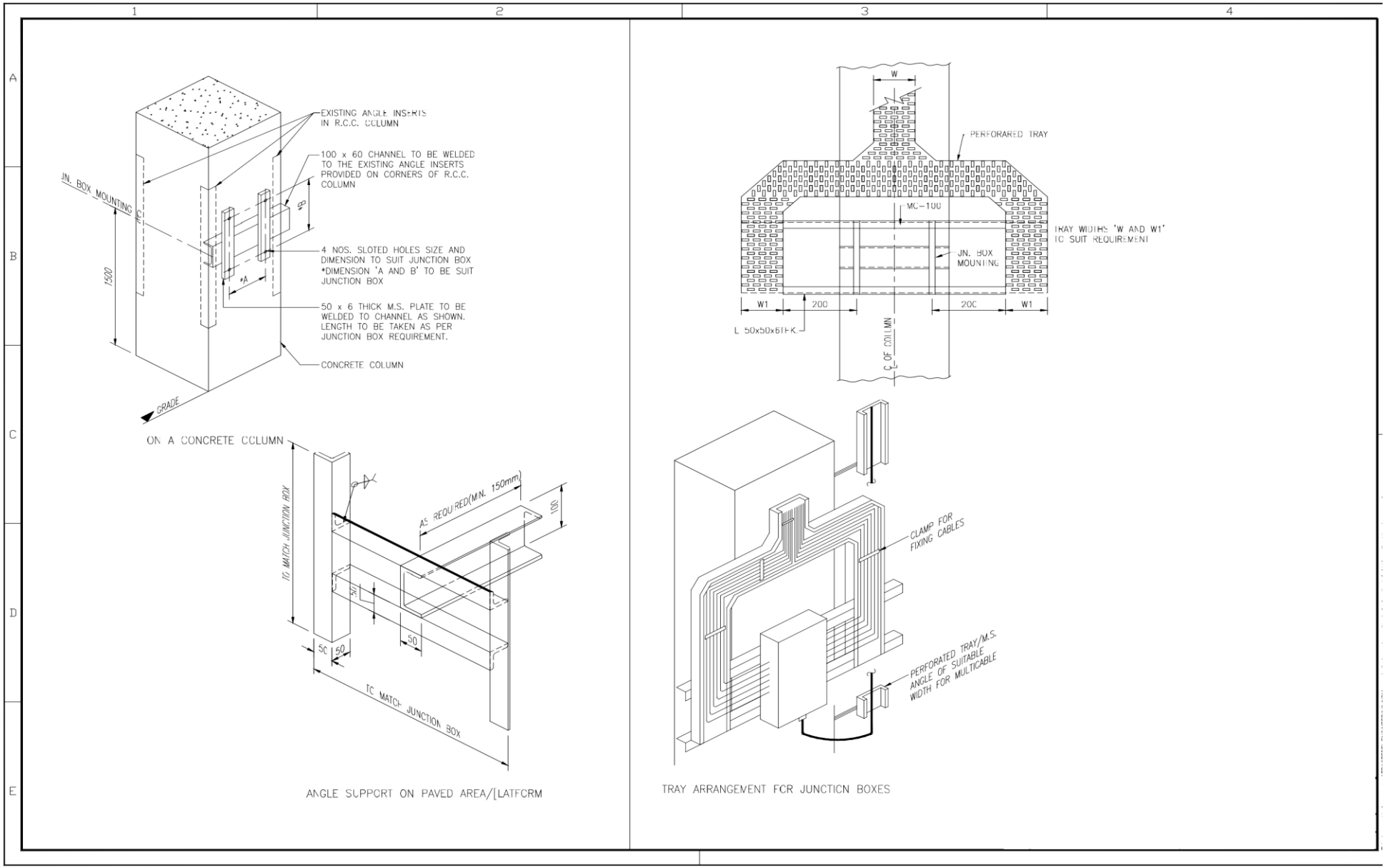

STANCHION FOR TWO INSTRUMENT
2" PIPE
300
3"x2" REDUCER
1300
3" PIPE
X
X
250
6mm THK. MS-PLATE
SIDE VIEW
SEE BELOW FOR VARIATION IN MOUNTING DETAILS
500
2" PIPE
3"x2" REDUCER
U-BOLTS
L 40x40x5THK.
300
300
6mm ø HOLE
FRONT VIEW
PAVED AREA MOUNTING
250
200
6mm THK. MS-PLATE
12 ø HOLE 4 NOS.
SECTION X-X (TYP.)
PLATFORM MOUNTING
250
6mm THK. MS-PLATE
12 ø HOLE 4 NOS.
SECTION X-X (TYP.)
3" PIPE
WELD WITH PLATFORM
TYPE-22
CINCH ANCHORS AND SS BOLT 10mm ø
TYPE-21
UNPAVED AREA MOUNTING
1850
1500
100
500
50
250
CONCRETE BLOCK WITH PROPER REINFORCEMENT
TYPE-23
CONCRETE COLUMN MOUNTING
6
280
300
A
A
CONCRETE COLUMN
TYPE-24
SIDE VIEW
250
250
2" PIPE
6mm ø HOLE
FRONT VIEW
250
200
250
200
6mm THK. MS-PLATE
12 ø HOLE 4 NOS.
SECTION A-A
STEEL BEAM MOUNTING
FIELD WELD
B
B
300
250
STEEL COLUMN
TYPE-25
SIDE VIEW
250
250
2" PIPE
6mm ø HOLE
FRONT VIEW
6mm THK. MS-PLATE
250
SECTION B-B

SECTION 32

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

DRAWING- SUPPORT DETAILS FOR JUNCTION BOXES

(Doc. No.- DR-SD_JB/IGL/ET2/CP/CP18160)

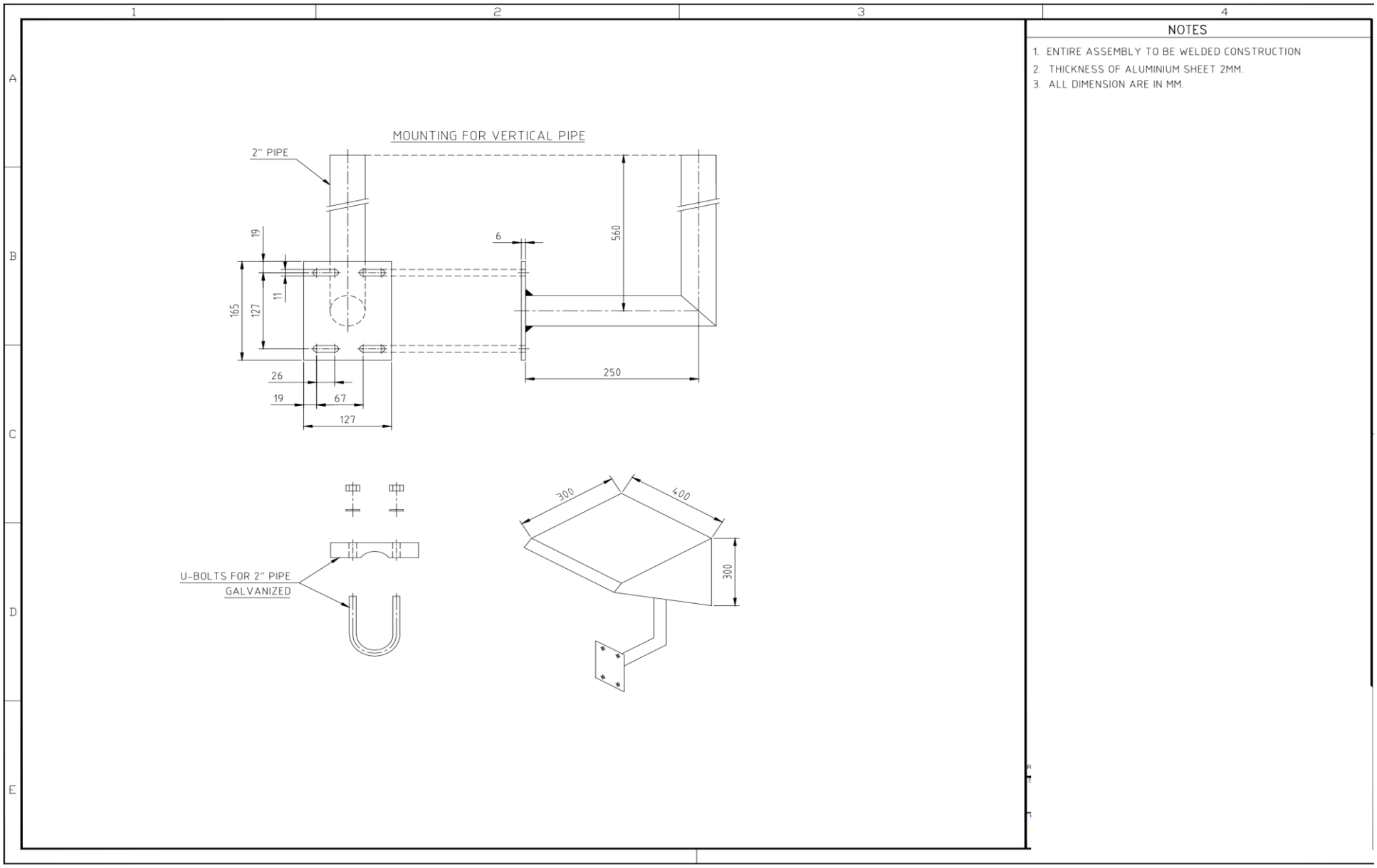

1
2
3
4
A
B
C
D
E
EXISTING ANGLE INSERTS IN R.C.C. COLUMN
100 x 60 CHANNEL TO BE WELDED TO THE EXISTING ANGLE INSERTS PROVIDED ON CORNERS OF R.C.C. COLUMN
JN. BOX MOUNTING
1500
*A
*B
4 NOS. SLOTED HOLES SIZE AND DIMENSION TO SUIT JUNCTION BOX *DIMENSION 'A AND B' TO BE SUIT JUNCTION BOX
50 x 6 THICK M.S. PLATE TO BE WELDED TO CHANNEL AS SHOWN. LENGTH TO BE TAKEN AS PER JUNCTION BOX REQUIREMENT.
CONCRETE COLUMN
GRADE
ON A CONCRETE COLUMN
TO MATCH JUNCTION BOX
AS REQUIRED(MIN. 150mm)
150
50
50
50
50
TC MATCH JUNCTION BOX
ANGLE SUPPORT ON PAVED AREA/[LATFORM
W
PERFORARED TRAY
MC-100
TRAY WIDTHS 'W AND W1' TC SUIT REQUIREMENT
JN. BOX MOUNTING
W1
200
200
W1
L 50x50x6THK.
C OF COLUMN
CLAMP FOR FIXING CABLES
PERFORATED TRAY/M.S. ANGLE OF SUITABLE WIDTH FOR MULTICABLE
TRAY ARRANGEMENT FOR JUNCTION BOXES

SECTION 33

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

DRAWING- TYPICAL DRAWING FOR CANOPY

(Doc. No.- DR-CNPY/IGL/ET2/CP/CP18160)


1
2
3
4
A
B
C
D
E
NOTES
1. ENTIRE ASSEMBLY TO BE WELDED CONSTRUCTION
2. THICKNESS OF ALUMINIUM SHEET 2MM.
3. ALL DIMENSION ARE IN MM.
MOUNTING FOR VERTICAL PIPE
2" PIPE
19
11
165
127
6
560
250
26
19
67
127
U-BOLTS FOR 2" PIPE
GALVANIZED
300
400
300

SECTION 34

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

GTS – INSTRUMENT ERECTION

(DOC No.-GTS-IE/IGL/ET2/CP/CP18160)

TABLE OF CONTENTS

1. SCOPE

This specification covers the technical requirements for installation, calibration, checking, testing and commissioning of Instrumentation for Gas pipeline project.

2. GENERAL

2.1. DEFINITIONS

Subject to the requirements of the context, the terms (hereafter listed in alphabetical order) used in this document are given the following meaning :

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.
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 REPRESNTATIVE	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, materiel, 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.

2.2. CODES, STANDARDS AND LEGAL REQUIREMENTS

The Instrumentation erection shall be in accordance with the codes and standards mentioned in the present specification and with the codes, standards and legal requirements listed in various documents for the PROJECT.

2.3. REVIEW AND/OR APPROVAL

Whenever OWNER and/or OWNER's REPRESENTATIVE review and/or approval is requested on a document to be submitted by the CONTRACTOR or before an action is implemented by the CONTRACTOR, such review and/or approval shall always be requested in writing by the CONTRACTOR to the OWNER and/or the OWNER'S REPRESENTATIVE before any action subject of this review and/or approval is taken.

OWNER and/or OWNER'S REPRESENTATIVE approval shall always be given in writing.

3. BASIC PRESCRIPTIONS

1) The technical requirements laid down in this specification do not relieve the CONTRACTOR from any responsibility resulting from the awarded works.

2) The layout drawings attached to the tender document for the PROJECT and the models regarded as part thereof, show approximate locations of instruments, analysers, single and multicore cable routings, junction box locations, and shall be used as a guide by the CONTRACTOR.

   They need not to be strictly adhered to, unless so specified, provided that accessibility, accuracy and lag requirements are taken into consideration.

   Any drawing showing connection details and dimensions, or containing any specific information, shall be adhered to and any deviation from the drawings shall be approved by the OWNER'S REPRESENTATIVE before starting installation.

3) Any discrepancy between this specification and other documents shall be immediately notified to the OWNER'S REPRESENTATIVE, in writing, for resolution.

4) Protection of equipment and personnel against damage through malfunctioning or mishandling the instrument or instrument system shall be provided by the CONTRACTOR as an integral part of contract. Adequate protection shall be included for ensuring safety of personnel from any possible hazards.

4. SCOPE OF WORKS

The CONTRACTOR shall perform the following works (unless explicitly excluded in the tender for the PROJECT):

1) Verification of all instruments, when receiving them, to ensure that all components have been delivered and to ascertain any damage suffered.

   Failure by the CONTRACTOR to give notice of visible damages or omissions to the OWNER'S REPRESENTATIVE when receiving a consignment of materials and instruments shall be considered as an implicit confirmation that the CONTRACTOR takes upon himself all responsibilities for their soundness until final testing and acceptance.

2) Installation of all instruments and ancillary equipment.

3) Installation and connection to lines and equipment of instrument process piping including, where specified, seal welding of threaded connections.

4) Tracing of instruments, instrument impulse lines, wherever required.

5) Installation of protection boxes for instruments, wherever required.

6) Installation of junction boxes, wherever required.

7) Installation of ladders, trays, trunking and conduits for cables and tubes.

8) Installation of consoles, desks, panels and cabinets for instruments.

9) Installation of electrical power supply cabinets for the Instrumentation.

10) Installation of all the necessary supports for the instruments, cable ladders, trays, trunking and conduits, impulse lines, pneumatic transmission lines, steam tracing lines, cabinets, panels, consoles, desks, junction boxes, connection boxes, cross boards, synoptic panels, etc.

11) Painting of the supports, frameworks and locally manufactured panels.

12) Installation and connection at both ends of instrumentation cables and conductors.

13) Installation of nameplates and/or labels for identification and numbering of instruments, cables, wires, junction boxes, connection boxes, cross boards, terminals, cabinets, panels, desks, pneumatic transmission lines, lines or cables for tracing, etc.

14) Carrying out any auxiliary work necessary for installation of the instrumentation as per technical specifications (e.g. removing and replacing doors to facilitate work, drilling small holes in walls and floors, filling back the holes, reparation of damages made during installation and repainting all damaged paint work).

15) Handling and properly protecting instruments, cabinets, boxes, panels, desks, consoles after receipt and after installation (especially capillary tubes, proximity switches etc.).

16) Removal of oxidation and, if necessary, greasing of parts oxidized during transportation or storage.

17) Performing additional works upon request of the OWNER'S REPRESENTATIVE.

18) Performing all changes and repairs, as required, resulting from CONTRACTOR'S failure to comply with specifications, standards and/or drawings or from incorrect installation.

19) Checking and testing of all instruments.

20) Calibration and precommissioning of all instruments.

21) Installation and removal as per site regulations of temporary stores, workshops and buildings, for performance of the WORKS and in order to properly protect and store all instruments.

22) Cleaning of the site.

23) Fabrication of pipe nipples as necessary including threading as per installation standard.

24) Drilling of holes in blind flanges including cutting threads as per installation standards.

25) Back/seal welding of screwed fittings as required by standards or as per the instruction of Owner/Owner's Representative. This may involve welding of dissimilar materials using appropriate electrodes.

26) Civil works including the casting of foundation as required for instrument support.

27) Minor civil works like chipping of pavement, grouting of instrument panels, laying of conduits below pavement after chipping and refinishing of pavement as necessary.

28) Sealing of cables/ tube entries into the control room after laying and testing of all cable/ tubes by installing Multi-Cable Transit block (MCT) including fixing of MCT frame, routing of cables through cable blocks, tightening of cable blocks.

29) Degreasing of impulse lines, valves, instruments and other instrument items in oxygen and chlorine service as per manufacturer's instructions.

30) Minor modification/repairs required to be carried out on the instruments namely replacement of dial, glass for pressure gauges or any other similar instrument, replacement of damaged signal tubes on valves, tapping of damaged threads on couplings, tees and other fittings; cleaning of nozzles and relays in pneumatic instruments.

31) Painting of all structural supports for trays, pipes, junction boxes, instruments.

32) Punching of tag numbers on items or tag plates.

33) Fabrication and installation of pipe stanchion as per Instrument support standards including casting of concrete pedestal, grouting, welding etc. as necessary.

34) Drilling holes for providing glands/grommets on panels, shut down cabinets, power supply cabinets, local control panels, pneumatic enclosures, junction boxes etc. wherever required for cables/ multitube entry.

35) Grounding of shields cables to respective instrument earth bus provided in the control room/local panel/RTD head etc. as required.

36) Laying and termination of earth cable at both ends between instrument earth bus provided in control room/local panel to instrument earth pits provided by other contractors.

37) Supply of all types of consumables required for the execution of the job without any exception.

38) Sealing of safety valves with standard lead seals after final setting in the presence of Owner/Owner's representative.

39) Supply and installation of base frames along with necessary civil works for all the panels / cabinets / consoles including the RTU base frame (RTU size shall be provided during execution) envisaged inside the control room are included in the scope of CONTRACTOR.

40) Co-ordination during installation, pre-commissioning and commissioning with mechanical and other sub-contractors for proper installation of line mounted instruments like control valve, ultrasonic flow meters etc. which involve removal of instruments disconnection of tubes/ cables, reconnection of same for alignment and proper installation.

41) Incorporation of all information in drawings/document as per the actual execution of work at site including preparation and submission of as-built drawings.

42) Any other work not specifically mentioned above, but required for the proper execution of the erection work.

5. EXTENT OF SUPPLY

The CONTRACTOR shall supply the following materials and documents (unless explicitly excluded in the tender for the PROJECT) in accordance with the requirements for the PROJECT:

1) All the supports for the installation of instruments, cable ladders, trays, ducts, conduits, instrument process lines, pneumatic transmission lines, cabinets, panels, desks, consoles, junction boxes, connection boxes, cross boards, etc.
2) Material for the instrument process piping (except the first isolating valve).
3) Material for the tracing of instruments, instrument process piping.
4) Material for the pneumatic transmission lines.
5) Junction boxes, the connection boxes, the cross boards including terminals and accessories.
6) Protection boxes for the instruments and ancillary equipment, including all required accessories.
7) Cable ladders, trays, trunking, conduits.

8) Cable glands.

9) Accessories for fixing the cables on cable ladders, trays and trunking.

10) Nameplates and labels for identification and numbering of instruments, analyzers, ancillary equipment, cables, wires, junction boxes, connection boxes, cross boards, terminals, cabinets, panels, desks, consoles, pneumatic transmission lines, air supply lines, lines or cables for the tracing, etc.

    Numbers to be used shall be given by the OWNER'S REPRESENTATIVE.

11) All the required accessories for an installation in accordance with the prescriptions, drawings and technical specifications and for the verifications, checks and tests of the Instrumentation.

12) All equipment and material asked for by the OWNER'S REPRESENTATIVE on site.

13) Required equipment for the calibration, testing and the precommissioning of the Instrumentation, when applicable.

14) Consumables (electrodes and welding rods, primer, lubricants, sealants, soldering flux, paint, screws, bolts, expansion bolts, nuts, washers, etc.).

15) Necessary tools, equipment and temporary stores, workshops and buildings, in order to perform the works (including lifting engines, scaffolding, etc.).

16) Required test documents and certificates.

17) As-built drawings (marked up copies).

18) Welding procedures and welders qualification certificates, when applicable.

19) Weekly reports with progress status.

20) Planning and organisation documents such as:

- work preparation sheets,
- activity bar chart schedule
- cable cut program for cables delivered by the OWNER.

21) The precommissioning sheets filled in and signed off "ready for commissioning". Those sheets could be an OWNER'S REPRESENTATIVE standard, an OWNER standard or a CONTRACTOR standard approved by the OWNER'S REPRESENTATIVE.

6. GENERAL INSTALLATION PROCEDURES

6.1. GENERAL

6.1.1. Site regulations

The CONTRACTOR shall strictly adhere to the site regulations.

6.1.2. Materials

All materials supplied by the CONTRACTOR shall be in accordance with (but not limited to) the requirements laid down in the Technical Specification for the PROJECT and attached documents and drawings.

The CONTRACTOR shall ensure that all materials and equipment are adequately protected and stored until they are installed / erected.

6.1.3. Local fabrication

All equipment necessary for proper installation of instruments (like supports, frameworks, local panels, etc.) and not supplied in prefabricated form shall be fabricated locally by the CONTRACTOR.

6.1.4. Storing and handling of instruments

Immediately after receipt, instruments and installation materials shall be stored by the CONTRACTOR (unless stated otherwise in the Particular Technical Specification for the PROJECT).
When instrumentation is taken from stock temporarily (e.g. for testing), it shall be returned to the CONTRACTOR's store in the original packing.
For preventing damage, the CONTRACTOR shall transport and handle instruments with the utmost care. All covers and plugs on instrument connections and flange facings shall be left in place as long as possible.
Instruments shall be protected against general construction site hazards, and in particular against adverse weather conditions during the construction period, (e.g. extensive use of large size commercial quality polyethylene bags to cover control valves and local instrumentation). All openings shall be properly sealed if the connections are not made immediately after the installation of the instrument, junction box etc.

6.1.5. Cable storage

All cables shall be stored in a locked compound. Partly used drums shall have their ends sealed and an indication of the quantity remaining marked on the drum.
The fenced off area shall be of sufficient size to allow entry of vehicles, and allow the storage of cables by type and size in a neat and orderly manner. The surface of the compound shall be such that it does not get water logged.

6.2. INSTRUMENT INSTALLATION IN THE PLANT

6.2.1. General

1) The CONTRACTOR shall make a preliminary study of instrument, junction boxes location and instrument cable run.

   Locations and runs proposed by the CONTRACTOR shall be in accordance with sound installation practices and submitted to OWNER'S REPRESENTATIVE for approval. The approval of the OWNER'S REPRESENTATIVE cannot be used as an argument for an extra-cost in case of relocation afterwards.

2) All instruments, there measuring elements and their process manifolds and valves shall be safely and permanently accessible from grade, platforms or walkways (2 m above or 1 m either side of).

   Where permanent accessibility is impossible, the process connections and measuring elements for instruments may be located so that they are accessible by temporary facilities (ladders or mobile platform, maximum length : 4 m).

   In such cases additional block valves shall be provided close to the instrument. This requires approval of the OWNER'S REPRESENTATIVE.

All instruments, their process connections shall have such orientation and location as to allow easy reading.

Control instruments and transmitters shall also be located in such a way that they are easily accessible for operation and maintenance.

3) The connections to the process lines and equipment shall be made in accordance with the pipe class up to and inclusive of the first block valves. Their orientation shall be selected so that instruments or instrument process piping will not obstruct walkways or platforms.

   Seal welding may be requested on threaded connections for special services. That welding shall be performed in conformity with the welding procedure for threaded connections.

   The CONTRACTOR shall check the type, size, material and orientation of the instrument process connections.

4) The run of instrument impulse lines shall be such as to avoid liquid pockets in lines containing gas, even if this is not specified on the typical drawings

   Slopes of instrument impulse lines shall be as specified on the engineering drawings. If not specified, they shall be at least 10 cm/meter to the tapping point when the instrument is mounted above the tapping point and to the instrument when the instrument is mounted below the tapping point.

   Vertical instrument impulse lines for differential pressure transmitters shall run as close as possible to each other.

   Instrument impulse lines shall be properly supported (maximum distance between supports: 1.50 m).

5) When the pipe class calls for welded connections, welding procedure shall be approved by the OWNER'S REPRESENTATIVE.

6) When seal welds on threaded connections are required, such connections shall be installed with the threads perfectly free of any trace of lubricant or sealing tape.

7) Instruments, associated process piping shall be securely fastened in order to avoid vibrations. When applicable, displacement of process pipes or equipment shall be taken into consideration.

8) In general the instrument supports shall either be fixed to concrete or be welded to structural steel. It is prohibited to weld supports to platforms, handrails, process piping or process equipment.

   If supporting from structural steel or concrete is not feasible, supporting of instruments by means of clamping around piping may be considered but approval of the OWNER's REPRESENTATIVE is required for each individual case

   All surfaces of structural steel which could not be painted afterwards shall be made free of rust, cleaned and painted with a layer of primer before supports, trays, cables, etc. are installed.

   All brackets and supports shall be finished smoothly, free from sharp and dangerous edges. Pedestal for yoke mounted instruments shall be closed at top to prevent water accumulation.

   In order to avoid electrolytic corrosion, insulating barriers shall be provided when instrument and analyser support are clamped on process piping of a different material.

9) Even when no cathodic protection is installed, all instrument connections to underground metallic lines shall be electrically insulated.

10) Instrument and supports, which must be fixed to fireproofed structures, shall be welded to the steel structure before the fireproofing is applied taking into account the thickness of the applied fireproofing.

When it is not possible, the supports shall be clamped around the fireproofing, if allowed by the OWNER's REPRESENTATIVE.

As a general rule, the support installation method has to be approved by the OWNER's REPRESENTATIVE.

11) All outdoor instruments shall be absolutely weatherproof. If required, weatherproof housings shall be supplied and installed by the CONTRACTOR.

In sunny areas, the field mounted instruments and analysers shall be protected from solar radiation.

12) Local pressure and differential pressure instruments shall be mounted so as to avoid vibrations.

13) Individual instrument tracing shall be installed as specified on engineering drawings. The requirements for heavy or light tracing shall be strictly adhered to.

Isolation valves on steam manifolds and steam trap stations for instrument and steam tracing and local isolating switches for electrical tracing shall be clearly tagged with the instrument loop number even if they are not installed by the CONTRACTOR.

14) Instrument impulse lines shall be installed in such a way that enough space is kept all around the lines to install the required insulation.

15) Stainless steel impulse and sample transport lines will be additionally protected against the climatic conditions by the use of PTFE spray after the hydrostatic test. The spray type and method of application are to be agreed by the OWNER's REPRESENTATIVE.

16) Instrument equipment shall be located such that it is protected against direct drainage of condensate, water and process fluids from adjacent plant equipment that can make the instruments, instrument components, junction boxes, etc. dirty, wet or inoperable.

17) Care shall be taken that no passage ways are obstructed or access to other plant equipment, electrical lighting panels, other instruments, etc. is impossible. All equipment shall remain easily operable. Ample space shall be available for the removal of covers, protection box doors, etc.

18) When API threadings are made by a thread cutting machine dies shall be properly oiled and threads produced shall be agreed by the OWNER's REPRESENTATIVE. PTFE tape shall be used for the installation of threaded fittings, except where temperatures in excess of 200 °C occur, as indicated on the process piping details; for these cases a suitable dope shall be used.

19) When installing steel or stainless steel tubing with compression type fittings, all the fitting manufacturer's instructions shall be exactly followed which shall include, but are not limited to :

- proper cutting of tube and deburring,
- proper installation of the ferrules,
- taking care that all tubes have the required roundness.

When storing tubes, care shall be taken that no mechanical damage can occur, which makes the tubes unround.

In order to avoid unroundness of the tubes at the places where ferrules are to be applied, it is absolutely necessary to cut the tube at least 5 cm from the end of a bend. Mounting closer to the bend shall not be accepted.

20) To avoid galling of stainless steel ferrules into the tapered end of the stainless steel fittings, the stainless steel ferrules shall be greased slightly at the outside before installation

6.2.2. Temperature instruments

All temperature sensing elements shall be firmly bottomed in the thermowells.

6.2.3. Pressure instruments

Refer Standard Drawings enclosed in the tender.

6.3. INSTALLATION OF INSTRUMENTATION CABLES AND SIGNAL LINES

6.3.1. Trenches

Cable trenches shall be excavated as per requirement and site suitability taking into account the following requirements:

1) The CONTRACTOR shall do all excavation of whatever substances encountered to depth shown on drawings.

   Excavated materials not required for backfill shall be removed and disposed of as directed by the OWNER's REPRESENTATIVE.

2) Unstable soil shall be reported to the OWNER's REPRESENTATIVE who shall give instructions to the CONTRACTOR for its removal and replacement with suitable material. The CONTRACTOR shall be responsible for the excavation and disposal of this unsuitable material as directed by the OWNER's REPRESENTATIVE.

3) Unstable materials shall be replaced with approved fill material by the CONTRACTOR as directed by the OWNER's REPRESENTATIVE who shall approve the replacement fill. All replaced fill shall be compacted as directed by the OWNER's REPRESENTATIVE.

4) When approved by the OWNER's REPRESENTATIVE excavated material suitable for backfill may be deposited alongside the trench excavation but at a distance not less than 1 meter from the edge of the trench excavation or as otherwise instructed by the OWNER's REPRESENTATIVE. When instructed by the OWNER's REPRESENTATIVE, the CONTRACTOR shall remove all excavated material to a designated dump area.

5) Ground adjacent to all excavations shall be graded to prevent water running in.

6) The CONTRACTOR shall remove by pumping or other means approved by the OWNER's REPRESENTATIVE, any water accumulated in excavations, and shall keep trenches dewatered until cable bedding is completed to the satisfaction of the OWNER's REPRESENTATIVE.

   The CONTRACTOR shall note that to be effective, dewatering operations may have to be on a 24 hour, round the clock basis to ensure dry working conditions.

7) The CONTRACTOR shall at his own cost supply and install all necessary bracing, sheathing, shoring to perform and protect all excavations as required for conformity with safety regulations and as approved by the OWNER's REPRESENTATIVE.

8) Temporary crossings shall be built by the CONTRACTOR as directed by the OWNER's REPRESENTATIVE to maintain traffic on the site. After use, and when instructed by the OWNER's REPRESENTATIVE such temporary crossings shall be removed by the CONTRACTOR.

9) All open excavations shall be protected at CONTRACTOR'S cost by means of safety barriers, lamps, etc. as required or directed by the OWNER's REPRESENTATIVE.

10) The depth of the trenches shall be locally increased at crossing or branch-off of large quantities of cables.

11) The curvature of the trenches shall be compatible with the bending radius of cables.

12) The maximum slope of trench bottoms shall be 10 degrees. The transition to horizontal surfaces shall have a smooth curvature.

13) At crossing, signal cables shall be at least 0.3 m lower or higher than electric power cables.

14) In order to allow future laying of cables, sleeves (200 mm diameter) shall be provided at road and railway crossing and where trenches for signal cables pass under trenches for electric power cables as required on engineering drawings. The sleeves shall be provided with a steel wire in order to allow pulling of cables.

15) Trenches shall be kept (at least 0.5 m) away from buried pipes containing hot fluids and from pipes liable to temperature rise owing to steaming-out.

16) All stones and/or rocks shall be removed from the trench prior to laying of the cables.

17) The CONTRACTOR shall lay a 15 cm thick sandbed to receive the cables.

18) The laying of cables in the trenches shall be approved by the OWNER's REPRESENTATIVE.

19) The backfill of trenches may only start after approval from the OWNER's REPRESENTATIVE.

The cables shall be covered with a layer of 15 cm of sand on which red or yellow concrete tiles (300 x 300 x 40 mm) shall be installed, after which the trenches shall be backfilled and covered.

20) The backfill of the trenches shall be carried out using approved excavated materials, compacted in lifts of 30 cm max. When instructed by the OWNER's REPRESENTATIVE, the CONTRACTOR shall use fill from approved stock pile areas.

The work shall be carried out ensuring that the backfill is firm and compacted, using suitable equipment, and to specification requirements.

21) Backfill material shall be deposited by the CONTRACTOR to specification and as instructed by the OWNER's REPRESENTATIVE.

22) Puddling or water flooding for consolidating the backfill is not allowed.

23) After backfill of trenches, no surface load shall be placed on the backfill until a period of 48 hours has elapsed.

24) The location of the trenches shall be clearly marked and reported on "as built" drawings.

Markers shall be placed at 15 m intervals (or at intervals agreed by the OWNER's REPRESENTATIVE) and where the trench changes direction.

For trenches 500 mm or more in width, markers shall be provided on both edges of the trench. For trenches less than 500 mm in width, markers shall be placed at one edge of the trench only.

Markers shall have identification plates of corrosion resistant metal. The plate shall indicate the direction of the cable run and give the voltages of the cables in the trench at the point where the marker is located.

25) Excavation of trenches after cables have been laid requires approval of the OWNER's REPRESENTATIVE.

6.3.2. Cable ladders, trays and trunking

Cable ladders, trays and/or trunking shall be installed as indicated on layout drawings or on models and sectional drawings, taking into account the following requirements.

1) Cable ladders, trays and/or trunking shall be easily and safely accessible for maintenance reasons.

2) Cable ladders, trays and/or trunking shall be installed in such a way that they do not hinder traffic, nor interfere with accessibility or removal space of pumps, motors, compressors and any process equipment or part thereof.

   Minimum required clearances, are:

   - over railways (from top of rail) 7 m,
   - crane ways (process area) 6 m,
   - over elevated walkways or platforms 2.5 m,
   - where accessibility of mobile lifting equipment is required 4 m.

3) Cable ladders, trays and/or trunking shall be kept away from hot environments and places with potential fire hazards (hydrocarbon process pump, burner fronts).

   When cable ladders, trays and/or trunking must be installed where they are subject to fire hazards, suitable fireproofing shall be provided by the CONTRACTOR.

4) Cables ladders, trays and/or trunking shall be located so that they are not subject to mechanical abuse, spilt liquids, escaping vapours and corrosive gases, strong electrical interference.

   Ladders, tray and/or trunking riser points which can be damaged by traffic shall be suitably protected.

5) Cable ladders, trays and/or trunking shall be firmly supported.

   They shall be suitable for an equally distributed load of 120 kg/m and shall withstand an additional point load of 80 kg.

   The supports shall be installed at sufficiently short intervals so as to avoid bending exceeding 0.5 % of span. Wherever possible supports shall be arranged so that cables and multitubes can be laid sideways.

   Sufficient free space (minimum 0.5 m) shall be provided above ladders, trays and/or trunkings.

6) Cable ladders, trays and/or trunking shall be internally smooth. Attention shall be paid particularly at changes of directions, both in horizontal and vertical plans.

   All fabricated pieces shall be free of burrs and sharp edges (plastic covered ends).

7) The curvature of cable ladders, trays and/or trunking shall be compatible with the bending radius of cables.

8) At site, cable ladders, trays and trunking shall be lengthened by bolting, not by welding.

9) The minimum width of the main cable ladders, trays and/or trunking shall be as indicated on the drawings. The height, if not specified, shall be determined by the CONTRACTOR taking into account the quantity of cables and 30 % spare.

   The CONTRACTOR shall base his selection of not specified ladder, tray or trunking sizes taking into account the following considerations. The sizing of the cable ladders, trays or trunking for instrumentation cable depends only on the space required to accommodate the cables at various locations in the system. Space for at least 30 % future cables shall be provided. If mechanical separation is required to separate intrinsic safe cables from other low voltage cables installed on one cable tray or trunking, metal barriers extending approximately 5 cm above the top of the higher shall be used.

6.3.3. Conduits

1) The conduit system shall be installed in such a way that it will be impossible for rain-water to collect at low points. Conduit material shall be as specified in the Particular Technical Specification for the PROJECT.

2) Sharp edges on conduits shall be removed and any conduits ends shall be protected with metal ring collars or polythene inserts to prevent cable damage. All conduits shall be swabbed clean before wire or cable is installed.

3) Following methods are recommended for the supports and arrangement of the conduits.

- Conduit shall not be supported from piping that may have to be replaced or removed for inspection nor from high temperature piping. It is sometimes necessary to support conduits from ordinary piping.
- Provision shall be considered for thermal expansion or other movement of the supports, such as swaying of towers in high winds.
- Conduits are normally fastened to supports with pipe clamp or U-bolts; they shall not be tack welded. Substantial hangers shall be provided for groups of conduits where it is not practicable to clamp directly into building walls or structural members.
- Maximum distance between conduit supports : 1.5 m.

6.3.4. Junction boxes

1) The junction boxes shall be installed as indicated in typical block diagram for instrument interconnection and shall be permanently accessible.

2) Junction boxes shall be marked externally with suitable nameplates (corrosion - resistant).

3) Suitable corrosion-resistant cable glands shall be provided in order to house each cable.

4) All junction boxes shall be kept closed except when work is being performed upon them. Cable inlets shall be kept closed until cables are installed. Spare inlets shall be sealed.

5) Terminals inside junction boxes shall be installed and marked as indicated on drawings.

6) Connections inside the junction boxes shall be aligned so as to allow easy access to any wire.

6.3.5. Multicore cables

1) Installation of multicore cables and multitubes shall not start before all necessary trenches, ladders, trays and trunking are completely ready.
In addition trenches shall be cleared from all foreign matter and a bottom layer of sand shall be applied.

2) The CONTRACTOR shall cut to size cables and multitubes, seal the end remaining on the drum and put a label on the drum indicating taken quantity.

3) Multicore cables and multitubes shall be handled carefully. No excessive pulling or bending forces shall be applied in order to avoid any damage. The CONTRACTOR shall keep in mind the minimum permissible bending radius when handling and installing cables.

4) In order to avoid any damage due to low external temperatures, no cable or multitube shall be installed when the air temperature is below 5°C or less if accepted by the cable manufacturer.

When it is absolutely necessary to pull cables when it freezes, they shall be heated up at suitable temperature before pulling.

5) Installation of cables and multitubes shall be consecutive and uninterrupted. In case of interruption of cable installation, the trenches shall temporarily be covered and cables shall suitably be protected against damage due to traffic or to installation work.

6) In order to prevent stress, cables and multitubes shall be laid with sufficient slack when trenches are excavated in soft soils.

7) Cables and multitubes shall be suitably fixed in ladders and trays by preformed saddles or plastic ties (e.g. Colson strips). This shall be done :

- when changing direction,
- every 1.5 m on horizontal runs,
- every 30 cm on vertical runs.

If cables are clamped to conduits, pipes, etc. stainless steel cable ties shall be installed every meter in addition to plastic ones.

If cables are directly fixed to the structure, steel clips shall be used every 30 cm.

8) Marking of cables and multitubes shall be as follows :

- at approximately 5 m intervals (or at intervals agreed by the OWNER's REPRESENTATIVE) for underground cables and multitubes, by means of embossed strips of corrosion - resistant material.

- at their termination point (outside of junction box where applicable) and in between at places where markers can be easily traced for above ground cables and multitubes by means of suitable label of engraved or embossed plastic. Cables shall anyhow be tagged at the inside and outside of building walls.

9) After completion of the installation of multicore cables and multitubes, all trenches shall be backfilled as mentioned in par. 6.3.1. and all trunking shall be covered.

6.3.6. Electric signal lines

All electric signal lines shall be installed and connected as indicated on engineering drawings, taking into account the following requirements.

1) Plastic markers shall be provided on each side of each terminal for individual marking of all signal lines. Cross ferruling method shall be used.
2) Cable screens shall be interconnected in such a way that the screening is earthed only at the intended location.
3) Installation of special signal cables (e.g. coaxial cables) shall be performed as per manufacturer's recommendations.
4) Electric signal lines shall be laid in conduits or trays provided with supports at every 0.6 m maximum.
   Supports shall not in general be attached to piping, nor be attached or supported from instruments or control valves, except supports which are designed for direct mounting on pipes.
   Single pair cable shall be run on cable tray when more than 3 cables are run together. They shall be run as one single layer.

Where three cables or less are to be run (single circuit cables) from the main cable tray bank, these shall be run in straight lengths of conduit, size depending on number of cables. No conduit fittings shall be used, all angles, etc... are to be open. Alternatively the cables may be clipped in angle or channel section. Angle and channel shall be wire brushed and painted.

No cable shall be installed in the conduit until that part of the installation is complete. The conduit shall terminate away from angles to allow the permissible bend of the cable being installed. All conduits shall terminate away from instruments to allow for a loop of cable when terminating the cable.

5) No splicing of thermocouple extension cables is allowed. When absolutely necessary, connections shall be made in approved junction boxes.

6) Cables shall be suitably fixed in trays by plastic ties, every 25 cm on vertical runs and every 50 cm on horizontal runs.

7) Non isolated earthing cables laid on cable trays shall be isolated from the trays. Fixing bolts shall be stainless steel.

6.3.7. Segregation of cables

Instrumentation cables (4-20 mA, mV signals, etc..) shall be adequately separated from power wiring and electrical equipment to minimize interferences. The physical distance between instrumentation cables and power cables in parallel routing shall be as follows :

Voltage (V)	Min. distance (mm)
110	400
220/230	400
380/400	600
660/690	600
6000	1200

If required, the instrumentation cables shall cross the power cables at right angle and with a minimum distance of 300 mm.

6.3.8. Wiring terminations and installation practices

1) Cutting wire or cable to required lengths as it comes off a reel requires a location free from sharp objects.

A paved area is usually ideal, but if not available, a grassy or sandy area is adequate. Crushed stone, muddy, and shelled areas shall be avoided.
Where traffic must cross wire as it is laid on the ground, temporary board ramps shall be provided to keep vehicles from damaging the wire.

2) The Instrumentation cable list gives an indication of the cable lengths for information only, not to cut cables.

3) A cable end preparation shall allow for the following :

- terminate jackets and shield material without nicking insulation underneath,
- protect cable ends against moisture infiltration prior to connecting the cable to its

permanent terminations.

4) Stripping insulation from wire shall be done without nicking the conductor. Although this is of greater importance with solid wire than with stranded wire, it is a matter of concern with stranded wire also. The simplest way of avoiding nicks is to use stripping tools of proper design.

5) Insulated taper pins or spade lugs shall be used for all sizes of stranded wire. CONTRACTOR shall have proper tools to make these connections.

6) All wires or leads terminated at a connection shall have sufficient slack to reduce the effects of vibration. In application where multiple wires are routed from a common cable trunk to equally spaced terminals, the vibration bends shall be uniform in length to prevent stress on any one wire. Proper cable support is necessary to avoid having cable weight supported from wire terminations.

7) All cable or cable tray runs with entries into walls shall be sealed after installation of cables. To avoid any gas entering the control room(s) a special sealing box shall be installed in the wall of the control room(s).

8) Stainless steel kicking plates, sleeves or steel pipes shall be provided at least 500 mm above floor level where cables emerge from ground or from below steel structures.

9) In order to comply with the requirements for grounding at only one point, terminals are used to carry each shield through the junction boxes.

   Accidental shorting or grounding of this shield within a junction box shall be avoided. This can be done by insulating both the shield end and the shield drain wire between the end on the cable jacket and the terminal strip.
   Tubular heat shrink sleeves shall be installed on stripped pairs. The sleeves shall be applied immediately after stripping to prevent unravelling of the aluminum adhering mylar tape.
   Since only one end of a shield is grounded, each cable has an ungrounded end. This cable end is finished with no ground, and insulation is applied over the trimmed cable end to avoid accidental grounds on any exposed shield or the shield drain wire. Each shield shall be grounded in the control room or in the instrument room.
   Special care shall be taken to ground to the correct system, as indicated on the drawings.

10) Hot air heating equipment shall be provided to heat up the cables if connections have to be made when temperature is lower than 5°C.

6.3.9. Pneumatic signal lines

1) Single pneumatic lines shall be laid in trays, provided with supports at every 0.6 m maximum.
   Supports shall in general not be attached to piping nor be attached or supported from instruments or control valves.
2) The single pneumatic lines shall be marked with the instrument tag number at the point of connection to the multitube.
3) Sufficient slack shall be provided in all air tubing to avoid strain on the instrument connections and to facilitate dismantling of the instruments (provide extra loop, 8 cm diameter).
4) When PVC covered copper tubing is used copper tubing ends shall be coated with PVC spray and plastic tape and all copper or brass valves and fittings with PVC spray.
   The copper tubing shall be straightened and installed carefully to avoid kinking and unroundness.
5) In case the use of black polyethylene air tubing is specified (see air piping detail drawings) adequate tools shall be available for installation. Only careful handling of polyethylene tubing will result in a good installation. Elbow connectors shall be used for attaching the

tubing with short bends to solenoid.
valves, etc. to avoid that plastic tubing is bent with a small radius. Joints made with compression fittings shall have metal inserts to supports the tubing. Single polyethylene tubing shall be routed in open conduit.

6) Plastic sealing plugs shall be kept firmly fixed in air supply input, output and other connections, except during test and immediately before final plant connection.

7) Any air system, permanent or temporary used for energizing instrumentation shall be blown down thoroughly before making connections to the instruments and shall be from an oil free source.

Any connections between any air supply system and an instrument under test shall be via adequate filter and regulator. No temporary compressor shall be connected to the permanent instrument air distribution system.

6.3.10. Multi Cable Transit (MCT) Block

1) All cable entries inside control room shall be through MCT.

2) Actual sizing of MCT frame with blocks shall be the responsibility of CONTRACTOR based on actual no. of cables. While sizing MCT, CONTRACTOR to note that 50% spare block for each size / O.D. of cable shall be considered. MCT entries shall be closed with a thick CS plate which shall be removed by CONTRACTOR whenever the MCT shall be installed. The supply of MCT includes insert blocks, spare blocks, stay plates, end packing etc. For flexibility in engineering " peel of sleeve" type design shall be used to accommodate certain range of cable O.D. in the same size of insert block.

3) MCT shall be installed by CONTRACTOR as per the recommended practice of supplier. No spare space shall be uncovered in the frame.

6.4. INSTALLATION PRACTICES IN THE CONTROL ROOM AND IN INSTRUMENT ROOMS

6.4.1. General

Instrument installation work in control room and instrument rooms shall only start after completion of civil work (including air conditioning when applicable).

6.4.2. Installation of control boards and desks

1) The control boards and/or desks shall normally be delivered to site completely piped and wired up to bulkhead plates and/or to terminal strips. The CONTRACTOR shall install them in the control room upon their arrival on site in order to minimize storage time.
If not possible, they shall be stored by the CONTRACTOR under suitable ambient conditions.
2) The CONTRACTOR shall duly protect front and back of control boards and/or desks during installation and all construction phases in order to avoid any possible damage.
3) Any damage to control boards and/or desks occurring during installation shall be repaired at CONTRACTOR'S costs.
4) The CONTRACTOR shall clean front and back of control boards and/or desks and shall be responsible for maintenance until plant turnover.
5) The CONTRACTOR shall, if required by the OWNER's REPRESENTATIVE, make additional cut-outs on boards and/or desks after installation.
No flame cutting or welding is allowed on boards and/or desks.

Cutting shall be made using the most adequate tools so that board or desk finish be not damaged, and that cut-out will be neat and regular with smooth edges.

6) Any other authorized alteration that must be carried out to boards or desks shall be made in such a manner as to avoid shock or damage to instruments already installed.

7) If repairs have to be performed to the finishing of boards and desks, the procedure shall be submitted to the OWNER's REPRESENTATIVE before to proceed with the work.

8) Any holes drilled in walls, floors or ceiling for the passage of cables shall be filled with the appropriate material to prevent the spreading of fires, etc...

6.4.3. Installation of instrumentation equipment in instrument rooms

1) Racks, cross boards, control cabinets and auxiliary instruments shall be installed as shown on engineering drawings.

The CONTRACTOR shall provide all necessary protection during installation to avoid any damage and shall be responsible for maintenance and repair of possible damage until plant turnover.

2) Cable ladders, trays and/or trunking shall be installed as indicated on layout drawings.

They shall be firmly supported at sufficiently short intervals so as to avoid bending exceeding 0.5 % of span.

They shall be smooth internally in order to avoid any damage to cables.

6.4.4. Power supply cables

Power supply cables for instruments and analysers shall not be connected until complete tests have been performed on power distribution boards in order to avoid damages due to incorrect power supply or to avoid unsafe application of power supply.

6.5. MAINTENANCE

Upon arrival of the equipment in the field and prior to storage or installation, the CONTRACTOR shall remove all accessories which have not been shipped separately, mark them with the identification number of the relative equipment and store them in the warehouse. The same shall be done for spare parts.
The CONTRACTOR is also responsible for the following.

6.5.1. Instruments

1) To ensure that all instruments installed in the circuits are mechanically protected, until plant turnover, to prevent damages due to shocks.

2) Cleaning and greasing, with lead free grease, of the instrument flanges and threads oxidized during transport or storage.

6.5.2. Valves

1) Cleaning and greasing, with lead free grease, of block valve flanges and threads oxidized during transport or storage.

2) Replacement of stuffing in the stuffing boxes, wherever necessary.

6.5.3. Control room and instrument rooms

The CONTRACTOR shall clean the control room and instrument rooms on a continuous basis. Dust shall be removed from equipment and racks. Rubbish shall be collected and dumped in suitable places indicated by the OWNER's REPRESENTATIVE.

6.5.4. Keys

Locking keys for control cabinets, cubicles, relay boxes, panels, switches, locking devices shall be clearly identified, removed from their locks and carefully stored until plant turnover.

7. CALIBRATION, CHECKING AND TESTING

Upon receipt of instruments, after completion of installation and prior to setting instruments to work, the CONTRACTOR shall carry out adequate calibration, verifications and tests in order to ascertain that all equipment and systems are suitable for the intended duty, have been correctly installed and are in operating conditions.

7.1. TEST AND MEASURING INSTRUMENTS

1) Contractor shall include a list of test and measuring instruments and quote in the price bid.
2) Equipment to be supplied in this contract shall include comprehensive built in diagnostic and test facility for system maintenance.
3) The contractor shall include a list of special purpose test instrument and simulators necessary for the testing, trouble shooting and system maintenance of the equipment and quote in the priced bid.
4) The Contractor shall include a list of all general-purpose test instruments necessary for the maintenance of the equipment and quote in the price bid.
5) Special tools and maintenance accessories such as Card Extenders cable assemblies, card extractors, wire wrapping and unwrapping tools etc. shall be supplied in the form of maintenance kits. The number of such kits shall be 1 (one).
6) It is to be noted that the contractor shall arrange all test equipment, tools, accessories required for the installation and commissioning of the system to be supplied against this contract.

7.2. PROCEDURES

1) Calibration, tests and verifications shall be carried out in accordance with a schedule to be established by the CONTRACTOR and to be approved by the OWNER's REPRESENTATIVE.
   For those calibration, verifications and tests, the CONTRACTOR shall make available, at his expense, all personnel and equipment needed.
2) The OWNER's REPRESENTATIVE reserves the right to witness all calibration, tests and verifications and shall be advised with one week notice of such calibration, tests or verifications.
3) The results of calibration, verifications and tests shall be recorded on adequate documents by the CONTRACTOR.
   Those documents, which shall be approved by the OWNER's REPRESENTATIVE, shall indicate all works corresponding to calibration, verifications and tests.

After calibration, verifications and tests, the completed documents shall be transmitted to the OWNER's REPRESENTATIVE.

4) The CONTRACTOR shall correct at his expense all faults found in his works.

5) Readjustment and/or repair that may be required to instruments, ancillary equipments, mechanical, pneumatic, steam or electrical connections due to damages incurred during test operations and attributable to the CONTRACTOR shall be made by the CONTRACTOR at no extra cost.

7.3. CALIBRATION OF INSTRUMENTS

Instruments shall be calibrated before (or as soon as possible after) installation.

Calibration shall be carried out as follows.

7.3.1. Transmitters

Zero and range test (0, 25, 50, 75 and 100 %, upward and downward).

7.3.2. Indicators

Zero and range test (0, 25, 50, 75 and 100 %, upward and downward).

7.3.3. RTD'S

Zero and range test (0, 25, 50, 75 and 100 %, upward and downward).

The calibration method shall be approved by the OWNER's REPRESENTATIVE.

7.4. CHECKING

The CONTRACTOR shall perform the following verifications, using the latest revision of engineering documents.

1) To check, before installation, that instruments are in accordance with the technical specifications (correct tag number, range, size, type, rating, finish etc.).

2) To check all instrument and piping and associated fittings in order to ensure that they are installed in accordance with engineering drawings, are in perfect conditions and are fitted with necessary clamps.

   Those checks cover mainly process impulse lines, tracing, insulation and air supply. To check that all air sets are giving the correct air supply pressure.

3) Check of instrument location and orientation in order to ensure that they are accessible and easily readable.

   A check of instrument reading shall also be made during the night and local plant lighting changes suggested to the OWNER's REPRESENTATIVE, if necessary.

4) Check of all instrument block valves, drain and vent location for accessibility and from safety point of view.

   Drain valves shall be located in such a way that they do not contaminate underlaying instruments, machinery or equipment and are not hazardous for personnel.

5) To check that the high and low pressure taps are connected to the correct side of the respective instruments.

6) Check of all cable ladders, trays, trunking, conduits, supports, junction boxes, local instrument panels and protection cabinets. Attention shall be paid to damage, rust, missing gaskets, screws, bolts, keys, locks etc.

7) Check of terminal connections for proper identification and polarity.

   To check that spare wires are identified and properly connected to terminals or coiled inside the equipment.

8) To check that instruments, cabinets, boards etc. are properly earthed, wherever necessary.

9) To check that each instrument is suitably protected against adverse environmental conditions.

10) To examine all gaskets and valve stuffing boxes for tightness and replace if necessary.

11) To check connections for cable screening.

12) To check that correct power supply has been connected to instruments, analysers, relay boxes, control cabinets, control boards and other equipment and that suitable electrical protections are provided.

13) To check that cable entries to junction boxes are sealed and properly weather-proofed.

14) To check that temperature instruments are properly inserted inside thermowells.

7.5. TESTING

The CONTRACTOR shall carry out the tests described in the following paragraphs.

7.5.1. Testing of instrument process piping

Each instrument process piping, including sampling and transport lines for analysers shall be pressure tested and leak-tested.

The testing fluid shall normally be water.

However OWNER's REPRESENTATIVE shall specify the test medium which will be used.

The test pressure shall be 1.5 times the design pressure or equal to the maximum allowable pressure of the instrument whichever is the lower. After pressure testing, the instruments and associated process connection lines shall be drained and blown dry except in case where sealing liquid is used.

7.5.2. Testing of pneumatic transmission lines and air supply lines

Pneumatic transmission lines and air supply lines shall be leak-tested.

Test shall be performed as per ISA RP 7.1. "Pneumatic control circuit pressure test". During hydrotest, instruments shall be isolated.

7.5.3. Insulation test

All instrument wiring shall be checked out for insulation, shielding and grounding with megger test (500 volt range).

The test shall be made after the wires and cables have been installed but before connection to instruments and to control room termination cabinets or field mounted junction boxes.

Insulation shall not be less than 5 Megohm between wires, wire to shield and wire to ground.

7.5.4. Continuity test

A control of continuity of pneumatic lines or electrical lines shall be made between field mounted devices and equipment located in control room and auxiliary room.

These tests shall also be used in order to check that each instrument is perfectly working.

7.5.5. Testing of instrument loops

All electronic and pneumatic measurement and control loops shall be fully tested for proper operation. Special devices such as selection relays, computing relays etc. shall also be adjusted.

7.5.6. Testing of safety equipment and control systems

Alarm systems, safeguarding, sequential and control systems shall be fully tested for correct operation. This includes a careful check of initiating devices and final elements (connections and operation).

All settings for initiating devices, time relays etc. shall be adjusted.

7.5.7. Testing of electrical supply

A complete test shall be performed on electrical supply including automatic switch-over if applicable.

8. COMMISSIONING

After inspection and testing, all instrument loops shall be commissioned.

The CONTRACTOR shall make all necessary personnel available for repairs and modifications, which could be necessary during commissioning.

9. MEASUREMENT AND PAYMENT OF THE WORKS

1) The evaluation of the quantity of work performed, which has to be specified in the provisional work progress reports, shall be calculated by the CONTRACTOR and approved by the OWNER's REPRESENTATIVE.

2) The works shall be paid as specified in the AGREEMENT.

10. COORDINATION

The CONTRACTOR shall work in close cooperation with the OWNER's REPRESENTATIVE and other CONTRACTORS for necessary interfacing.

Every day during the erection period the CONTRACTOR'S representative on the site shall meet the OWNER's REPRESENTATIVE'S in order to receive instructions and comments and to examine all problems in relation to the works.

The CONTRACTOR shall also attend the weekly meetings and any other meeting if required on urgent basis.

SECTION 35

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

GTS – NAME PLATES, TAGS AND LABELS FOR INSTRUMENTATION

(DOC No.-GTS-NP,T&L/IGL/ET2/CP/CP18160)

SHEET	CAD-DWGNAME	TITEL	ISSUE 21/10/--	29/04/98							
A +	XX7001	NAMEPLATES,TAGS AND LABELS FRONT SHEET	1	2							
B –	XX7001_A	NAMEPLATES,TAGS AND LABELS REMSION SHEET	1	2							
001 +	XX700101	NAMEPLATES,TAGS AND LABELS GENERAL NOTES	1	2							
002 +	XX700102	NAMEPLATES,TAGS AND LABELS JUNCTION BOXES	1	2							
003 –	XX700103	NAMEPLATES,TAGS AND LABELS INSTRUMENTS AND PANELS	1	2							
004											
005											
006											
007											
008											
009											
010											
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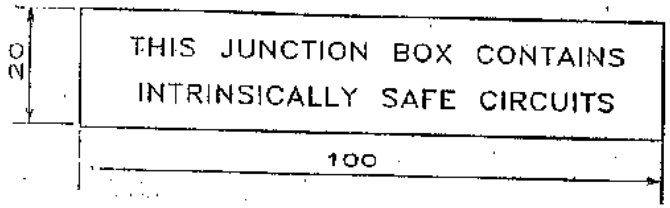
GENERAL NOTES

1. Identification lettering shall be oriented horizontally and centered.
2. All dimensions are in mm.
3. The nameplates shall be fixed by non-corrosive screws or rivets.

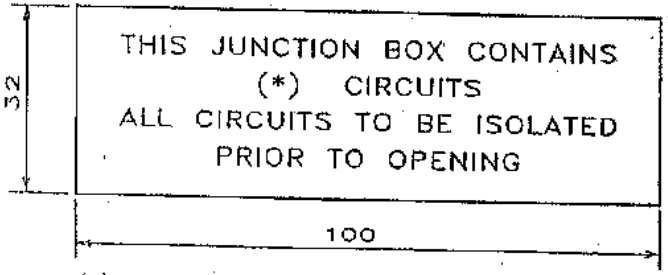
NAMEPLATE 1

I/S APPLICATION



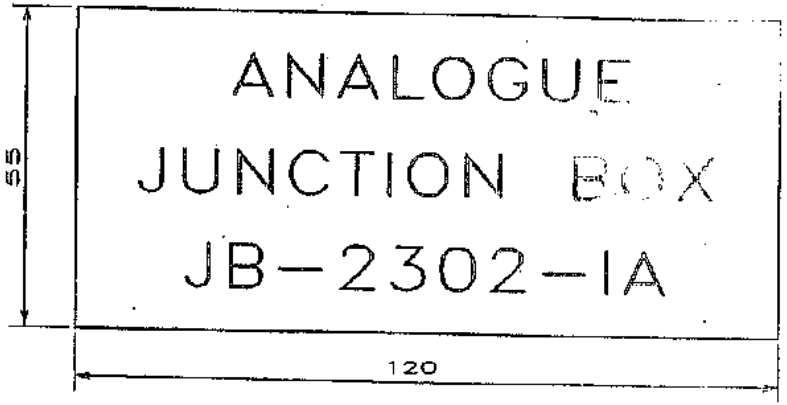
CHARACTERS TO BE 3MM HIGH
MATERIAL : BLUE – WHITE – BLUE TRAFFOLYTE

NON I/S APPLICATION



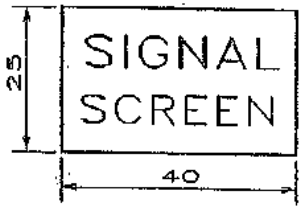
(*) APPLICABLE VOLTAGE
CHARACTERS TO BE 3MM HIGH
MATERIAL : WHITE – RED – WHITE TRAFFOLYTE

NAMEPLATE 2



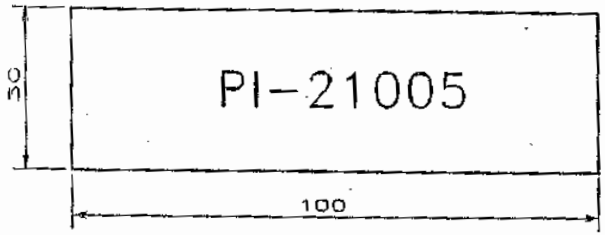
CHARACTERS TO BE 7,5MM HIGH FOR
ROWS 1 AND 2 , AND 10MM HIGH FOR ROW 3
MATERIAL : WHITE –BLACK – WHITE TRAFFOLYTE

NAMEPLATE 3



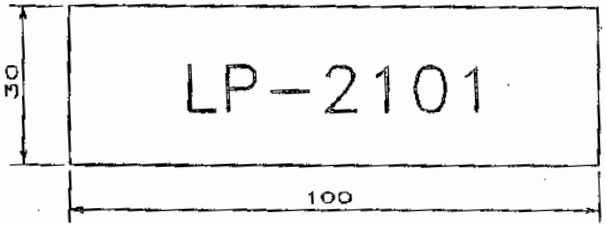
CHARACTERS TO BE 5MM HIGH
MATERIAL : WHITE –BLACK – WHITE TRAFFOLYTE

NAMEPLATES FOR FIELD INSTRUMENTS



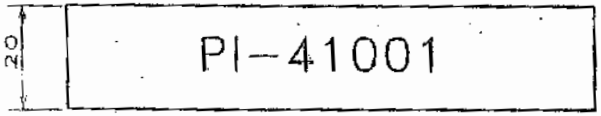
CHARACTERS TO BE 15MM HIGH
MATERIAL : WHITE –BLACK– WHITE TRAFFOLYTE

NAMEPLATES FOR PANELS AND CABINETS



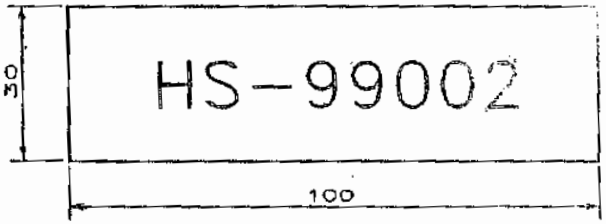
CHARACTERS TO BE 15MM HIGH
MATERIAL : WHITE - BLACK - WHITE TRAFFOLYTE

NAMEPLATES FOR PANEL MOUNTED INSTRUMENTS



CHARACTERS TO BE 10MM HIGH
MATERIAL : WHITE - BLACK - WHITE TRAFFOLYTE
WIDTH : DEPENDING ON AVAILABLE SPACE

NAMEPLATES FOR FIRE AND GAS DETECTORS AND MANUAL CALL POINTS



CHARACTERS TO BE 15MM HIGH
MATERIAL : RED - WHITE - RED TRAFFOLYTE

SECTION 36

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

GTS – PIPELINE VALVE
(DOC No.-GTS-PV/IGL/ET2/CP/CP18160)

TABLE OF CONTENTS

1. SCOPE

This General Technical Specification covers the supply of pipeline valves used in high pressure natural gas transport and distribution systems. It describes the general requirements, controls, tests, QA/QC, examination and final acceptance criteria which needs to be fulfilled.

This specification is general and is updated / amended by the Particular Technical Specification dedicated to the project.

2. DEFINITIONS

Engineer : 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.

Purchaser : The Company which makes the purchase order.

Control Authority or **CA** : The Organisation put in place/requested by the Purchaser/Engineer to proceed to Quality Controls and Certification.

Manufacturer : Manufacturer who receive the purchase order

3. PRELIMINARY STATEMENT

The name of Control Organisation shall be mentioned in the purchase order. 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 Purchaser/Engineer and the Control Authority before the eventual order to the Manufacturer. The latter is responsible and shall indemnify the Purchaser/Engineer for any damage resulting from the non-respect of this obligation.

The specifications of the steel used, the material Manufacturer and all potential subcontractors (such as forging plant, heat treatment, weld fabrication, …) will be described in the offer. After order, no change will be accepted except for justified "force majeure". In that case, the asked changes shall be supported by a technical file submitted to the Purchaser/Engineer for approval.

The Manufacturer shall provide a technical description of the manufacturing method that might influence the quality of the material.

When the order is placed, the Manufacturer shall promptly inform the Purchaser/Engineer about his subcontractor's names, addresses, phone numbers as well as sub-order numbers, extent and delivery terms. On this basis, the Manufacturer shall send a general planning including at least the raw material supply, the manufacturing stages (machining, welding, part assembly, …), testing , painting and packing/dispatching. This planning shall

be updated by the Manufacturer at least every month unless otherwise provided in the purchase order. A Dispatcher/Inspector delegated by the

Purchaser is entitled to follow, examine and verify the planning's' relevance and effectiveness

The Purchaser keeps the right to audit the Manufacturers and subcontractor's manufacturing process and control methods. All costs form such an audit shall be borne by the Manufacturer except the wages and travel expenditures of the auditor(s) supported by the Purchaser.

The manufacturing processes and the laboratories, in which welding tests, destructive and non destructive tests are carried out, shall be approved by the Control Authority.

The Purchaser/Engineer and the Control Authority shall have, at any time, free access to all parts of the Manufacturer's facilities and to those of all his subcontractors involved in the order manufacturing. All reasonable means shall be placed at the inspector(s)'s disposal to enable him to check that the product is being manufactured in accordance with this specification. All tests and inspections required in this specification shall be carried out, prior to shipment, in the Manufacturer's plant (or subcontractor's plant) and at the Manufacturer's expenses, unless otherwise provided in the order. The Purchaser/Engineer and the Control Authority shall try not to interfere unnecessarily with other Manufacturer's works when running these tests and inspection.

A valid copy of the ISO 9001 certificate shall be included in the offer.

For any control, test or examination required under the supervision of the Control Authority (LOFC intervention points included), the latter shall be informed in writing FIFTEEN (15) working days in advance by the Manufacturer about place and time with a copy to the Purchaser/Engineer.

If manufacturing is to be carried out under LOFC concept, the Manufacturer shall send for approval a List of Operation in Manufacturing and Control to the Control Authority and Purchaser/Engineer, 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.

Material, even released by the Control Authority and in which injurious defects are found after delivery, shall be rejected. The Manufacturer shall be notified and the material replaced : all costs involved, including wages and travel expenditure of the Control Authority's representative, Purchaser and Engineer shall be borne by the Manufacturer.

An approval of documents can never be considered as an acceptance of deviations on relaxations to requirements. A deviation is only possible after specific request to the purchaser.

4. GENERAL

- Valves are intended to be used in aboveground or underground, with cathodic protection services.

  All particular conditions for each valve are described in attached data sheet and valve list.

  All valves shall conform to API 6D spec. Whenever this specification and API 6D spec. conflict, this specification shall prevail.

  Unless otherwise specified, pipeline valves covered by this specification are suitable for use in gas transmission and distribution systems, and in accordance with ASME B31.8.

5. CODES, NORMS AND STANDARDS

Latest edition of following standards are applicable.

- ASME STANDARDS

ASME B16.5	Pipe flanges and flanged fittings
ASME B16.34	Valves- flanged and butt welding end
ASME B31.8	Gas transmission and distribution piping systems

- ASTM STANDARDS

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 193/A 193 M	Alloy steel and stainless steel bolting materials for high temperature service
ASTM A 194/A 194 M	Carbon and alloy steel nuts for bolts 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 & Steel Pipes 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

- API STANDARDS

API 5L	Specification for line pipe
API 6D	Specification for pipeline valves, end closures, connectors and swivels
API 6FA	Fire test for valves
API 605	Large diameter carbon steel flanges

- MSS STANDARDS

MSS SP 6	Standard Finishes for Contact Faces of Pipe Flanges & Connecting – End Flanges of Valves and Fittings
MSS SP 25	Standard marking system for valves, fittings, flanges and unions
MSS SP 44	Steel pipeline flanges
MSS SP 54	Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components Radiographic Examination Method
MSS SP 55	Quality standard for steel castings for valves, flanges

	and fittings and other piping components (visual method)
MSS SP 72	Ball valves with flanged or butt welding ends for general service
MSS SP 75	Specification for high test wrought butt welding fittings

- ASME STANDARDS

ASME	Boiler and Pressure Vessel code

- EN STANDARDS

EN 10204	Metallic products : types of inspection documents
EN 10045/1	Metallic products : Charpy impact test – test methods (V and U notches)

- ISO STANDARDS

ISO 148	Acier – Essai de résilience Charpy (entaille V)
ISO 9001 :	Quality management standard

- BRITISH STANDARDS

BS 5146	Inspection and test of valves
BS 5351	Steel ball valves for the petroleum, petrochemical and allied industries

- NACE STANDARDS

MR0175	Sulphide Stress Cracking Resistant Metallic Materials for Oilfield Equipment.

6. DESIGN AND CONSTRUCTION

6.1. RATINGS

1) The pressure temperature ratings of flanged and butt welding end valves shall be in accordance with ASME B16.34.

2) The temperature and pressure ranges of valves shall be in accordance with the indicated values on the appropriated piping specification and valve data sheet.

3) Wall thickness for parts used for the welding connection with the line pipes shall meet the following requirements :

- The maximum allowable stress in the material of the butt weld connection for butt welding end valves shall be equal to fifty per cent of the minimum yield strength guaranteed by the specification of the steel used.

- The minimum wall thickness for butt welding connection must be greater than or equal to the largest value of either the calculated minimum thickness of butt welding connection or the nominal thickness of the pipe as indicated on data sheet.

- If the butt welding connection has a 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 butt welding connection is at least equal to the specified pipe wall thickness times the ratio of the minimum yield strength guaranteed by the specification of the steel of the pipe and the minimum yield strength guaranteed by the specification of the steel of the butt welding connection.

- The specified pipe wall thickness and grade (with reference to the equivalent grade in API 5L spec. or ASTM spec.) with which the valve is intended to be used is specified in the data sheet/piping class.

4) The Manufacturer shall submit for approval to the Control Authority and to the Purchaser/Engineer the dimensional drawings, the calculation of the parts used for the welding connection to the pipeline and the material part list for all the types of valves. All these documents must be identified with the individual valve number according to attached valve list and shall be attached to the CMTR.

5) The design shall take into consideration performance requirements prescribed in the next paragraph.

All valves under this specification shall be designed to withstand a field hydrostatic test pressure with non corrosive water, after installation, during 24 hours when the gate, plug, ball or piston is partially or fully open at a pressure of 1.5 times the 38^{O}C pressure rating gauged by ASME B16.34

During this test the closure element shall not be moved.

6.2. DESIGN

6.2.1. Face-to-face and end-to-end dimensions

Face-to-face and end-to-end dimensions for ball valves shall be in accordance with API spec. 6D.

Valves may be made to special dimension by agreement between the Manufacturer and the Purchaser.

6.2.2. Welding ends

The connecting pipe outside diameter, wall thickness, specified minimum yield strength and material grade are mentioned in the relevant piping specification and valve data sheet.

Butt-welding ends shall be in accordance with figure 1 for wall thickness up to 20.0 mm; for thicker walls, refer to figure 2. The inside diameter at the welding end shall be equal to that of the pipe on which the valve shall be welded. If a welding end of a valve has a thickness not equal to the pipe with which it is intended to be used, the welding end preparation at the joint has to be in conformity with fig. 3.

The tolerance of the inside diameter at the bevel end shall be following :

NPS	Tolerance of inside diameter at bevel end (1) (mm)	
2" - 10"	+ 1.6	-0.4
12" - 48"	+ 2.4	-0.8

(1) Tolerance refers to variation from specified ID calculation by (OD spec. - 2t spec).

OD = outside diameter t = wall thickness

The out-of roundness at a welding end, defined as the difference between the maximum and the minimum inside diameter at the welding pipe end shall not exceed 1% of the specified inside diameter.

The length of the butt end shall be sufficient to allow welding and heat treatment without damage of the internal parts of the valve. If Purchaser/Engineer accepts design which do not meet this requirement, than Manufacturer shall inform the Purchaser/Engineer about the precautions which needs to be fulfilled in order to guarantee that during welding of the butt welding ends no damage shall occur to the seat. These precautions shall be highlighted by the Manufacturer in the erection and installation instruction book.

6.2.3. End flanges

End flanges shall be furnished in the same class as the valve body with raised face or ring-joint face, as specified by the valve data sheet. Dimensions and tolerances (including drilling templates, flange facing, spot facing and back facing) shall conform to :

- ASME B16.5 standard for NPS 24" and smaller
- MSS SP-44 for NPS 26" to 60"
- MSS SP-6 for flange facing.

6.2.4. Design features

All ball valves shall be full bore - to allow pigging - unless stipulated otherwise on the valve data sheet.

All trunnion mounted ball valves shall be fitted with following devices :

- Double block and bleed : design of a valve with two seating surfaces between which the cavity can be vented through a bleed connection and thus confirm the tightness of the valve, at least in closed position, when pressure is applied to any side or both sides of the valve.
- 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.
- Anti-static design : all ball valves shall be fitted with anti-static device conforming to BS 5351.
- Stem retention (anti blow-out) : In conformity with BS 5351 valve shall be designed with an anti blow-out stem so that the stem cannot be fully ejected by pressure inside the valve with the stem packing, gland retainer bolting removed.
- Secondary seat and stem sealing : all ball valves NPS 6" shall be fitted with a secondary stem sealing and all ball valves greater or equal to NPS 8" shall be fitted with a secondary seat and stem sealing. This system permits an injection of sealant and shall be fitted with an integral check valve. The number and the location of sealing points shall be on the Manufacturer's responsibility.

  Purchaser is allowed to request the check of this system design and its operation, specially for modified or new valve model.
- A drain connection shall be located at the lowest part of the body cavity.

6.2.5. Auxiliary connections

The Manufacturer shall complete the valve data sheet with the size and allowable pressure for the following auxiliary piping connections.

a) Aboveground valves

- The drain shall be plugged.
- The vent/bleed connection for valves NPS 6" and above shall be equipped with one block valve plus one needle valve, each with anti blow-out stem. The block valve shall be of ball type. The needle valve shall have screwed connections, shall be preferably of angular pattern and shall be fitted with a special plug at the outlet : this plug shall be designed to relieve slowly the pressure without being ejected.

- For valve size < NPS 6", the vent/bleed connection shall be equipped with this anti blow-out, depressurising plug only.
- Each secondary stem - and each secondary seat sealing device, when required (see § 6.2.4.), shall be fitted with a check valve integrated in the body plus a sealant fitting with built-in, spring loaded ball check valve, as mentioned in the valve data sheet.

b) Underground valves

- Vent/bleed connection shall be plugged and this functionality is by passed through the drain.
- Drain shall be fitted with a normally open block valve (ball type with anti blow-out stem) at the drain tap, piped to the upper part of the extension and ended by one ball valve plus one needle valve, each with anti blow-out stem.
- The needle valve shall have screwed connections, shall be preferably of angular pattern and shall be fixed with an anti blow-out, depressurising plug, at the outlet.
- Each stem and seat sealing connection, when required (see § 6.2.4) shall have a check valve integrated in the main valve body, a block valve (ball type with anti blow-out stem) closed to the body tap, shall be piped up to the upper part of the extension and equipped with a block valve (same type) plus a sealant fitting with built-in, spring loaded check valve, as mentioned in the valve data sheet.
- Valves and tubing shall be carefully fastened to the valve body and/or extension.

Valve bodies shall have tapped holes with a minimum effective threaded engagement at least equal to the nominal thread diameter. If body wall thickness is too thin, then unthreaded side of OEP/OET (One End Plain/One End Threaded) piece of pipe of a material compatible with the body, shall be welded to the valve body with full penetration or via a boss. Anyway, weld on threads is prohibited.

Material of auxiliary connections (pipe, tube, fittings, valve, …) shall be, at the least of the same material quality as the main valve and can be in stainless steel series AISI 300.

6.2.6. Stem extension for underground valve

When a stem extension is required (see valve data sheet), the configuration and the length H shall be in accordance with this valve data sheet.

In this case and except otherwise specified in the purchase order, valves shall be fitted with drain and sealant extensions well fixed to the stem extension and clearly indicated in the as built design. The stem extension shall be fully watertight, but shall be provided with a means to prevent overpressure built up in the mechanism resulting from stem or bonnet seal leakage.

Valves, equipped with stem extension and/or actuator, shall be delivered completely equipped and mounted (in one piece).

Underground actuated valves shall be provided with one identification plate on the valve body and one on the upper part of the extension.

6.2.7. Miscellaneous

Lifting lugs are required on all valves NPS 6" and larger. The lifting lugs shall be stamped with the safe working load. Number of lugs shall be sufficient for safe handling on site. Valve support : All valves greater than NPS 24" shall be equipped with supports to permit the installation of the valve in horizontal position directly on the floor. These supports shall be directly welded or fitted on the body of the valve.

6.2.8. Design review

The Manufacturer shall submit for approval to the Engineer/Purchaser and Control Authority the calculation for all bonnet, cover and body bolting for pressure retaining parts conforming to ASME B16.34.

6.3. OPERATION

6.3.1. Valve shall be operated by a hand-wheel, wrench, manual key or actuator.

Manual override devices shall be provided on all valves. Hand-wheels of electric actuators, shall be normally disengaged and shall automatically disengage when the actuator is operated.

6.3.2. The length of the wrench or diameter of the hand-wheel for direct or gear operated valves shall (after opening and closing a new valve at last three times) be such that a force not exceeding 350 N shall be required to operate the ball from either the open or closed position under the maximum differential pressure recommended by the Manufacturer.

For valves without stem extension equipped with a hand-wheel in vertical position, the maximum radius of the hand-wheel is equal to the distance between the centre line of the pipe and the centre of the hand-wheel minus 120 mm. In this case no extruding lugs on hand-wheel are permitted, and provision for by-pass valve shall be kept.

6.3.3. Hand-wheel shall be marked to indicate the direction of closing.

6.3.4. Hand-wheels and wrenches shall be fitted in such a way that whilst held securely they can be removed and replaced where necessary.

6.3.5. All ball valves shall be provided with a mark on the stem to show the position of the ball in order to enable a good regulation of the actuator without seeing the ball. Exception can be made for valves with gear boxes for underground service.

6.3.6. Ball manual direct operated valves shall be fitted out with fully open and fully closed stops. These stops shall be well fixed to the body of the valve in order to withstand many extreme opening and closing actions. These stops shall be easily removable. Ball gear operated valves shall be fitted out with fully open and fully closed stops shall be adjusted and fixed on the gear box.

6.3.7. The Manufacturer shall advise the maximum operating torque or force which can be sustained without causing permanent damage anywhere in the drive train from the actuator to the obturator. The Manufacturer shall also provide the torque graph : torque value in function of opening angle of the ball and pressure.

Deflection in the extended drive train must be limited so that the closing position contact reflects exactly the real position of the obturator.

6.3.8. Maximum rated differential pressure (MRDP)

The MRDP is the maximum difference between the valve upstream and downstream pressure at which the obturator (closure member) may be operated (opening). The Manufacturer shall specify this value and shall mark it on the valve name plate.

For the specification of different types of actuator refer to the concerned GTS/740/403.

7. MATERIALS

7.1. STEEL USED

The steel used in the valve Manufacturing shall be selected by the Manufacturer and filled in data sheet form

This list shall be submitted for approval to the purchaser/Engineer at the time of the offer. This list shall be added to the CMTR.

7.2. PRESSURE RETAINING PARTS

For pressure retaining parts the following requirements must be fulfilled

7.2.1. 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 Purchaser/Engineer) and be furnished with certificates EN 10204-3.1. B 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), 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.

For the valves with butt welding end, for the part on which the line pipe shall be welded, see paragraph 7.2.4. and 8.4.

7.2.2. Notch toughness properties

The impact test temperature conditions and temperature are defined under Section 8.4.2.

7.2.3. The carbon content of parts involved in welding operation (except for those parts which shall be used for the welding connection with the line pipes) shall be restricted as follows :

- maximum percentage of carbon : 0.230
- $C + \frac{Mn}{6} \leq 0.41$

7.2.4. For parts used for the welding connection with the line pipes the following supplementary requirements must be fulfilled :

- The chemical composition of the steel meets the requirements of table 1. The choice and use of alloying elements made from high strength low alloy steels to give the tensile properties prescribed in table 2 shall be made by the Manufacturer and included and reported to identify the type of steel.
- For each heat, the Manufacturer shall analyse the following elements : C, Mn, Si, P, S, Nb, V, Cr, Mo, Ni and Cu.
- The carbon equivalent shall be computed by the following equation :
- $$C.E. = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

  and shall not exceed 0.45.
- The steel used shall be fully killed, fine grain practice.
- The steel used shall be suitable for field welding to pipes, flanges or fittings manufactured under ASTM A53, A105, A106, A234, A333, A350, A381, A420, A694, A707 or API 5L, 605 or MSS SP-44, SP-72, SP-75, EN10208-2.
- The steel used has tensile properties conforming to requirements prescribed in table 2 and capable of meeting the valve design.
- The ratio of yield strength to tensile strength shall not exceed 0.85.
- Mechanical tests as prescribed in section 8.4. shall be performed after final heat treatment.

7.3. BONNET, COVER AND BODY BOLTING

Bonnet flange cover, and body bolting shall be conform to ASTM A320 Gr L7 or L7M or ASTM A193 grade B7 or B7M. Nuts shall be conform to ASTM A194 Gr 7 or 7M or 2H. For NPS greater than 4", they must be supplied with certificates EN 10204-3.1.C. and for NPS 4" and smaller with certificates EN 10204.3.1.B. These certificates shall be added to CMTR.

Bolt design shall be done to withstand safety all stresses occurring under operating conditions, calculations shall be submitted for approval.

Materials shall be compatible in order to avoid galvanic corrosion and shall not be susceptible to hydrogen embrittlement or stress corrosion cracking. Manufacturer must take into account that the materials shall be eventually cathodic protected.

7.4. NON-METALLIC PARTS

Non-metallic parts and elements, which usually include such items as packing, injectable material and lubricants, shall be suitable for the service and must be defined in the offer.

7.5. OTHER PARTS

Metal parts, which usually include such items as yokes, yoke nuts, stems, glands, gland bushing, gates, balls, plugs, discs, pistons, hand-wheel, gearing and motor drive attachments, shall be of material suitable for the service and must be defined in the offer.

7.6. SOUR GAS SERVICE

When sour gas service or NACE is specified, all process wetted, pressure containing parts and bolting shall meet the requirements of NACE MR0175.

8. FABRICATION AND TEST

Prior to manufacturing a meeting shall be organised between Manufacturer, Purchasing agent, Engineer and Control Authority.

8.1. WELDING FABRICATION

1) Welds and repair welds shall be performed according to written procedures. The welding procedure must be submitted for approval to the Control Authority before any fabrication and/or repair.

2) Only welders and welder operators who are qualified shall be used in production.

3) The joints shall be furnished in accordance with the requirements of Section VIII of ASME Boiler and Pressure Vessel Code - Division 1.

4) The machine welding shall be done by an electric process, preferably by submerged arc.

5) Repair by welding is prohibited on forged material.

8.2. WELDING PROCEDURES

8.2.1. 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.

For the tensile test, the rupture of the specimen must take place in the unaffected parent material.

The welding procedure qualification must include an impact test set in the weld and in the HAZ with requirements of paragraph 8.4.2. and a macrographic examination described in paragraph 8.2.2. These tests shall be performed after eventual final heat treatment. If weld thickness is higher than 25 mm, even covered by the PQR, additional impact test shall be performed on the test specimens taken in weld thickness layers.

8.2.2. 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 macroscopic 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 8.5.).

8.2.3. Additional requirements for "Sour Gas". Qualified welding procedure shall guarantee a good geometry without stress concentration and shall be realised according to NACE MR 0175 (max. 1% Ni in welding consumables).

On the macro, series of hardness tests shall be performed in the base metal, weld and Heat affected zone; results shall be maximum 248HV10

8.3. HEAT TREATMENT

8.3.1. After hot working and before re-heating for normalising heat treatment, forging or casting shall be allowed to cool substantially below the transformation range. All forging or casting 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.

Heat treatment of welds : the rules of ASME VIII Div. 1 are applicable. If a required treatment is not feasible (seat damage, etc, …), special agreement must be obtained from Purchaser/Engineer and Control Authority ACA, after the Manufacturer has proved good quality of welds.

8.3.2. The Manufacturer shall include in the CMTR data of this heat treatment.

8.4. MECHANICAL TESTS ON THE PARTS USED FOR WELDING CONNECTION WITH THE LINE PIPES

The following mechanical tests shall be performed on these parts after final heat treatment under the supervision of the Control Authority's delegate and the certificates shall be added to the CMTR.

Test specimens may only be cut after a marking transfer by the Control Authority.

8.4.1. Tensile testing

Requirements :

The material shall be in conformity with table 2. The ratio of yield strength to tensile strength shall not exceed 0.85.

Test specimen :

The test specimen represents any part of the same shape, the same heat of steel and the same heat treatment lot.

Number of test : one

Test location and orientation :

The test specimen shall be orientated transversally to direction of lamination and if this orientation is not feasible, it shall be orientated longitudinally. For castings only one orientation is applicable.

Test method :

Testing shall be performed in accordance with ASTM A370 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. If another material are accepted by the Purchaser, the test method will be as specified in the material specification.

8.4.2. Impact test

Requirements

The standard impact test temperature is -20°C, except if otherwise stated in the "Material Requisition" or particular Technical Specification. The average value of a set of 3 test specimens shall be equal to 35 J/cm². The minimum value per test specimen shall be equal to 35 J/cm² but this value may drop to 28 J/cm² for only one test specimen per series.

- Test specimen :

  The test specimen represents any part of the same shape, the same heat of steel and the same heat treatment lot.

- Number of tests :

  2 test sets (3 test specimens constitute one test set). For castings only 1 test set.

- Test location and orientation :

  1 set shall be orientated longitudinally and another one transversally. For castings only one orientation is applicable.

- Test method :

  The notched bar impact test shall be performed in accordance with ISO 148 or A370- Charpy V - Notch.

  If the wall thickness of these parts 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 these parts. If the weld thickness is > 25 mm, several specimen sets shall be taken in the weld thickness with min one (1) set per 12.5 mm of thickness, the specimen sets shall be selected in agreement with the Purchaser/Engineer and Authorised Control Authority.

8.5. NON DESTRUCTIVE EXAMINATION (NDE)

The following NDE will be performed after the final heat treatment and before coating.

8.5.1. List of NDE

- All butt welds shall be examined by a radiographic examination. If the thickness exceeds 15 mm or if the radiographic examination is not feasible than welds are only examined by ultrasonic examination to the largest extent possible.

The radiographic examination shall be executed in accordance with ASME Boiler and Pressure Vessel Code, section V, art. 2 - using fine grain film and lead screens.

- Butt welding ends on cast bodies shall be examined before fabrication welding end, by radiography in accordance to MSS-SP-54 and over a width of 70 mm.

- 25 mm of base material at each side of each weld and each weld shall be 100 % ultrasonically examined.

  The ultrasonic examination shall be executed in accordance with ASME Boiler and Pressure Vessel Code, section 5, art. 5.

- Body for all valves NPS 6" and greater shall be tested by magnetic particle examination in conformity with ASME Boiler and Pressure Vessel Code, section V, art. 7.

  - All valves shall be visually examined.

  - All valves shall be dimensionally examined.

  - For butt welding end valves after machining, the finished bevel end pipe used for field welding shall be submitted to the following tests :

    - Magnetic (ASME V Art. 7) or liquid penetrant (ASME V Art. 6).

    - Ultrasonic inspection (ASME V Art. 5) or radiographic examination (ASME V Art. 2)on 25 mm of base material.

    - Visual and dimensional examination.

  - If any repair by welding is performed, the concerned parts shall be completely re- examined.

8.5.2. Additional NDE requirement for "SOUR Gas"

A series of hardness test on surfaces in contact with the fluid shall be performed to NACE MR 0175. Results shall be 22 HRC or 248 HV 10 max.

8.5.3. Acceptance criteria of the different NDE

- Radiographic examination :

  ASME Boiler and Pressure Vessel Code, section VIII, division 1, UW 51 for forged steel

  ASME Boiler and Pressure Vessel Code, section VIII, division 1, appendix 7 for casted steel. The control will done on width of 70mm with.

  On the first 40mm A1,B1,C1 acceptable, D, E, F and G are rejected.

Between 40mm and 70mm, A2, B3, C3 acceptables; D, E, F, G are rejected.

- Ultrasonic inspection of weldings and HAZ:

  ASME Boiler and Pressure Vessel Code, section VIII, division 1, Appendix 12.

- Magnetic particle inspection of the body:

  ASME Boiler and Pressure Vessel Code, section VIII, division 1,

  Appendix 6. For casted pieces refer to Appendix 7.

- Visual examination

  MSS-SP-55.

- Magnetic particle or liquid penetrant of 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.

All the NDE (except radiographic examination) shall be performed under the supervision of the control authority's delegate and the certificates shall be added to the CMTR.

8.6. PRESSURE TESTING

8.6.1. General requirements

- Each valve shall be tested by the Manufacturer under the supervision of the Control Authority after final completion of all welding and all heat treatment operations.
- Hydrostatic and air seat test shall be performed after an acceptable shell test.
- Fluid for shell and hydrostatic seat tests shall be liquid as water (which may contain a corrosion inhibitor), kerosene, or other fluid with a viscosity not greater than that of water. Temperature of the test fluid shall not exceed 50°C.
- Valves shall be substantially relieved of air when tested with liquid.
- Valves shall be shell tested prior to painting.
- Valve test fixture loads applied to valve ends shall be limited to those required to effectively seal the valve ends.
- Pressure testing certificates shall be included in the CMTR.

- Drain, the sealant and the bleed valve shall be included in all pressure tests.

- If any supplementary welding, repair by welding or treatment are performed, valve shall be completely re-tested.

8.6.2. Shell test

- Each valve shall be given a shell test at the gauge pressure not less than 1.5 times the 38°C rating gauged by ASME B16.34, rounded off to the next higher 1 bar increment.

- Shell test shall be conducted with the valve in a partially open position and with the valve ends closed.

- *Drain lines and valves*

  Shall be either included in the hydrostatic shell test, or tested separately.

- Duration of the shell test

  NPS up to 18" shall not be less than 15 minutes.

  NPS 20" and larger shall not be less than 30 minutes.

- Visual leakage or harmful inelastic deformation are not accepted.

8.6.3. Hydrostatic seat test

- Each valve shall be given a hydrostatic seat test at the gauge pressure not less than
  1.1 times the 38°C rating gauged by ASME B16.34, rounded off to the next higher 1 bar increment.

- Seat closure testing shall be performed with seat surfaces free of sealant, grease or other foreign material that aids in sealing except as provided hereafter :

  - When necessary to prevent damage during valve actuation, a light oil of viscosity not greater than that of kerosene may be applied to sealing surface.

  - When valve primary design is based on the presence of a sealant material (lubricated plug valve), the sealant material may be in place.

- For valve of the double seating type such as gate, plug and ball valve, the test pressure shall be applied successively to each end of the closed valve and leakage to opposite end checked. Provision shall be taken before, for de energising the self relieving pressure system.
  - For soft seated valves there shall be no visible leakage - for metal seated valves the leakage rate shall not exceed 0.006 ml per minute and per mm of nominal pipe size (ND).
  - For double block and bleed valve the following tests shall be performed :

Close valve, open body vent, apply seat test pressure to both ends of the valve. Close valve, open body vent, apply seat test pressure to one end of the valve, release pressure and repeat test for the other end of the valve.

- For double piston effect valve the following test shall be performed :

  Release pressure, close valve, open body vent, apply seat test pressure through the body vent.

- For other valve type, the test pressure shall be applied across the closure member in the direction producing the most adverse seating conditions. For example, a globe valve shall be tested with pressure under the disc. A check valve, globe valve or other valve type designed, sold and marked as a one-way valve, requires a closure test only in the appropriate direction.
- The duration of the hydrostatic seat test shall not be less than 5 minutes for each end.
- Visual leakage or harmful inelastic deformation are not accepted.

8.6.4. External leak testing

Under the supervision of the Control Authority's delegate, the Manufacturer shall check the external leak tightness of body, stem and all external taps. This shall be done with soap suds at an inner pressure of 6 bar. For underground valves, this test shall include piping, fittings and valves of the auxiliary lines for drain, vent/bleed and sealant connections.

8.6.5. Air seat test

- Each valve shall be given an air seat test at 6 bar.
- This test shall be performed in the same manner as hydrostatic seat test.
- The duration of this test shall not be less than 5 minutes for each end.
- No signs of leakage are accepted.

8.6.6. Procedure

Procedure of all pressure tests shall be included in the offer.

8.6.7. After tests

After test, any auxiliary connections shall not be removed, and auxiliary piping shall be cleaned and dried, especially the sealant piping.

8.7. OPERATIONAL TORQUE TEST

For valves operated with an actuator the Manufacturer shall perform an operational torque test at full rated differential pressure and at ambient temperature. The procedure must be included in the offer. The certificates shall be included in the CMTR.

8.8. FIRE TEST

The Manufacturer shall supply valves qualified by fire testing as specified in API 6FA and this certificate shall be added to the CMTR.

8.9. 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.

8.10. VISUAL AND DIMENSIONAL EXAMINATION

All valves shall be visually and dimensionally examined, according to API 1104 and MSS-SP-55.

9. MARKING

9.1.1. All valves supplied under this specification shall be clearly identified on the body, on the identification plate and on the valve flange edge.

9.1.2. Body markings

The following markings shall be cast, stamped, forged or engraved on the body of the valve :

c) Manufacturer's name or trademark.

Individual tag number according to attached valves list.

The monogram of the Control Authority. This marking shall only be applied after complete approval of the CMTR.

Flow direction on unidirectional valve.

9.1.3. Permanently attached identification plate markings

On minimum the following markings shall be shown on permanently attached identification plates :

a) Manufacturer's name or trademark.
b) Individual valve fabrication number (serial number).
c) Individual tag number.
d) The maximum operating pressure;
e) The min and maximum operating temperatures
f) Body material designation (conforming MSS SP-25).
g) Rating designation (conforming ASME B16.34).
h) Valve trim identification (conforming MSS SP-25).
i) Nominal valve size.
j) Monogram of the Control Authority.

10. INSPECTION

10.1. INFORMATION

The Manufacturer shall inform the Control Authority min. five (5) working days in advance of any intervention required by this specification and shall send a copy of it to the Purchaser/Engineer (by fax).

10.2. DOCUMENTS

Before starting any fabrication, the Manufacturer shall submit for approval to the Control Authority and the Purchaser/Engineer the following documents :

- Detailed fabrication drawing and calculations.
- Fabrication and control procedure.
- Qualified welding procedures;
- Welders performances qualifications;
- NDT procedures;
- List of Operations in Fabrication and Control (LOFC) in accordance with annex 1.

Each company dealing in the order by fabrication and/or control shall implement a LOFC for all operations and interventions performed in its organisation. They shall also be responsible for the implementation of the same by their subcontractors

10.3. CERTIFIED MATERIAL TEST REPORT

A Certified Material Test Report (CMTR) shall be furnished listing as built drawings and calculations, the LOFC (see paragraph 10.2.), the base material certificate, the chemical check analysis of the welding ends. The certificate of the heat treatment, the mechanical test, the non-destructive examination, the pressure testing, the operational torque test, the quality release note (see paragraph 10.4.) and any special test required by the purchase order. The valve individual number (see paragraph 9.1.2.) must be indicated in the CMTR to permit the correct traceability of each valve. The Manufacturer shall furnish one copy of the CMTR to the Control Authority's delegate and one original and one copy to the Purchaser/Engineer.

10.4. QRN

After final approval of valves and the acceptance of the CMTR, the control authority's delegate shall furnish to the Purchaser/Engineer and to the Manufacturer a Quality Release Note (QRN). The Manufacturer shall deliver one copy of the QRN with the valves and one copy shall be included in the CMTR (see paragraph 10.3.).

10.5. REPAIR

Defects in material may only be repaired provided written acceptance by the contracting parties and the Control Authority has first been obtained.

This written acceptance must be given case per case. Defective material, that cannot be satisfactory repaired or repaired without written approval shall be definitively rejected.

10.6. REJECTION

Each valve in which injurious defects are found after delivery shall be rejected. The Manufacturer shall be notified. In this case, the valve shall be replaced immediately. All the costs involved, including wages and travel expenses of the Control Authority's delegate shall be borne by the Manufacturer.

11. PAINTING AND COATING

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 consist of a primer coating (30 - 40 µm) and a finish coating (30 - 40 µm).

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 Purchaser/Engineer's specifications.
Painting and coating procedures shall be submitted for approval before manufacturing to the authorized Control authority and to the purchaser / engineer.

For underground valves the Manufacturer shall propose an adequate protection at the time of offer. This adequate protection shall be in accordance with the Purchaser/Engineer's specification.

TABLE 1

CHEMICAL COMPOSITION FOR WELDING END OF VALVES

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 3.2.4.3.

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 %.

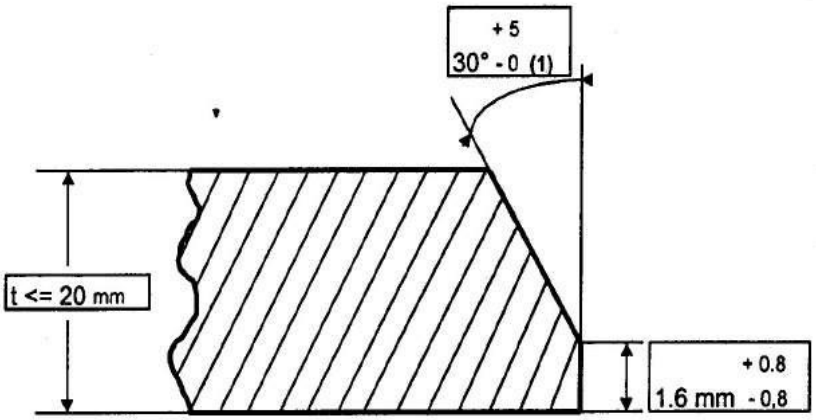
In grades X42 through X60 for each reduction of 0.01 % below the maximum carbon content, an increase of 0.05 % manganese above the specified maximum is permissible, up to a maximum of 1.70 %.

TABLE 2

TENSILE REQUIREMENTS OF THE WELDING END OF VALVES

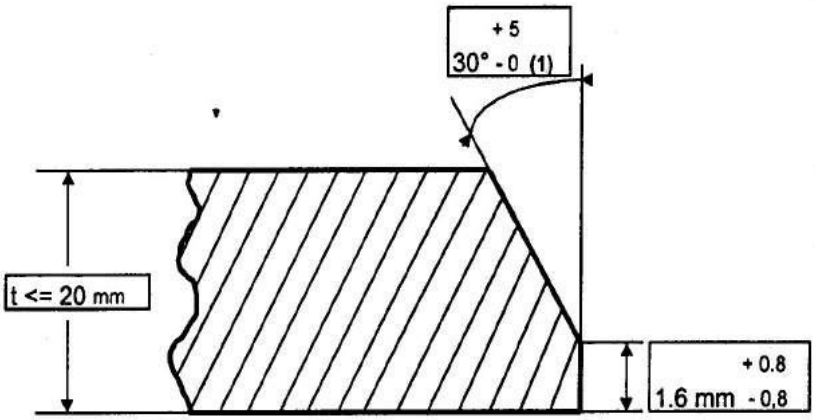
CLASS SYMBOL	FIELD STRENGTH (min) (min)		TENSILE STRENGTH		ELONGATION in 2" min. %
	KSI	MPa	KSI	MPa	
B	35	241	60	413	25
X42	42	289	60	413	25
X46	46	317	63	434	25
X52	52	358	66	455	25
X60	60	413	75	517	20

The ratio of effective yield strength to effective tensile strength of the steel shall not exceed 0.85.



(1) : welding end, size 24" and smaller may be furnished with 37.5° +- 2.5 bevel at manufacturer option.

Figure 1



(1) : welding end, size 24" and smaller may be furnished with 37.5° +- 2.5 bevel at manufacturer option.

Figure 2

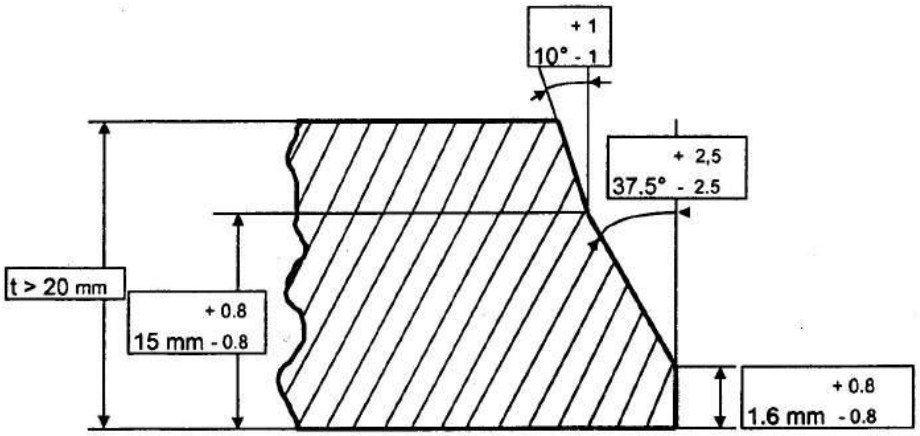
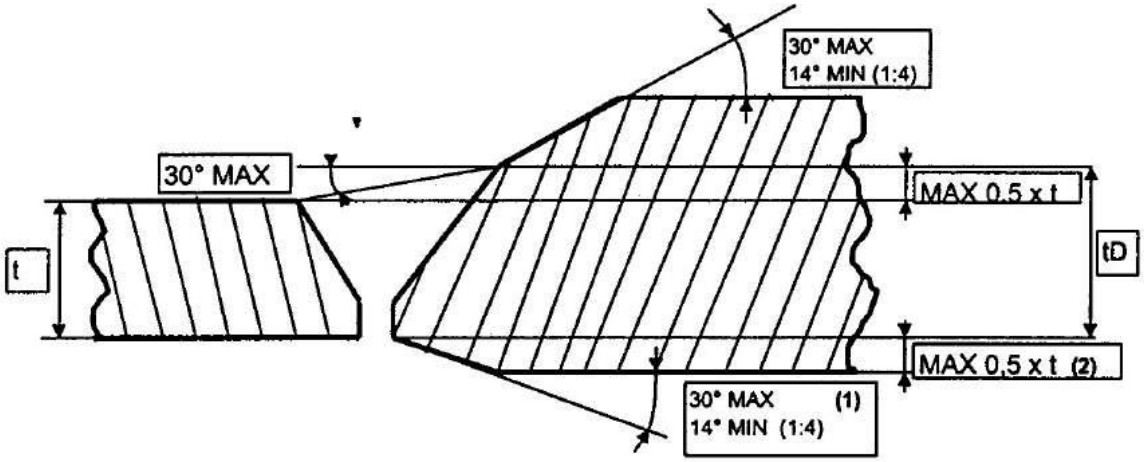


Figure 3

ACCEPTABLE DESIGN FOR UNEQUAL WALL THICKNESS AT WELDING END OF VALVE



Notes

(1) No minimum when materials joined have equal yield strength.

(2) Dimension to be limited to a minimum.

When the minimum specified yield strengths of the sections to be joined are unequal :

- the deposited weld metal shall have mechanical properties at least equal to those of the section of the higher strength.
- tD shall be equal to at least t times the ratio of min. specified yield strength of pipe by those of welding end of valve.

- $tD \geq tx \dfrac{\text{Min. Yield strength guaranteed by the standard of the steel of the pipe}}{\text{Min. yield strength guaranteed by the standard of the steel of the welding end of the valve}}$

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.

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/Engineer,

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/Engineer will do the same in their designated columns, but this will not implicate a relaxation or wearing 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.

k) 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.

l) 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.

SECTION 37

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

GTS – INSTRUMENT SYMBOLS & IDENTIFICATIONS

(DOC No.-GTS-IS&I/IGL/ET2/CP/CP18160)

TABLE OF CONTENTS

1. SCOPE

This specification defines the symbolisation and identification of instrumentation to be used for Piping and Instrumentation Diagrams, for instrumentation documents and drawings and for instrumentation tagging.

2. GENERAL

2.1. Definitions

Subject to the requirements of the context, the terms (hereafter listed in alphabetical order) used in this specification are given the following meaning:

AGREEMENT	Designates the agreement concluded between the CLIENT 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.
CLIENT	Designates the purchaser of the GOODS and/or SERVICES which are the subject of the AGREEMENT.
CONTRACTOR	Designates the individual or legal entity with whom the order has been concluded by the CLIENT. The term "CONTRACTOR" may be used indifferently for a supplier, a manufacturer, an erection contractor, etc.
ENGINEER	Designates the individual or legal entity to which the CLIENT 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 by 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.

2.2. Instrumentation Terminology

The terminology conforms to ANSI/ISA S51.1 "Process Instrumentation Terminology".

3. INSTRUMENT SYMBOLS AND IDENTIFICATION

3.1. Symbols and Functional Identification

1) Instrument symbols and functional identification shall be in accordance with ANSI/ISA S5.1 "Instrumentation Symbols and Identification" and ANSI/ISA S5.3 "Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems".

2) The action of a valve in case of electrical or air failure shall be indicated under the symbol of the valve body by one of the following abbreviations :

   FC = fail closed,

   FI = fail indeterminate,

   FL = fail locked (last position),

   FO = fail open.

3) The on-off valves shall be identified by :

   - the letters XV if they are operated by a Process Control System (PCS), a Programmable Logic Controller (PLC), an Emergency Shut-Down (ESD) system or a relay system; the associated solenoid valves shall be identified by the letters XY;
   - □the letters HV if they are only operated by a hand switch (HS).

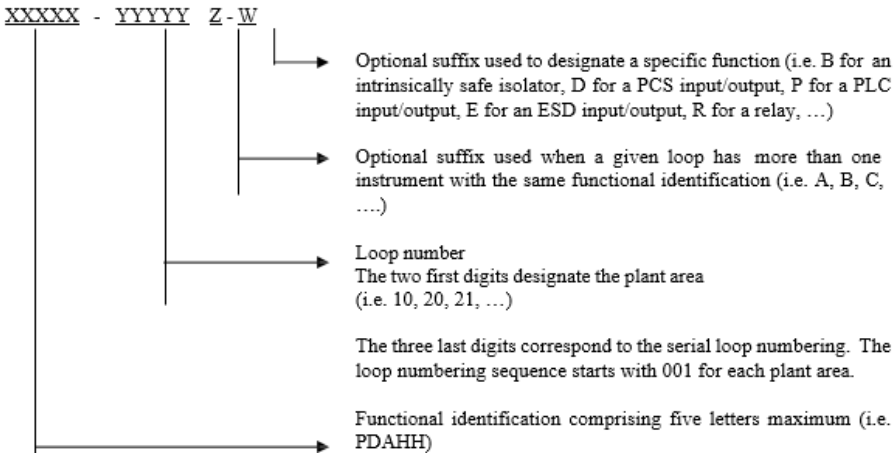
4) The auxiliary contact of a contactor (e.g. for a motor), which shows if the contactor is energized or not shall be identified by YS.

   The control of a motor will be tagged HS in all cases (PCS or panel/local control).

5) Identification letters, typical letter combinations, and function blocks and function designations are given respectively in Tables 1, 2 and 3 of ANSI/ISA S5.1

3.2. Loop and Instrument Identification

1) Each instrument or function shall be identified by a tag number comprising two groups of characters :

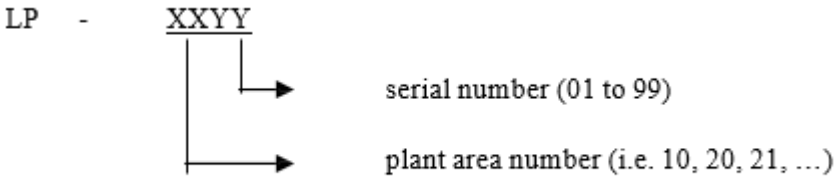


2) Inside one plant area, no loop will bear the same serial number.

4. INSTRUMENTATION EQUIPMENT IDENTIFICATION

4.1. Local Panels and Cabinets

1) Each local panel shall be identified as follows :



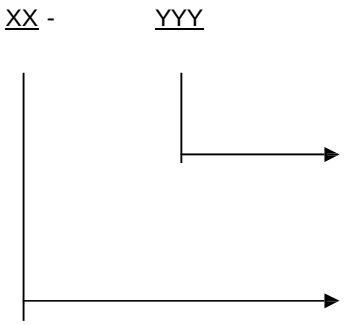
ex. : LP – 2101

2) For local cabinets, the letters LP will be replaced by the two letters corresponding to the cabinet type (see par. 4.2.).

ex.: PS – 3001

4.2. Cabinets and Panels in the Instrumentation Rooms and Control

The cabinets and panels located in the instrument rooms or in the control rooms shall be identified as follows :



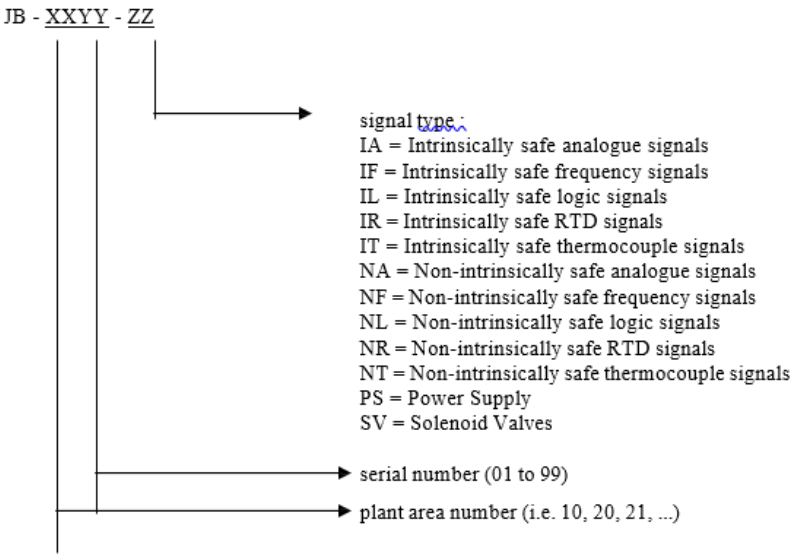
the first digit designates the room number; the two last digits are serial numbers from 01 to 99.

(i.e. 101, 102, 201, 202, ...)

cabinet/panel
identification letters :
AL = Alarm Cabinet/Panel
AU = Auxiliary Cabinet
BA = Barrier Cabinet
CC = Control Cabinet
CD = Control Desk
CP = Control Panel
EA = Earthing Cabinet
FF = Fire fighting Cabinet/Panel
FG = Fire/Gas detection cabinet
IF = Interface Cabinet
EL/IN MA = Marshalling Cabinet
PL = PLC Cabinet
PS = Power Supply Distribution Cabinet
RE = Relay Panel/Cabinet
TU = Termination Unit Cabinet

4.3. Junction Boxes

1) The junction boxes shall be identified as follows



ex.: JB - 2201 - IA

2) Inside one plant area, no junction box will bear the same serial number even if type of signals is different.

3.2. Cables

1) A cable between a field instrument and a junction box or local panel shall be identified by the instrument tag number :

e.g. : FT - 23001

2) A cable between a junction box or a local panel and an instrument room or a control room shall be identified by the junction box or local panel identification number :

e.g. :

JB - 2309 - SV LP - 4110 - NL

3) Cables in instrument rooms or control rooms shall take the identification of the cabinet to which they are connected with, when applicable, the signal type letters :

e.g. : TC 101 – NL

4) When several cables are connected to the same equipment, a serial number will be added to the cable identification :

e.g. : LP - 2301/1-IL, LP - 2301/2-IA
CC 101/1 - IA, CC 101/2 – IL

5) For power supply cables, the identification will be completed by the letter "S" :

e.g. : LP - 2101 - S

5. TAGGING

5.1. Instruments

1) Each instrument will be identified by its tag number.
2) The identity plate or tag plate supplied by the instrument manufacturer shall be made of 316 stainless steel. The plate shall have a minimum thickness of 0.5 mm and a maximum thickness of 1.5 mm. The size and shape of the plate is left to the discretion of the equipment manufacturer so that he may supply his own standard item, where one exists.
3) The engraving must be done in upper case letters, with a minimum size of 6mm. The letters may be stamped if this method is preferred.

   The engraving or stamping must be heavy duty so that the letters do not become obscured by dirt or tarnishing.
4) The tag plate is to be fixed to the equipment such that it is secure and cannot be accidentally removed.

   It must be fixed in such a way that it can be deliberately removed and replaced. This is necessary if a duty is assigned to a spare item, or if it is necessary to reassign an item to another duty.

   Acceptable methods of fixing are :
   1) Screwing. This shall not be done if it affects the integrity of the enclosure, such as it might be the case with an item which is classified for use in a hazardous area e.g. Zone 1 or Zone 2, or with an item which has an IP (Ingress Protection) rating.
   2) Wiring. The wire, which is used, must be 316 stainless steel.
   3) Riveting. The rivets used must be 316 stainless steel and they must be capable of being drilled out without creating any danger of swarf entering the equipment.

      Glue may not be used to fasten labels to equipment.
   4) Complementary to the instrument identity plate, all field instruments shall be equipped with a second and permanent identity plate, fixed to immediate vicinity of the instrument, i.e. on the support itself if possible.
      Details on that identity plate are given in standard drawing 70000/734/XX/7001 "Nameplates, tags and labels for instrumentation".
   5) Instruments installed in panels, cabinets, racks, etc. shall also be identified by a second identity plate fixed at the location of the instruments.
      Details on that plate are given in standard drawing 70000/734/XX/7001.

5.2. Panels and Cabinets

Panels and Cabinets shall bear an identity label in accordance with standard drawing 70000/734/XX/7001.

The label shall preferably be fixed by screwing at a 1.6 m height.

3.3. Junction Boxes

1) One or two engraved labels per box shall be fixed on the lid.

Label 1 :

Text : JB type and number

Label 2 (When applicable) :

- IS application

  Text: THIS JUNCTION BOX CONTAINS INTRINSICALLY SAFE CIRCUITS

- Voltage above 24 V application

  Text: THIS JUNCTION BOX CONTAINS (*) CIRCUITS ALL CIRCUITS TO BE ISOLATED PRIOR TO OPENING

  (*) = applicable voltage

2) When applicable, one engraved label per box shall be fixed next to the screen busbar: Text : SIGNAL SCREEN

3) Details on these labels are given in standard drawing 70000/734/XX/7001.

4. REFERENCES

Reference is made in this specification to the following documents.

4.1. Industries Standard Drawings

70000/734/XX/7001	Nameplates, tags and labels for instrumentation.

4.2. Instrument Society of America Standards

ANSI/ISA S5.1	Instrumentation Symbols and Identification.
ANSI/ISA S5.3	Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems.
ANSI/SA S51.1	Process Instrumentation Terminology

SECTION 38

SUPPLY, INSTALLATION, TESTING AND COMMISIONING OF METERING AND REGULATING STATION (MRS)

Piping and Instrumentation Drawing (P&ID)

(DOC No.-P&ID/IGL/ET2/CP/CP18160)

LINE SYMBOLS

GEAR OPERATED VALVE
ISOLATION MANUAL VALVE (NOTE 1)
THROTTLING MANUAL VALVE (NOTE 1)
CHECK VALVE
MANUAL THREE-WAY VALVE
MANUAL FOUR-WAY VALVE
BELLOWS SEAL VALVE
CONTROL VALVE (FLANGED) (PNEUMATIC ACTUATOR) (WITH POSITIONER)(NOTE 1)
CONTROL VALVE (WITH HANDWHEEL) (FLANGED) (PNEUMATIC ACTUATOR) (WITH POSITIONER) (NOTE 1)
PRESSURE REDUCING REGULATOR (FLANGED)
BACK PRESSURE REGULATOR (FLANGED)
ISOLATION VALVE (ELECTRIC ACTUATOR) (NOTE 1)
ISOLATION VALVE (WITH HANDWHEEL) (ELECTRIC ACTUATOR)(NOTE 1)
ISOLATION VALVE (GAS ACTUATOR) (NOTE 1)
ISOLATION VALVE (WITH HANDWHEEL) (GAS ACTUATOR) (NOTE 1)
ISOLATION VALVE (ELECTROHYDRAULIC ACTUATOR) (NOTE 1)
ISOLATION VALVE (WITH HANDWHEEL) (ELECTROHYDRAULIC ACTUATOR) (NOTE 1)
ON-OFF VALVE (SOLENOID ACTUATOR)
PRESSURE OR THERMAL RELIEF VALVE (FLANGED)
BREATHER VALVE (FLANGED)
VACUUM RELIEF VALVE (FLANGED)
RUPTURE DISK FOR PRESSURE RELIEF (FLANGED) RUPTURE DISK FOR VACUUM RELIEF (FLANGED)
MANUAL SLIDE GATE
ACTUATED SLIDE GATE
SPACER
SPADE
SPECTACLE BLIND NO (NOT FOR INSULATED CRYOGENIC PIPING)
SPECTACLE BLIND NC (NOT FOR INSULATED CRYOGENIC PIPING)
CONICAL STRAINER
TEMPORARY STRAINER
Y STRAINER
T STRAINER
DUPLEX TYPE STRAINER (FLANGED)
TRAP
SAMPLING
DEAERATOR
PURGE OR FLUSHING SERVICE
INSULATING JOINT
INSULATING GASKET
FLAME ARRESTOR (FLANGED)
SPRAY INJECTION NOZZLE
SPRAYER
SPECIAL PIPING ITEM

HYDRANT
MONITOR
SPRINKLER NOZZLE
FLANGED CONNECTION
CAPPED, PLUGGED OR BLIND FLANGE AS PER PIPING CLASS
HOSE CONNECTION
REDUCER
RESTRICTION ORIFICE (FO)
VENTING
VENT WITH FLAPPER
EXPANSION JOINT
FLEXIBLE HOSE
SPOOL PIECE - NORMALLY IN (IF POSSIBLE THE DRUM FLANGE WILL BE USED)
FLOW TEE
BARRED TEE
SERVICE 1 P1102 P-101A
ELECTRICAL TRACING
TIE-IN POINT
SLOPED LINE
MOTOR
INSTRUMENT SUPPLY OR CONNECTION TO PROCESS
ACTUATION GAS
ELECTRIC SIGNAL
MECHANICAL LINK
CAPILLARY TUBE
INTERNAL SYSTEM LINK (SOFTWARE OR DATA LINK)
TELETRANSMISSION SIGNAL
SERIAL SIGNAL
OR ELECTROMAGNETIC, SONIC OR NUCLEAR RADIATION SIGNAL
MAIN PROCESS LINE
SECONDARY PROCESS LINE & UTILITIES
EXISTING LINE
FUTURE LINE
LIMITS OF PACKAGE UNITS
LIMITS OF BATTERY LIMIT
TP TRANSITION PIECE BETWEEN STEEL & PE PIPE

EARTH CONNECTION
DIAPHRAGM SEAL
VENTURI TUBE (FLANGED)
ORIFICE PLATE (FLANGED) (FE)
VORTEX METER (FLANGED)
TURBINE OR PROPELLER TYPE METER (FLANGED)
POSITIVE DISPLACEMENT METER (FLANGED)
ULTRASONIC TYPE METER
CORIOLIS METER (FLANGED)
ELECTROMAGNETIC METER (FLANGED)
AVERAGING PITOT TUBE
FLOW STRAIGHTENER
FI 12345 VARIABLE AREA FLOW INDICATOR (FLANGED)
METAL TE 12345 PERMANENT SKIN TEMPERATURE SENSOR LOCATED AT BOTTOM OF PIPE
TE 12345 METAL PERMANENT SKIN TEMPERATURE SENSOR LOCATED AT TOP OF PIPE
METAL TE PROVISION FOR PORTABLE SKIN TEMPERATURE INDICATOR
LOCAL MANUAL RESET FOR ACTUATOR
REMOTE ELECTRICAL RESET
FIELD MOUNTED INSTRUMENT
INSTRUMENT MOUNTED THE CENTRAL CONTROL ROOM
INSTRUMENT MOUNTED IN THE INSTRUMENT ROOM
INSTRUMENT MOUNTED ON LOCAL PANEL
PROCESS CONTROL /SHARED DISPLAY INSTRUMENTATION (SCADA)
LOGIC IN SCADA
PROGRAMMABLE LOGIC CONTROLLER (PLC)
ESD EMERGENCY SHUTDOWN (ESD) LOGIC
UNDEFINED INTERLOCK LOGIC
BY OTHERS
LIMIT LINE

NOTE 1, NOTE 2, ...
BL: BATTERY LIMIT
CSO: CAR SEAL OPEN
CSC: CAR SEAL CLOSED
FO: FAIL OPEN
FC: FAIL CLOSED
FI: FAIL INDETERMINATE
FL: FAIL LOCKED (LAST POSITION)
IDB: INTEGRATED DOUBLE BLOCK & BLEED
LO: LOCKED OPEN
LC: LOCKED CLOSED
NC: NORMALLY CLOSED
NO: NORMALLY OPEN
AG: ABOVE GROUND
UG: UNDER GROUND
TEG: THERMO ELECTRIC GENERATOR
CCVT: CLOSED CYCLE VAPOR TURBO GENERATOR
DPI: DIFFERENTIAL PRESSURE INDICATOR
XI: PIG INDICATOR
XV: ACTUATED VALVES
GOV: GAS OPERATED VALVE
HOV: HAND OPERATED VALVE
CV: CHECK VALVE
BV: BALL VALVE
GV: GLOBE VALVE
SSV: SLAM SHUT VALVE
RV: REGULATOR VALVE

INSTRUMENT SYMBOLOGY DEFINITION
IDENTIFICATION LETTERS

	FIRST - LETTER		SUCCEEDING - LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER , COMBUSTION				
C	—			CONTROL	
D	DENSITY	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			
G	—		GLASS, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME , TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	—	MOMENTARY			MIDDLE INTERMEDIATE
N	—				
O	—		ORIFICE , RESTRICTION		
P	PRESSURE , VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE , TOTALIZE			
R	RADIATION		RECORD		
S	SPEED , FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION , MECHANICAL ANALYSIS			VALVE , DAMPER LOUVER	
W	WEIGHT ,FORCE		WELL		
X	UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT ,STATE OR PRESENCE	Y AXIS		RELAY, COMPUTE CONVERT	
Z	POSITION , DIMENSION	Z AXIS		DRIVER, ACTUATOR UNCLASSIFIED FINAL CONTROL ELEMENT	

LINE NOMENCLATURE

0001 - PL - 6" - 1C1 - C

- 0001 — LINE NO.
- PL — FLUID (NG : NATURAL GAS; AG : ACTUATING GAS; CS : CONDENSATE)
- 6" — SIZE
- 1C1 — CLASS (SEE PIPING CLASS)
  - 1st DIGIT : (RATING) 1 : 150# ; 3 : 300# ; 6 : 600# ; 9 : 900# ; 15 : 1500#
  - 2nd DIGIT : (MATERIAL) C : CARBON STEEL ; S : STAINLESS STEEL ; G : GALVANISED CARBON STEEL ; F : FIBRE REINFORCED POL
  - 3rd DIGIT : TO DIFFERENTIATE TWO OR MORE PIPING CLASSES OF (FLUID) : THE SAME RATING & MATERIAL BUT HANDLING DIFFERENT FLUID
  - X52 : PIPE - X52, FITTING - X52
- C — INSULATION (SEE INSULATION CLASS)
  - C : COLD
  - H : HOT
  - A : ANTIFREEZE
  - P : PERSONEL
  - N : NOT INSULATED

NOTES

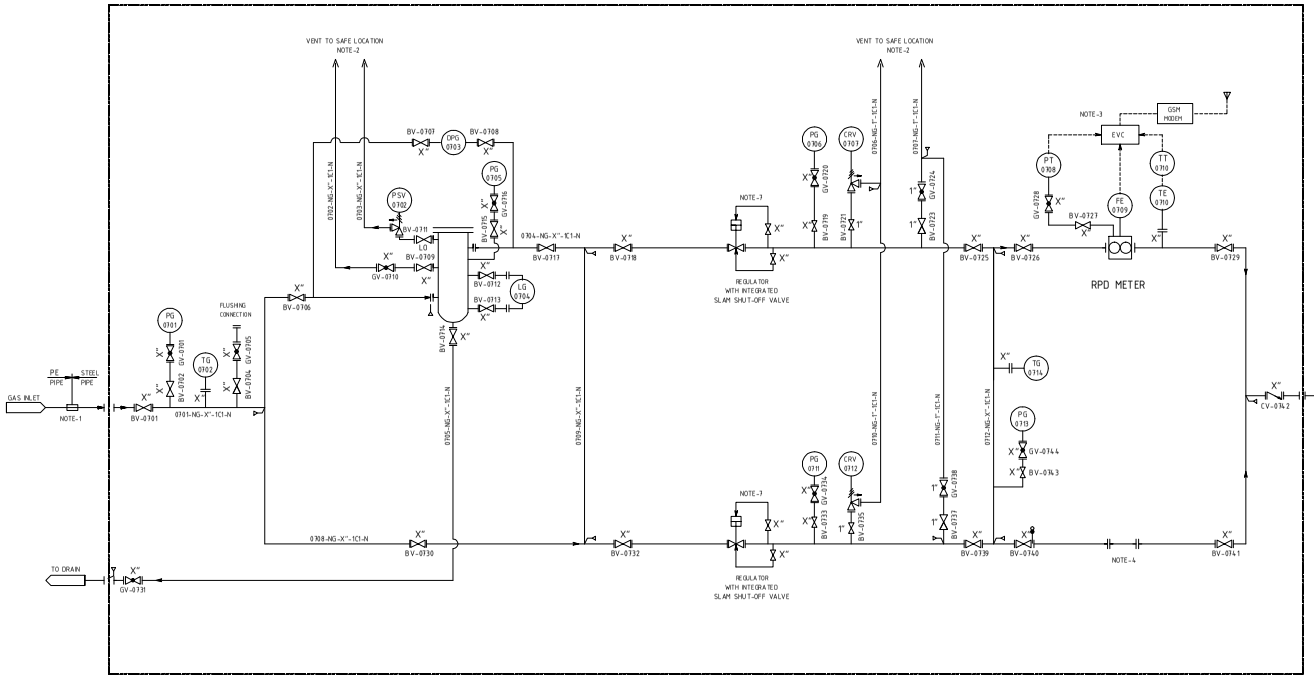
1. FOR ISOLATION USE BALL VALVES, FOR THROTTLING USE GLOBE VALVES.

Indraprastha Gas Limited

PROJECT: IGL CITY GAS DISTRIBUTION PROJECT

SUBJECT: LIST OF SYMBOLS

MRS TYPICAL P&ID
TYPE-1



PROCESS PARAMETERS	
SERVICE	NATURAL GAS
INLET PRESSURE	4 Bar(g)
OUTLET PRESSURE	2 Bar(g)
DESIGN PRESSURE	19 Bar(g)
DESIGN TEMPERATURE	-29° TO 65°C
FLOW	MAX. 250/450/750 SCMH
END CONNECTION	2" ANSI 150# INLET 2" ANSI 150# OUTLET
INSTALLATION	ABOVE GROUND / OUTDOOR

NOTES

1. STEEL/PE TRANSITION FITTING. ALSO INLET SKID PIPE SHALL HAVE A MINIMUM GROUND CLEARANCE OF 150MM.
2. ALL VENT LINES SHALL BE ELEVATED 3 METERS FROM THE HIGHEST OPERATING PLATFORM OR NEARBY STRUCTURE WITHIN 15 METER, WHICHEVER IS HIGHER AND SHALL BE PROVIDED WITH FLAME ARRESTOR.
3. ELECTRONIC VOLUME CORRECTOR SHALL BE PROVIDED WITH GSM MODEM FOR SIGNAL TRANSMISSION.
4. SPOOL PIECE FOR FUTURE METER.
5. RESTRICTION ORIFICE (DOWN STREAM OF RPD METER) REQUIREMENT AND SIZING TO BE FINALIZED BY THE BIDDER.
6. RELIEF VALVE SHALL BE SIZED AS PER PNGRB GUIDELINES.
7. ALTERNATIVELY SEPARATE REGULATOR AND SLAM SHUT CAN BE CONSIDERED.
8. RPD METER SHALL BE PROVIDED WITH SUITABLE RESTRICTION ORIFICE.

LEGEND

PACKAGE UNIT BOUNDARY LIMIT

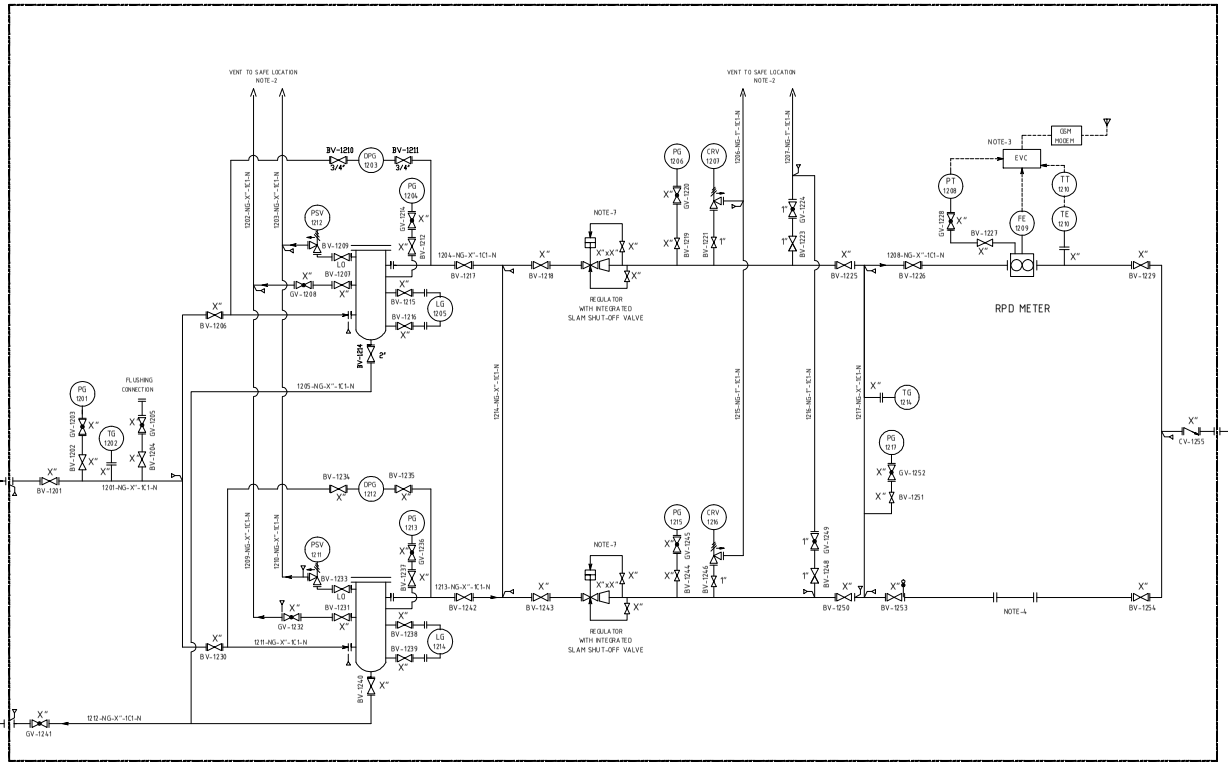
EVC ELECTRONIC VOLUME CORRECTOR

Indraprastha Gas Limited

PROJECT: IGL CITY GAS DISTRIBUTION PROJECT

SUBJECT: PIPING & INSTRUMENTATION DIAGRAM
MRS WITH RPD METERING

MRS TYPICAL P&ID
TYPE-2



PROCESS PARAMETERS	
SERVICE	NATURAL GAS
INLET PRESSURE	4 Bar(g)
OUTLET PRESSURE	2 Bar(g)
DESIGN PRESSURE	19 Bar(g)
DESIGN TEMPERATURE	-29° TO 65°C
FLOW	MAX. 1500/2000/3000 SCMH
END CONNECTION	2" ANSI 150# INLET 2" ANSI 150# OUTLET
INSTALLATION	ABOVE GROUND / OUTDOOR

NOTES

1. STEEL/PE TRANSITION FITTING. ALSO INLET SKID PIPE SHALL HAVE A MINIMUM GROUND CLEARANCE OF 150MM.
2. ALL VENT LINES SHALL BE ELEVATED 3 METERS FROM THE HIGHEST OPERATING PLATFORM OR NEARBY STRUCTURE WITHIN 15 METER, WHICHEVER IS HIGHER AND SHALL BE PROVIDED WITH FLAME ARRESTOR.
3. ELECTRONIC VOLUME CORRECTOR SHALL BE PROVIDED WITH GSM MODEM FOR SIGNAL TRANSMISSION.
4. SPOOL PIECE FOR FUTURE METER.
5. RESTRICTION ORIFICE (DOWN STREAM OF RPD METER) REQUIREMENT AND SIZING TO BE FINALIZED BY THE BIDDER..
6. RELIEF VALVE SHALL BE SIZED AS PER PNGRB GUIDELINES.
7. ALTERNATIVELY SEPARATE REGULATOR AND SLAM SHUT CAN BE CONSIDERED.
8. RPD METER SHALL BE PROVIDED WITH SUITABLE RESTRICTION ORIFICE.

LEGEND

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EVC	ELECTRONIC VOLUME CORRECTOR

Indraprastha Gas Limited

PROJECT: IGL CITY GAS DISTRIBUTION PROJECT

SUBJECT: PIPING & INSTRUMENTATION DIAGRAM
MRS WITH RPD METERING
(1500/2000/3000 SCMH)