



NGN LETEKUJAN TERMINAL UP TO NRL IGGL RT PIPELINE PROJECT

BID DOCUMENT

FOR

PROCUREMENT OF USM CHECK METER

Bid Document No. AGCL/PROJ/USM/2023/03

OPEN DOMESTIC COMPETITIVE BIDDING

VOLUME - II OF II

PREPARED AND ISSUED BY



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NGN LETEKUJAAN TERMINAL UP TO NRL IGGL RT PIPELINE PROJECT

Material Requisition for USM Check Meter

Doc No.: P158-MRR-I006

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MATERIAL REQUISITION FOR USM CHECK METER

DOCUMENT NO.:
P158-MRR-I006
Rev.CA
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1.0 INTRODUCTION

Assam Gas Company Ltd. (AGCL) is a 60-year-old Natural Gas transmission and distribution company, wholly owned by the Govt. of Assam with its registered office at Duliajan, Dist. Dibrugarh, Assam 786602. The company transports Natural Gas through its integrated pipeline infrastructure to several market segments i.e., Power, Fertilizer, Petrochemicals, Industrial, Commercial and Domestic consumers primarily located in upper Assam. The present infrastructure of the company has a transportation capacity of about 6.0 MMSCM of gas per day.

AGCL plans to extend their existing NGN pipeline to transport natural gas to Numaligarh Refinery Limited (NRL) and Indradhanush Gas Grid Limited (IGGL), for which AGCL has taken up the NGN Letekujan Terminal to NRL IGGL RT pipeline project, covering approximately 6 kilometers in length.

Pipeline Engineering Consultants Pvt. Ltd. has been appointed as Engineering, Procurement and Construction Management consultant by AGCL for Engineering, Procurement, RFP Preparation, Site Supervision and Project Management for the Project.

1.1 Purpose of the Document

This document specifies the basic requirements for the Design, Engineering and Procurement of USM type Metering skid for NGN LETEKUJAAN TERMINAL UP TO NRL IGGL RT PIPELINE PROJECT.

2.0 DEFINITION

Where used in this document, the following terms shall have the meanings indicated below, unless clearly indicated by the context to this order.

PROJECT	NGN LETEKUJAAN TERMINAL UPTO NRL IGGL RT PIPELINE PROJECT
CLIENT/ OWNER	Assam Gas Company Limited
EPMC	Pipeline Engineering Consultants Pvt. Ltd. (PLECO) the party to act for and on behalf of OWNER for the Detailed Engineering Services and Project Management.
CONTRACTOR	Agency appointed by CLIENT/ OWNER for execution of assigned tasks
PURCHASER	Either of CLIENT, OWNER or EPMC
VENDOR/ MANUFACTURER	Party, which manufactures and supplies equipment and services to the OWNER or to CONTRACTOR

3.0 PROJECT BRIEF

The primary objective of the Project is to transport the volume of 0.19 - 0.28 MMSCMD of natural gas from NGN Letekujan terminal to NRL IGGL receiving station via newly proposed 8" x 6.2 km (approx.) pipeline:

Dispatch Terminal	Receiving Station	Size & length
NGN Letekujan	NRL IGGL	8" x 6.2 km

4.0 DOCUMENT PRECEDENCE

It shall be the responsibility of the Manufacturer / Vendor to inform the Purchaser of any errors, ambiguities, inconsistencies, discrepancies or conflict of information that may be found to exist in any document, specification or drawing submitted by the Purchaser.

In case of conflict, the order of precedence shall be as follows:

- Data Sheets;
- Specifications;
- P&ID
- Basic Documents
- Codes and Standards.

4.1 SCOPE OF DESIGN AND ENGINEERING

As a general rule in the event of any discrepancy between technical matter and local laws / regulations (and documents above listed) the most stringent shall be applied.

Manufacturer / Vendor shall notify Purchaser of any apparent conflicts between MR, specifications, related datasheets, any code and standards and any other specifications noted herein. (Resolution and/or interpretation precedence shall be obtained from Purchaser in writing before proceeding with the design/ manufacturer or completion of services.)

5.0 SCOPE OF WORK

Vendor shall be completely responsible to supply, laying, installation, testing and commissioning of below mentioned materials and services for satisfying the functional / operational requirements stated in this Material Requisition and its Attachments:

S. No.	Description	Quantity
1	USM Meter: Inlet X Outlet line size and rating:8" X 8" and 300# Flow Capacity Design =0.19 - 0.28 MMSCMD Packaged Skid shall consist of Ultrasonic Type Flow Transmitter with necessary Instruments with interconnecting piping and associated Valves, fittings & related accessories, Pre wired skid edge junction box, PLC based metering panel, Flow Computer, cable and cabling in accordance with attached P&ID, Datasheets, Specifications etc., along with this requisition and including mandatory spares, commissioning spares, and supervision for erection, testing & commissioning.	2 Lot

Vendor shall have complete responsibility for all the items supplied by him including his sub-Vendors if any. The Vendor's scope of work includes, but not limited to:

- Design & Engineering;

- Procurement, Supply, Inspection, Factory Testing and Acceptance
- Supervision in installation, field calibration / testing, pre-commissioning & commissioning of the system
- Transportation, Transit Insurance, loading and unloading of material at AGCL site/ stores;
- Rectification of any damage (if any) occurred during transportation/ unloading / observed on receipt of material at site;
- Compliance of Checklist points during FAT, SAT, Site, stores (if any);
- If required by Client, Vendor to provide Caesar file of Metering on the basis of which final load are provided.
- Cable & Cabling from field instrument to Flow computer / Flow Controller etc.;
- Other General scope of work.

It is the responsibility of vendor to verify the sizes of each and every skid component and provide details of the same along with basis of size selection/ sizing calculation.

The vendor shall also be responsible for carrying out any residual basic engineering necessary for proceeding with detailed engineering like equipment/ instrument sizing, utility consumption, specifying derived data in process data sheets, type and material selection of instruments/ equipment's wherever required.

Notes:

- i. Ultrasonic type metering and its accessories shall be sized as per requirements as mentioned in datasheet and suitable for installation.
- ii. Vendor shall submit datasheets, sizing calculations and drawings for approval. Vendor to proceed further only upon approval of Vendor submitted documents.
- iii. Vendor shall quote separately spares for 2-year normal operation and mandatory spares. List of spares quoted shall be furnished as per OEM standard formats.
- iv. Vendor to include the startup and commissioning spares in the quoted price. In case no startup/commissioning spares are recommended by the Vendor but the same are required at the time of startup/commissioning, Vendor shall supply such spares free of cost.
- v. Vendor shall provide one week of Technical Training on the Operation and maintenance of Metering to five AGCL/Client personnel by the Vendor's Technical Consultants at vendor's place. All Travel and lodging expense shall be borne by the Client/ AGCL. Training dates shall be decided by AGCL/Client. Vendor quoted price shall include the above.
- vi. Vendor shall furnish quotation only in case he can supply material strictly as per this MR and specification / data sheets forming part of MR.
- vii. The submission of prices by the Vendor shall be construed to mean that he has confirmed compliance with all technical specifications of the corresponding item(s).

- viii. If the offer contains any technical deviations or clarifications or stipulates any technical specifications (even if in line with MR requirements) and does not include complete scope and technical / performance data required to be submitted with the offer, the offer shall be liable for rejection.
- ix. Vendor must submit all design documents / drawings / calculations as specified in relevant specification along with offer and after award of order.
- x. Purchaser's inspector reserves the right to perform stage wise inspection and witness tests, as indicated in Specification for Metering at Manufacturer's works prior to shipment. Manufacturer shall give reasonable notice of time and shall provide without charge reasonable access and facilities require for inspection to the Purchaser's inspector. Inspection and tests performed/witnessed by Purchaser's inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and test.
- xi. Vendor shall deliver the Metering at AGCL site LETEKUJAAN TERMINAL and the delivery schedule shall be 3 months FOT site basis.
- xii. Vendor shall arrange checking of all material as per item list before handling over to Company. In case materials are packed in boxes, boxes shall be opened for inspection. All transportation, handling, Delivery (Mobilization of Crane, Manpower etc. as required for delivery) shall be in bidder's scope.

6.0 WARRANTY

The Vendor will warrant the equipment to be free of defects in material and workmanship and that it is adequately engineered to fulfill the design and operating conditions specified herein. The Vendor shall replace and install without cost to EPC Contractor any materials, supplies or equipment that fails under design conditions due to defects in design, material, or workmanship. If a defect is observed and/or such failure occurs within one (1) year from the date such equipment is put into operation, the Vendor shall replace and install without cost to EPC Contractor any materials, supplies or equipment involved.

Vendor shall provide another twelve (12) months warranty period for any repair or replacement in whole or in part made during the warranty period beginning on the day of satisfactory restoration of services. If the repair or replacement during the warranty period concerns an essential component, the new warranty shall extend to the whole equipment.

7.0 VENDOR DOCUMENTS

7.1 Vendor Data Requirements

This section describes the Vendor Data Requirements applicable to a Vendor's scope. The Vendor data requirements shall be as mentioned in Metering specification.

Vendor shall submit, as a condition of Purchase Order or Contract, all data requirements specified on the Vendor Data Requirements. Electronic copies of all drawings will be provided on CD in DWG format for all drawing issues.

Each document submitted for review must be clear, legible, complete and properly identified. Failure to provide adequate documents may result in them being returned without review at Vendor's expense. In that event, Vendor will be considered not to have formerly submitted the documents so returned.

Vendor shall submit accurate, properly checked documents approved by the responsible Engineer(s). The documents shall be in English language. Dimensions, weights, and measures for drawings, etc. to be in SI units

Vendor shall submit Manufacturers Record Books with all certification, test and inspection information of a manufactured item.

Additionally, Vendor shall provide Vendor Data Books consisting of all pertinent Manufacturer's technical data and information relating to all the various elements of the units supplied by the Vendor. The data and information shall pertain to the facilities as a whole, to each major system, to each subsystem and every component. The Data Books shall commence with copy of the Purchase Order (pricing information may be blanked out) followed by the manufacturer's equipment brochures, data sheets, certificates, parts list and relevant "As Built" drawings.

7.2 Vendor Drawing Review

Drawings returned to Vendor for correction after markup by Company and / or Company designated representative shall be resubmitted by Vendor until "Proceed with Fabrication Issue Final Drawings". All revisions to documents must be clouded and identified with the revision number contained within a triangle placed beside the cloud.

Vendor shall not proceed with changes having a commercial impact unless authorized by Change Order.

If, for any reason, Vendor believes that he is not able to comply with Purchaser and / or Purchaser's designated representative marked-up comments on documents returned after review, Vendor shall notify, in writing, Purchaser within five (5) working days of receipt, giving his reasons and requesting a resolution. It is not acceptable to ignore marked-up comments.

Vendor must submit updated documents and drawings one (1) weeks after return of approved documents.

Drawings and data approval do not relieve Vendor of his responsibility to meet Purchase Order or contract conditions relating to specifications, material design or construction, and delivery requirements, nor relieve Vendor of responsibility for compliance with laws, codes and regulations.

8.0 PACKAGE AND STORAGE

Preparation for shipment shall be in accordance with the Vendor's standards and as noted herein. Vendor shall be solely responsible for the adequacy of the preparation for shipment provisions with respect to materials and application, and to provide equipment at the destination in ex-works condition when handled by commercial carriers.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the jobsite.

Preparation for shipment and packing will be subject to inspection and rejection by Company's / Contractor's inspectors. All costs occasioned by such rejection shall be to the account of the Vendor.

Equipment shall be packed, securely anchored, and skid mounted when required. Bracing, supports, and rigging connections shall be provided to prevent damage during transit, lifting, or unloading.

Separate, loose, and spare parts shall be completely boxed. Pieces of equipment and spare parts shall be identified by item number and service and marked with Contractor's order number, tag number, and weight, both inside and outside of each individual package or container. A bill of material shall be enclosed in each package or container of parts.

One complete set of the installation, operation, and maintenance instructions shall be packed in the boxes or crates with equipment. This is in addition to the number called for in the Purchase Order.

Equipment and materials shall be protected to withstand ocean transit and extended period of storage at the jobsite for a minimum period of 18 months. Equipment shall be protected to safeguard against all adverse environments, such as: humidity, moisture, rain, dust, dirt, sand, mud, salt air, salt spray, and sea water.

9.0 LIST OF ATTACHMENTS

- a) Datasheet;
- b) Standard Specifications;
- c) P&ID;
- d) Piping Material Specification;
- e) ITP - Instrumentation items;
- f) Plot Plan

10.0 LIST OF DRAWINGS/DOCUMENT REQUIRED ALONG WITH THE BID.

The following sample documents are required at the enquiry stage to be included in the bid by the bidder. This document shall be treated as information & understanding of the bidder's work quality:

1. No deviation Form / certification
2. Meter sizing calculation.
3. Drawings / Documents / catalogues of offered model flow meter, flow computer, field instruments etc.;
4. Signed and stamped copy of complete tender
5. Piping GA drawing of meter along with meter run, tapping points with root valves, of instruments etc.;
6. MTO of offered metering system;
7. Minimum specification / datasheet of offered flow meter, instruments, flow computer / flow controller etc.;

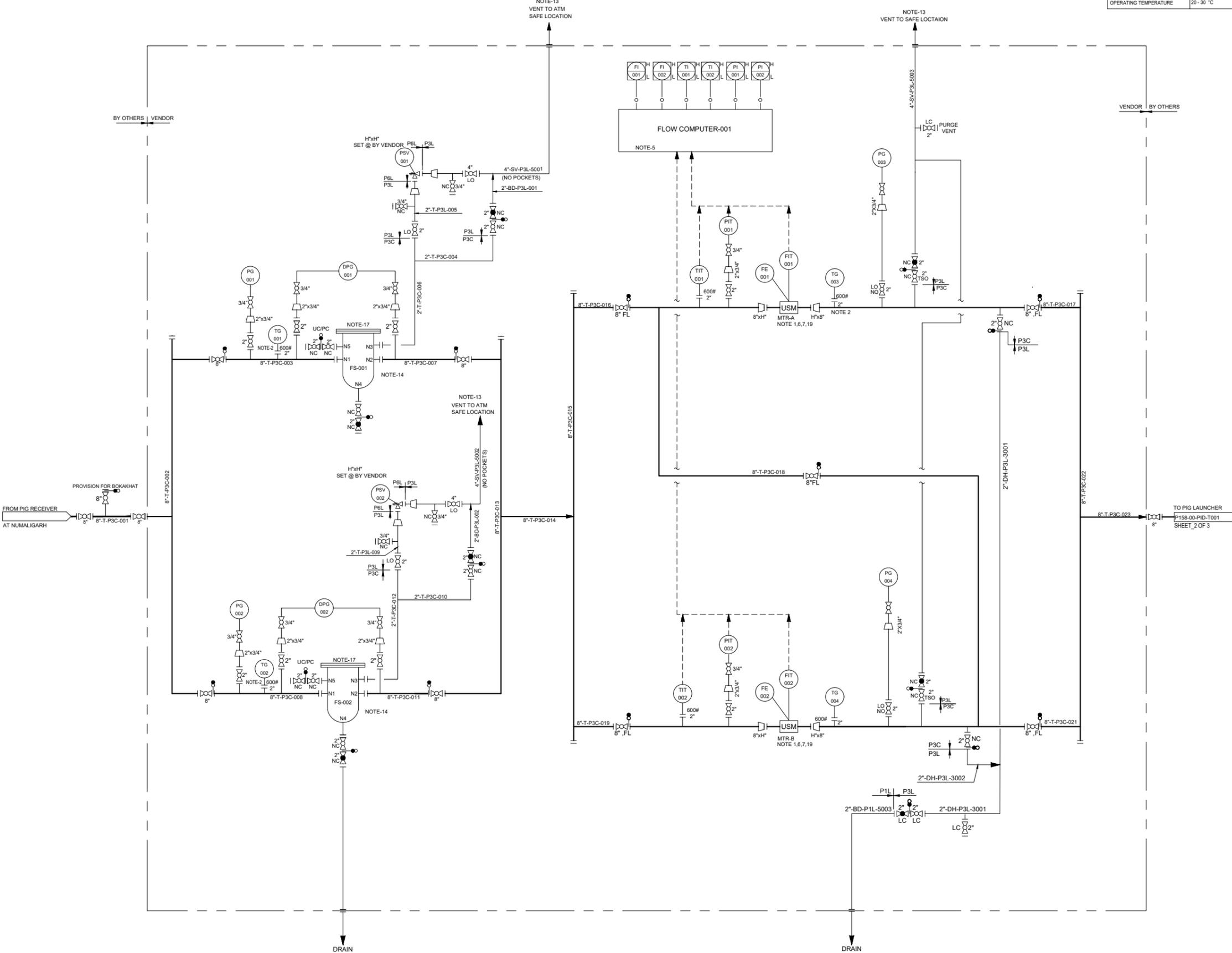
CARTRIDGE FILTER	
TAG NO.	FS-001/002
SERVICE FLUID	NATURAL GAS
DESIGN FLOWRATE	0.50 MMSCMD
OPERATING FLOWRATE (MIN. / MAX.)	0.19 - 0.28 MMSCMD
DESIGN PRESSURE	49 kg/cm ² g
DESIGN TEMPERATURE	-29 / 65 °C
OPERATING PHILOSOPHY	1WORKING + 1 STAND BY
OPERATING PRESSURE	8 - 15 kg/cm ² g
OPERATING TEMPERATURE	20 - 30 °C
MAX. PRESSURE DROP (CLEAN / DIRTY)	0.1 / 0.5 kg/cm ²

METERING SKID	
ITEM NO.	MS-001
SERVICE FLUID	NATURAL GAS
DESIGN FLOW RATE	0.50 MMSCMD
OPERATING FLOW RATE (MIN. / MAX.)	0.19 - 0.28 MMSCMD
INLET PRESSURE	8 - 15 kg/cm ² g
OUTLET PRESSURE	7.5 - 14.5 kg/cm ² g
DESIGN PRESSURE	49 kg/cm ² g
OPERATION PHILOSOPHY	1W-1S
DESIGN TEMPERATURE (MIN./MAX.)	-29°C TO 65°C
PRESSURE DROP	0.5 kg/cm ²
OPERATING TEMPERATURE	20 - 30 °C

REFERENCE DRAWINGS	
DRAWING TITLE	DRAWING NUMBER
P & ID LEGENDS	P158-00-LGD-T000

- GENERAL NOTES:-**
- ALL LINE NUMBERING AND EQUIPMENT TAG NUMBERING SHALL BE PRE-FIXED WITH PROJECT CODE & AREA CODE "P158".
 - ALL INSTRUMENT TAG NUMBER SHALL BE PRE-FIXED WITH PROJECT CODE & AREA CODE "P158".

- NOTES :-**
- METER SHALL BE ULTRASONIC METER TYPE.
 - THERMOWELL SHALL BE OF 600# RATING.
 - JUMPER SHALL BE PROVIDED ACROSS ALL FLANGES.
 - PROVIDE UPSTREAM / DOWNSTREAM STRAIGHT LENGTH AS PER INSTRUMENT REQUIREMENT.
 - FLOW COMPUTER SHALL BE CONTROL ROOM PANEL MOUNTED.
 - MTR "B" WILL BE IN OPERATION AND MTR "A" AS STANDBY. IN CASE THE ACTIVE MTR FAILS, THE STANDBY MTR SHALL BE MANUALLY LINED UP.
 - DETAILS SHOWN IN THE P&ID ARE MINIMUM. VENDOR TO CONSIDER THE REQUIRED INSTRUMENTS / VALVES ETC., IN THEIR SCOPE.
 - DETAILS OF METERING STATION COMPUTER SHALL BE ELABORATED BY MTR PACKAGE VENDOR.
 - INLET, OUTLET & CROSS OVER VALVE SHALL NORMALLY BE OPERATED & MANUALLY CONTROLLED.
 - ALL THE STATUS SIGNALS SHALL BE AVAILABLE IN CONTROL ROOM AND REPEATED TO RTU.
 - FILTER IS CARTRIDGE TYPE (1 OPERATING + 1 STAND BY).
 - FILTER SHALL BE PROVIDED WITH MANUAL CHANGEOVER.
 - ALL VENTS SHALL BE PROVIDED MIN. 3M HIGH FROM HIGHEST OPERATING PLATFORM ON NEARBY STRUCTURE WITH IN 15M WHICHEVER IS HIGHER NON SPARKING MATERIAL (BRASS) SHALL BE USED FOR FLAPPER TYPE VENT CONNECTION.
 - WHEREVER SPACER ARE SHOWN SPADE SHALL ALSO BE PROCURED DE AND VICE VERSA.
 - LOW POINT DRAIN SHALL BE PROVIDED AT MINIMUM DISTANCE FROM RISER PIPE OF VENT. ADEQUATE SLOPE TO BE MAINTAINED IN HORIZONTAL SECTION OF THE PIPE FOR LOW POINT DRAIN CONNECTION.
 - THE ITEMS GIVEN IN THIS P&ID IS INDICATIVE ONLY. ALL DETAIL ENGG. / RESIDUAL ENGG. INCLUDING LINE SIZE FINALIZATION SHALL BE DONE BY VENDOR POST AWARD OF CONTRACT WITHOUT ANY COST IMPLICATIONS TOWARDS CLIENT.
 - FILTER COVER SHALL BE OF PRESSURE CLOSURE TYPE AND SHALL NOT OPEN UNLESS THE FILTER IS FULLY DEPRESSURIZED. END COVER SHALL BE BODY FLANGE WITH BLIND FLANGE AND DAVIT. VALVE POSITION SHALL BE FAIL LAST.
 - VALVE SHALL BE GO TO FAIL CLOSE POSITION IN CASE OF POWER SIGNAL FAILURE. ALL OTHER CASE FAIL LAST.
 - MINIMUM DISTANCE FOR STRAIGHT RUN SHALL BE EITHER 10D OR 15D WHICHEVER IS HIGHER.



REV	DATE	DESCRIPTION	BY	CHKD	APPD
CB	04.08.23	ISSUED FOR CLIENT APPROVAL	SKU	GST	AD
CA	01.07.23	ISSUED FOR CLIENT REVIEW	SKU	GST	AD
IA	21.06.23	ISSUED FOR IDC	SKU	GST	AD

OWNER: **ASSAM GAS COMPANY LTD** (A GOVT. OF ASSAM UNDERTAKING)

ENGINEERING CONSULTANT: **PLECO** PIPELINE ENGINEERING CONSULTANTS PVT. LTD.

PROJECT: **NGN LETEKUJAN TERMINAL UPTO NRL IGGL RT PIPELINE**

DWG. TITLE: **P&ID FOR FILTER CUM METERING SKID AT LETEKUJAN TERMINAL**

SCALE	JOB NO.	DRAWING NUMBER	REV.
NTS	P158	P158-00-PID-T001	CB
SHEET	1 OF 3		

PIG LAUNCHER	
TAG NO.	PL-001
SIZE MAJOR / MINOR	14" x 8"
DESIGN PRESSURE	49 kg/cm ² g
DESIGN TEMPERATURE	-29°C TO 65°C
OPERATING PRESSURE	7.5 - 14.5 kg/cm ² g
MAX. ALLOWABLE OPERATING PRESSURE	40 kg/cm ² g
OPERATING TEMPERATURE	20°C TO 30°C
MAX. OPERATING TEMPERATURE	45°C

COMPRESSOR STATION FUTURE SCOPE	
INLET PRESSURE	6 - 8 kg/cm ² g
OUTLET PRESSURE	40 kg/cm ² g
INLET TEMPERATURE	20 - 30°C
OUTLET TEMPERATURE	45°C

REFERENCE DRAWINGS	
DRAWING TITLE	DRAWING NUMBER
P & ID LEGENDS	P158-00-LGD-T000

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 - ALL INSTRUMENT TAG NUMBER SHALL BE PRE-FIXED WITH PROJECT CODE & AREA CODE "P158".
- NOTES:-**
- VALVES UP TO 4" SHALL BE LEVER OPERATED TYPE & ABOVE 4" SHALL BE GEAR OPERATED TYPE.
 - DISTANCE SHALL BE AT LEAST EQUAL TO THE LENGTH OF THE LONGEST INTELLIGENT PIG.
 - DELETED.
 - DEPRESSURIZATION VALVE SHALL BE LOCATED IN SUCH A WAY THAT PIT-003/004 & TIT-004 CAN BE READ DURING VENTING.
 - LOW RANGE PRESSURE GAUGE (0-2 kg/cm²g) PROVIDED WITH GAUGE SAVER.
 - TEMPERATURE INSTRUMENT SHALL BE SKIN TYPE.
 - ADEQUATE SLOPE TO BE MAINTAINED IN HORIZONTAL SECTION OF PIPE IF ANY FOR LOW POINT DRAIN CONNECTION.
 - JUMPERS SHALL BE PROVIDED ACROSS ALL FLANGES.
 - MAINLINE BALL VALVES SHALL BE FULL BORE TYPES.
 - PROVISION OF A TROLLEY WITH PUSH ROD & PULLING LINE SHALL BE CONSIDERED TO ASSIST LOADING OR REMOVAL OF PIGS FROM THE SCRAPPER TRAP.
 - TIT SHALL BE INSTALLED CLOSED TO THE PIG BARREL.
 - VALVE SHALL GO TO FAIL CLOSE POSITION IN THE EVENT OF FIRE. IN ALL OTHER CASES POSITION SHALL BE FAIL LAST.
 - QUICK OPENING END CLOSURE TYPE DOOR. CANNOT BE OPENED UNLESS PIG BARREL IS FULLY DEPRESSURIZED.
 - GAS DETECTORS TO BE PROVIDED IN DOWNWIND DIRECTION NEAR PIG BARRELS & OTHER STRATEGIC LOCATIONS TO MONITOR THE LEAKAGE FROM FAILURE PRONE EQUIPMENTS PARTS, ACCESSORIES, VALVE & PIPES.
 - ALL VENTS SHALL BE PROVIDED MIN. 3M HIGH FROM HIGHEST OPERATING PLATFORM OR NEARBY STRUCTURE WITH IN 15M WHICHEVER IS HIGHER NON SPARKING MATERIAL (BRASS) SHALL BE USED FOR FLAPPER TYPE VENT CONNECTION.
 - THERMOWELL CONNECTION SHALL BE 600#.
 - HIGH POINT VENT & LOW POINT DRAIN SHALL BE PROVIDED WHENEVER APPLICABLE.
 - MONOLITHIC INSULATION JOINT.
 - PURGE / FLUSH CONNECTION SHALL BE PROVIDED WHENEVER APPLICABLE.
 - THIS VALVE SHALL BE GAS OVER OIL OPERATED TYPE WITH REMOTE OPERATION.
 - NECESSARY I/O's AND SIGNALS FOR INTERFACE WITH SCADA SHALL BE DEVELOPED BY INSTRUMENTATION.
 - ACTUATOR DETAILS OF GOOV-001 / 002 & CONTROL LOGIC SHALL BE DEVELOPED BY VENDOR.
 - 5% OF PIG TRAP VOLUME. DRAIN PIT SHALL BE COVERED WITH CHEQUERED PLATE.
 - QUICK OPENING AND QUICK CLOSING FOR VENTING SHALL BE USED.

INTERLOCK:

I 01 GOOV-001 SHALL CLOSE ON PIAH-003

REV	DATE	DESCRIPTION	BY	CHKD	APPD
CB	04.08.23	ISSUED FOR CLIENT APPROVAL	SKU	GST	AD
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IA	21.06.23	ISSUED FOR IDC	SKU	GST	AD

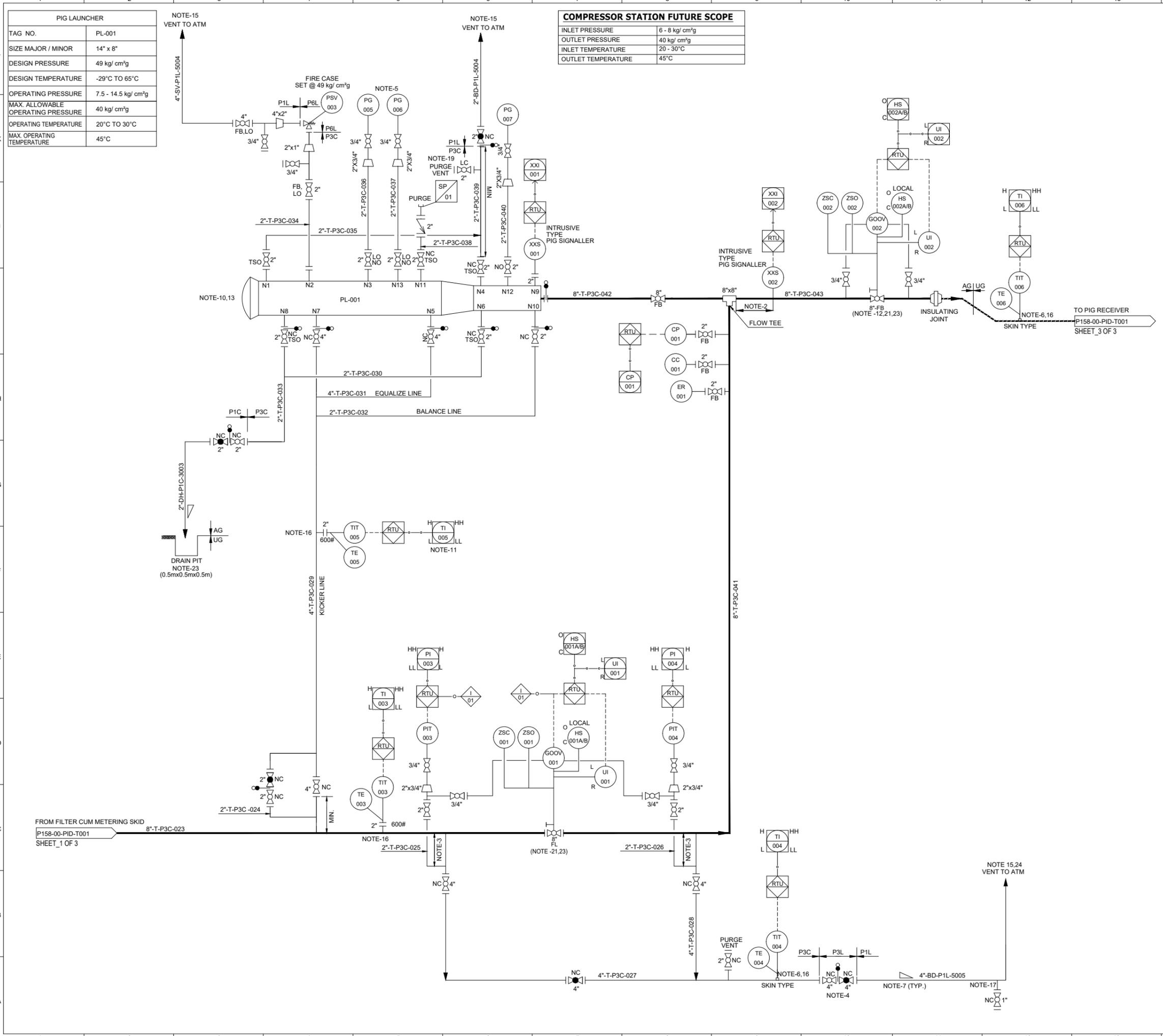
OWNER: **ASSAM GAS COMPANY LTD**
(A GOVT. OF ASSAM UNDERTAKING)

ENGINEERING CONSULTANT: **PLECO PIPELINE ENGINEERING CONSULTANTS PVT. LTD.**

PROJECT: **NGN LETEKUJAN TERMINAL UPTO NRL IGGL RT PIPELINE**

DWG. TITLE: **P&ID FOR PIG LAUNCHER AT LETEKUJAN TERMINAL**

SCALE	JOB NO.	DRAWING NUMBER	REV.
NTS	P158	P158-00-PID-T001	CB
SHEET	2 OF 3		



PIG RECEIVER	
TAG NO.	PR-001
SIZE MAJOR / MINOR	14" x 8"
DESIGN PRESSURE	49 kg/cm ² g
DESIGN TEMPERATURE	-29°C TO 65°C
OPERATING PRESSURE	6.5 - 13.5 kg/cm ² g
MAX. ALLOWABLE OPERATING PRESSURE	38.5 kg/cm ² g
OPERATING TEMPERATURE	20°C TO 30°C
MAX. OPERATING TEMPERATURE	45°C

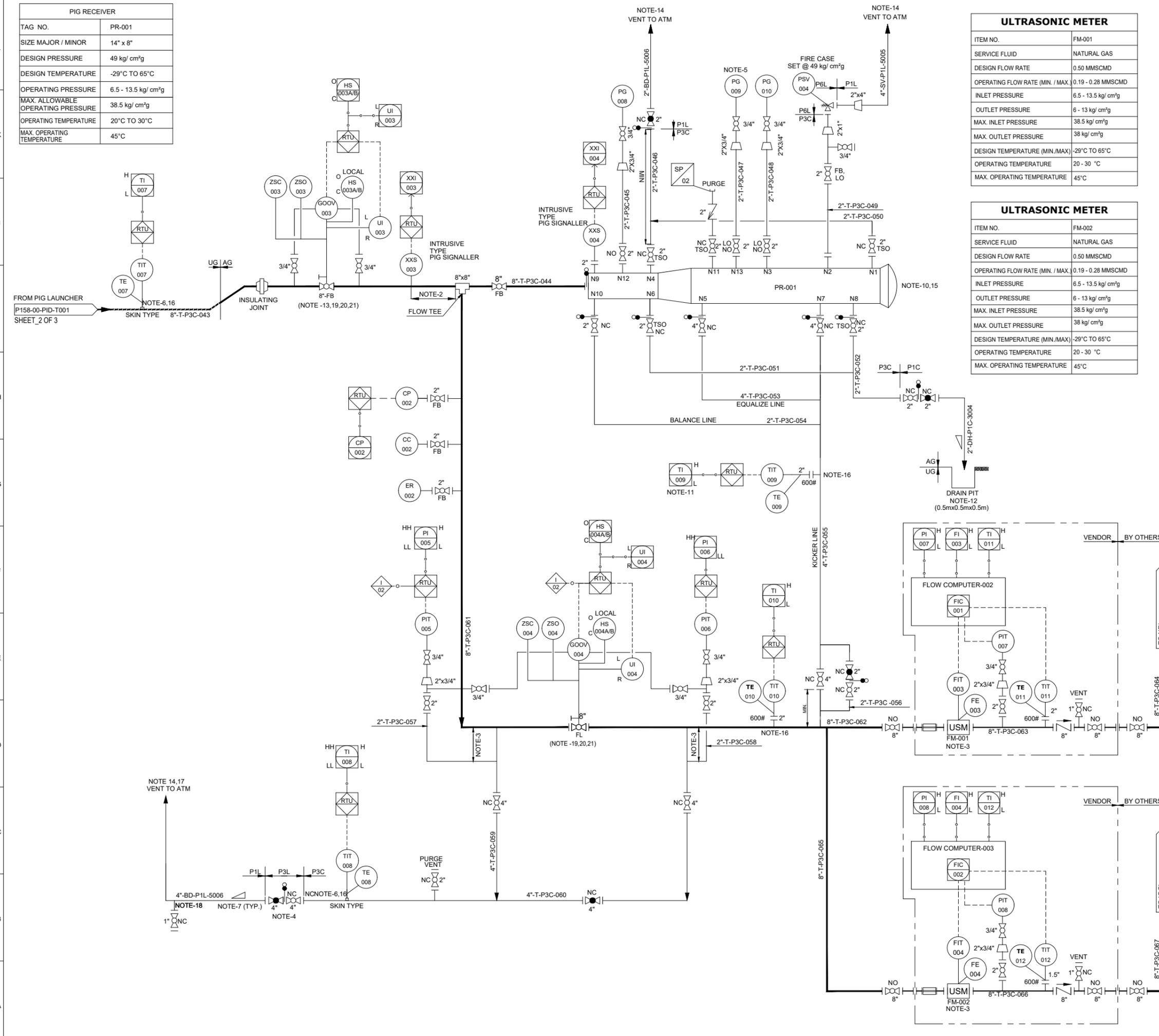
ULTRASONIC METER	
ITEM NO.	FM-001
SERVICE FLUID	NATURAL GAS
DESIGN FLOW RATE	0.50 MMSCMD
OPERATING FLOW RATE (MIN. / MAX.)	0.19 - 0.28 MMSCMD
INLET PRESSURE	6.5 - 13.5 kg/cm ² g
OUTLET PRESSURE	6 - 13 kg/cm ² g
MAX. INLET PRESSURE	38.5 kg/cm ² g
MAX. OUTLET PRESSURE	38 kg/cm ² g
DESIGN TEMPERATURE (MIN./MAX.)	-29°C TO 65°C
OPERATING TEMPERATURE	20 - 30 °C
MAX. OPERATING TEMPERATURE	45°C

ULTRASONIC METER	
ITEM NO.	FM-002
SERVICE FLUID	NATURAL GAS
DESIGN FLOW RATE	0.50 MMSCMD
OPERATING FLOW RATE (MIN. / MAX.)	0.19 - 0.28 MMSCMD
INLET PRESSURE	6.5 - 13.5 kg/cm ² g
OUTLET PRESSURE	6 - 13 kg/cm ² g
MAX. INLET PRESSURE	38.5 kg/cm ² g
MAX. OUTLET PRESSURE	38 kg/cm ² g
DESIGN TEMPERATURE (MIN./MAX.)	-29°C TO 65°C
OPERATING TEMPERATURE	20 - 30 °C
MAX. OPERATING TEMPERATURE	45°C

REFERENCE DRAWINGS	
DRAWING TITLE	DRAWING NUMBER
P & ID LEGENDS	P158-00-LGD-T000

- GENERAL NOTES:-
- ALL LINE NUMBERING AND EQUIPMENT TAG NUMBERING SHALL BE PRE-FIXED WITH PROJECT CODE & AREA CODE "P158".
 - ALL INSTRUMENT TAG NUMBER SHALL BE PRE-FIXED WITH PROJECT CODE & AREA CODE "P158".

- NOTES :-
- VALVES UP TO 4" SHALL BE LEVER OPERATED TYPE & ABOVE 4" SHALL BE GEAR OPERATED TYPE.
 - DISTANCE SHALL BE AT LEAST EQUAL TO THE LENGTH OF THE LONGEST INTELLIGENT PIG.
 - MINIMUM DISTANCE FOR STRAIGHT RUN SHALL BE EITHER 10D OR 15D WHICH EVER IS HIGHER.
 - DEPRESSURIZATION VALVE SHALL BE LOCATED IN SUCH A WAY THAT PIT 005 / 006 & TIT-008 CAN BE READ DURING VENTING.
 - LOW RANGE PRESSURE GAUGE (0-2 kg/cm²g) PROVIDED WITH GAUGE SAVER.
 - TEMPERATURE INSTRUMENT SHALL BE SKIN TYPE.
 - ADEQUATE SLOPE TO BE MAINTAINED IN HORIZONTAL SECTION OF PIPE IF ANY FOR LOW POINT DRAIN CONNECTION.
 - JUMPERS SHALL BE PROVIDED ACROSS ALL FLANGES.
 - MAINLINE BALL VALVES SHALL BE FULL BORE TYPES.
 - PROVISION OF A TROLLEY WITH PUSH ROD & PULLING LINE SHALL BE CONSIDERED TO ASSIST LOADING OR REMOVAL OF PIGS FROM THE SCRAPPER TRAP.
 - TIT SHALL BE INSTALLED CLOSED TO THE PIG BARREL.
 - 5% OF PIG TRAP VOLUME. DRAIN PIT SHALL BE COVERED WITH CHEQUERED PLATE.
 - VALVE SHALL GO TO FAIL CLOSE POSITION IN THE EVENT OF FIRE. IN ALL OTHER CASES POSITION SHALL BE FAIL LAST.
 - ALL VENTS SHALL BE PROVIDED MIN. 3M HIGH FROM NEAREST HIGHEST OPERATING PLATFORM OR NEARBY STRUCTURE WITHIN 15M WHICHEVER IS HIGHER. NON SPARKING MATERIAL (BRASS) SHALL BE USED FOR FLAPPER TYPE VENT CONNECTION.
 - QUICK OPENING END CLOSURE TYPE DOOR CANNOT BE OPENED UNLESS PIG BARREL IS FULLY DEPRESSURIZE.
 - THERMOWELL CONNECTION SHALL BE 600#.
 - QUICK OPENING AND QUICK CLOSING FOR VENTING SHALL BE USED.
 - LOW DRAIN POINT SHALL BE PROVIDED WHEREVER APPLICABLE ARRIVING GAS.
 - THIS VALVE SHALL BE GAS OVER OIL OPERATED TYPE WITH REMOTE OPERATION.
 - NECESSARY I/O'S AND SIGNALS FOR INTERFACE WITH SCADA SHALL BE DEVELOPED BY INSTRUMENTATION.
 - ACTUATOR DETAILS OF GOOV003/004 & CONTROL LOGIC SHALL BE DEVELOPED BY VENDOR.



INTERLOCK:

GOOV-004 SHALL CLOSE ON PIAH-005

REV	DATE	DESCRIPTION	BY	CHKD	APPD
CB	04.08.23	ISSUED FOR CLIENT APPROVAL	SKU	GST	AD
CA	01.07.23	ISSUED FOR CLIENT REVIEW	SKU	GST	AD
IA	21.06.23	ISSUED FOR IDC	SKU	GST	AD

OWNER: **ASSAM GAS COMPANY LTD** (A GOVT. OF ASSAM UNDERTAKING)

ENGINEERING CONSULTANT: **PLECO PIPELINE ENGINEERING CONSULTANTS PVT. LTD.**

PROJECT: **NGN LETEKUJAAN TERMINAL UPTO NRL IGGL RT PIPELINE**

DWG. TITLE: **P&ID FOR PIG RECEIVER AT NRL & CHECK METERING AT NRL & IGGL**

SCALE	JOB NO.	DRAWING NUMBER	REV.
NTS	P158	P158-00-PID-T001	CB
SHEET	3 OF 3		

**NGN LETEKUJAN TERMINAL UP TO
NRL IGGL RT PIPELINE PROJECT**

Datasheet for Instrument

Doc no.: P158-00-DSH-I007

Rev.	Date	Description	ORG	REVIEW	APPROVAL
CA	23.08.2023	Issued for Client Review	SC	NC	AD
IA	21.08.2023	Issued for Internal Review	SC	NC	AD



ASSAM GAS COMPANY LIMITED

**NGN LETEKUJAN TERMINAL UP TO
NRL IGGL RT PIPELINE PROJECT**

JOB NO. P158

Doc no.: P158-00-DSH-I007

Datasheet for Instrument

Sht. 1 of 12

Rev.

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23	23		

TEMPERATURE TRANSMITTER

GENERAL	1	Tag Number		Refer Attachment-1	
	2	P&ID Number	Quantity	Refer Attachment-1	Refer Attachment-1
	3	Line No/Equipment No		Refer Attachment-1	
	4	Enclosure Type		IP-67 , Ex 'ia'	
	5	Hazardous Area Classification		Zone 1 Group IIA /IIB as per IEC, T3	
PROCESS	6	Fluid state	Phase	Refer Attachment-1	
	7	Corrosive	Erosive		
	8	Operating Pressure (Min/Nor/Max) (Barg)			
	9	Operating Temperature (Min/Nor/Max) (Deg.C)			
	10	Design Pressure	Design Temperature		
	11	Viscosity (cP)	Density (Kg/m ³)		
12	Velocity (m/s)				
ELEMENT	13	Type	Material	RTD-Pt100	SS316
	14	Simplex/Duplex	Grounded	Duplex	N/A
	15	Cold Junction Comp.	Ice Point Resistance	*	*
	16	Temperature Range		*	
	17	Mounting Connection		1/2" NPTM	
	18	Sheath Material	Outside Diameter	*	*
	19	No. of Lead Wires	Termination Type	*	*
	20	Vibration Req.	Spring Loaded	*	*
	21	Replacement Element Length		*	
HEAD	22	Type		Screwed Cap with SS chain	
	23	Material		Die Cast Aluminium	
	24	Mounting Connection	Conduit Connection	1/2" NPTF	1/2" NPT
	25	Nipple	Union	*	1/2" NPT
	26	Nipple/Union/Nipple Length		To suit well and element	
THERMOWELL	27	Type		Tapered	
	28	Construction	Material	Drilled Bar Stock	SS 316
	29	Process Connection	Instrument Connection	2" Flanged 600#	1/2" NPTF
	30	Outside Dia (OD)	Bore	*	*
	31	Tip Diameter	Tip Thickness	*	*
	32	Lag Length	Insertion Length (U)	*	*
	33	Maximum Allowable Insertion (U)		*	
TRANSMITTER	34	Type		2 Wire , SMART, HART	
	35	Output	Power Supply	4 - 20 mA HART	24 VDC loop powered
	36	Instrument Range (°C) *		*	
	37	Calibrated Range (°C)		TBD	
	38	Accuracy	Response Time	±0.18%	*
	39	Damping	Failure Mode Output	*	*
	40	Integral Indicator		Required	
	41	Electrical Connection Size		1/2" NPT x 2 entries	
	42	Ambient Temperature Rating		N/A	
MISC.	43	Mounting Location		USM CHECK METER	
	44	Lightning Protection		N/A	
	45	Mounting Bracket		Required	
	46	Manufacturer	Model No.	*	*

Notes: TBD: To be decided

1	Vendor to specify. *
2	Please refer Process Datasheet and P&ID for more information.
3	Calibration, material and hazardous area certificates shall be provided by the Vendor.
4	Tagplate (SS316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).
5	Temperature Transmitter shall be selected in such a manner that normal operating temperature is approximately in the middle third of full scale (50% - 70% of range).
6	Vendor to perform natural frequency and wake frequency calculations of thermowell as per ASME PTC 19.3 and submit the same for review and approval.
7	Thermowell Rating shall be 600# class.

Attachment-1

SNo.	Tag.No	Service	Location	Fluid	Phase	P&ID Number	Line/Equipment No.	Temperature (Operating / Design) (degC)	Pressure (Operating / Design) (Kg/cm ² g)	Density (Kg/cm ³)	Viscosity (cP)	Instrument Range * (Deg c)	Calibration Range (Deg c)	Remarks
1	P158-00-TIT-011	ULTRASONIC METER FM-001	CHECK METERING AT NRL	Natural Gas	Gas	P158-00-PID-T001 sheet_3	8"-T-P3C-063	20-30 / 45	6.5-13.5 / 49	6.496 - 13.08	0.01105 - 0.01157	*	*	
2	P158-00-TIT-012	ULTRASONIC METER FM-002	CHECK METERING AT IGGL	Natural Gas	Gas	P158-00-PID-T001 sheet_3	8"-T-P3C-066	20-30 / 45	6.5-13.5 / 49	6.496 - 13.08	0.01105 - 0.01157	*	*	

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	Datasheet for Instrument		Sht. 3 of 12	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th colspan="5">Rev.</th> </tr> <tr> <th>IA</th> <th>CA</th> <th></th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>21.</td> <td>23.</td> <td></td> <td></td> <td></td> </tr> <tr> <td>08.</td> <td>08.</td> <td></td> <td></td> <td></td> </tr> <tr> <td>23</td> <td>23</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Rev.					IA	CA				21.	23.				08.	08.				23	23		
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PRESSURE TRANSMITTER

GENERAL	1	Tag Number		Refer Attachment-2	
	2	P&ID Number	Quantity	Refer Attachment-2	Refer Attachment-2
	3	Line No/Equipment No.		Refer Attachment-2	
	4	Enclosure Type		IP-67 , Ex 'ia'	
	5	Hazardous Area Classification		Zone 1 Group IIA /IIB as per IEC, T3	
	6				
PROCESS DATA	7	Service		Refer Attachment-2	
	8	Fluid	Phase	NG	Gas
	9	Corrosive	Erosive		
	10	Pressure (Min/Nor/Max) (Kg/cm2g)		Refer Attachment-2	
	11	Temperature (Min/Nor/Max) (°C)			
	12	Design Pressure (Kg/cm2g)	Design Temperature (°C)		
	13	Viscosity (cP)	Liquid Density (kg/m3)		
	14	Steady / Pulsating	% Solids		
	15	Ambient Temperature		10-50 °C	
	16				
BODY AND SENSOR	17	Sensor Type		Capacitance type/ Piezo-resistive type	
	18	Process Connection Size		2" Flanged	
	19	Instrument Connection Size		1/2"NPTM	
	20	Body Material	Sensor Material	Aluminium Epoxy Coated	SS316
	21	Seal Ring Material		*	
	22	Fill Fluid		Silicone Oil	
	23	Design Pressure		*	
	24	Design Temperature		*	
	25	Burst Pressure		130% of range	
	26				
TRANSMITTER	27	Type		2 Wire , SMART, HART	
	28	Output	Power Supply	4 - 20 mA	24 VDC 2-wire loop powered
	29	Instrument Range (Kg/cm2g)		Refer Attachment-2	
	30	Calibrated Range (Kg/cm2g)		Refer Attachment-2	
	31	Accuracy	Response Time	±0.1%	*
	32	Damping	Failure Mode Output	*	*
	33	Integral Indicator		Required	
	34	Electrical Connection Size		1/2" NPTF x 2 entries	
	35	Elevation / Suppression		N/A	
	36	Ambient Temperature Rating		*	
SEAL	37	Seal Conn Size	Conn Type & Rating	N/A	
	38	Diaphragm Material	Seal Flange Material		
	39	Capillary Conn Size	Capillary Conn Type		
	40	Capillary Material	Capillary Length		
	41	Fill Fluid			
	42	Seal Design Pressure			
	43	Seal Design Temperature			
MISC.	44	Manifold Type	Manifold Mounting	3-way Manifold	Direct
	45	Manifold Manufacturer	Manifold Model No.	*	*
	46	Lightning Protection		N/A	
	48	Flush Ring		N/A	
	49	Mounting Bracket		Required	
	50	Manufacturer	Model No.	*	

Notes: TBD: To be decided

1	* Vendor to specify
2	Calibration, material and hazardous area certificates shall be provided by the Vendor.
3	Please refer Process Datasheet and P&ID for more information.
4	Tagplate (SS316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).
5	Pressure transmitter shall be of the direct sensing type with the sensing element as per Manufacturer's standard.
6	Pressure transmitter shall be fitted with and shall have a over-range protection of 130% of range.

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GENERAL	S NO.	Flow Computer			
	1	Tag Number	Quantity	P158-00-FC-002 P158-00-FC-003	02 Nos
2	P&ID Number	P158-00-PID-T001 sheet 1			
3	Location	Metering Package at NRL & IGGL			
4					
FLOW COMPUTER	5	Processor Type	32 Bit CMOS Microprocessor, 16 MHz Operation		
	6	Primary Flow Device	Ultrasonic flow transmitter		
	7	Primary Flow Device Tag No.	P158-00-FIT-003, P158-00-FIT-004		
	8	Power Supply	24V DC		
	9	Power Consumption	35 Watts (max.)		
	10	Display	LCD (4 line, 20 alpha-numeric character)		
	11	Mounting	Panel flush mounted		
	12	Alarms	Active alarm LED		
	13	Software Lock	Shall be provided		
	14	Battery Backup	NIMH battery as RAM power backup is provided which can retain data for more than 30 days in case no external power is connected.		
	15	Memory Details	a) 4 Mbytes of FLASH memory b) 2 Mbytes of battery Backed RAM c) EEPROM for storing I/O calibration Data		
	16	Calculation Accuracy	+/- 0.05% of Full scale		
	17	Analog Input Accuracy	+/- 0.025%		
	18	Standard	AGA-9 for Ultrasonic flow meter		
19					
INPUT/OUTPUT	20	Analog Input	06 Nos. for FC-002 & 06 Nos. for FC-003		
	21	Analog Output	*		
	22	Pulse Input	1 Nos.		
	23	Digital Input / Output	6 Nos.		
	24	Ethernet Port	2 Nos.		
	25	Serial Interface	4 Nos. RS232/485 (Selectable)		
	26	Protocol	MODBUS (RTU or ASCII), MODBUS TCP/IP		
	27	Baud Rate	Software selectable (38400, 19200, 9600, 4800, 2400, 1200, 600, 300)		
	28	A/D & D/A converter of flow computer	At least 12 bit resolution		
29	Scan process Time	i) Max. 1sec for interval between computer readings of process variable ii) Max. 1 sec for Interval between each cycle of instantaneous flow rate & totalized flow			
MISC.	30	Model No.	*		
	31	Manufacturer	*		
	32	Interface cables	Will be provided		
	33	Software	*		
	34	Approval Certification	Declaration of Conformity for NMI Approval, W&M Certificate will be provided		
	35				

- Notes :
- 1 Vendor to specify. *
 - 2 Refer Process Design Basis and Process data sheet for more information.
 - 3 20% Spare I/O shall be considered extra for the flow computer.
 - 4 Flow Computer shall have following computation capacity:
 - i) Volume flow rate at standard, normal or operation specified base conditions
 - ii) Integareted corrected volume
 - iii) Mass flow rate & Integareted mass
 - iv) Energy flow rate & integrated energy
 - v) Linearisation of Temp.input
 - vi) Generation standard and user defined reports at record
 - 5 Memory type of FC shall be Non- volatile
 - 6 Flow computer shall have the capacity to detect loop defalut
 - 7 Communication protocol of Fc with SCADA MODBUS
 - 8 Buffer memory of FC for event log shall be minimum 450 events
 - 9 FC shall have the facility to enter manually the gas composition.

 	ASSAM GAS COMPANY LIMITED		JOB NO. P158	
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	.23	.23		

ULTRASONIC TYPE FLOW TRANSMITTER					
	S.No.				
General	1	Tag No.	P158-00-FIT-003, P158-00-FIT-004		
	2	Quantity	2		
	3	Line No.	Refer P158-00-PID-T001 sheet_3		
	4	Line Size & Schedule	Refer P158-00-PID-T001 sheet_3		
	5	Service	Natural Gas		
	6	Type	Multipath (Minimum 4 path)		
Flow Meter	7	End connection	Size and Rating	Flanged 8" & 300#	
	8	Facing & Finish	RF		
	9	Pulses / M3	*		
	10	Flow Range (MMSCMD)(min./nor./max.)	Refer Process Datasheet for Metering Skid		
	11	Enclosure	Weather proof IP67 as per IEC 60529 / IS 2147		
	12	Material	Body	*	
	13	Bi-directional /Unidirectional	Unidirectional		
	14	Radiography/Charpy test	Required		
	15	Overall uncertainty (including lab)	±0.3% OF READING(for Qt<Qi<Qmax)		
	16	Repeatability	±0.1% for qt<qi<qmax & ±0.2% for qmin<qi<qt		
	17	Transducer	ASTM A182F316		
Pre - amplifier	18	Type - 2 wire/ 3 wire	*		
	19	Preamplifier location	Meter Mounted		
	20	Power supply	From transmitter		
	21	Cable Entry	1/2" NPT(F)		
	22	Enclosure	Weather proof IP67 as per IEC 60529 / IS 2147		
	23	Intrinsic safe	Certification Exia IIB T3 as per CENELEC		
	24				
Transmitter	25	Power Supply	Cable Entry	24 VDC M20 Cable gland connection	
	26	Output	Frequency & RS422/485		
	27	Enclosure	Weather proof IP67 as per IEC 60529 / IS 2147		
	28	Intrinsic safe	Certification Exia IIB T3 as per CENELEC		
	29	Mounting	Meter Mounted		
	30	Transmitter Type	Electronics SMART compatible with HART protocol of latest version		
Options	31	Meter runs (Up & Down stream)	Required		
	32	Flow Conditioner/ Profiler	Required		
	33	Retractable Probes	*		
	34	Pressure Tap on Meter Body	Required - 1/2" NPT(F)		
	35	Cold Insulation			
	36	On Meter (Jacket type)	Required		
	37	On Meter tube (Up & down stream)	Required		
	38	Thermowell & Impulse tubing	Required		
Service Conditions	39	Fluid and State	Natural Gas & Gas		
	40	Flow	Design	Refer Process Datasheet for Metering Skid	
	41	Temp.	Design		
	42	Pressure	Design		
	43	Molecular Wt.			
	44	Viscosity (cP)			
	45	Cp/ Cv ratio			
	46	Max.allowable pressure drop			
	47	Compressibility Factor			
	48	Area Classification	Hazardous Zone 1 Group IIA /IIB as per IEC		
49	Model No.	Manufacturer	* *		
50	Transmitter	*			
Notes: Vendor to specify.*					
1	Vendor to provide meter sizing calculations based on process conditions for review and approval				
2	Refer Process Data Sheet & P&ID(P158-00-PID-T001) for more information.				
3	Maximum permitted velocity through USM is 20 m/sec.				
4	Vendor offer shall include mandatory spares and operating spares for 2 years.				
5	Vendor shall provide detailed GA drawing along with all parts name and MOC for the ultrasonic flow meter along with data sheet.				
6	Number of paths to be confirmed by vendor confirming to the performance specifications, but minimum 4 path is preferred				
7	A qualified flow conditioner and upstream and down stream pipe runs shall be supplied by the meter manufacturer and shall be used				
8	During wet calibration,(7 point calibration before adjustment, 2 point verification after adjustment in USM electronics)				
9	Straight meter run of 10 D(Nominal pipe diameter) between upstream of the flow conditioner, 10 D between flow conditioner and the meter and 5D downstream of meter shall be supplied by the meter manufacturer and used during wet calibration				
10	Flow transmitter housing material shall be Die cast Aluminium				

NGN LETEKUJAAN TERMINAL UPTO NRL IGGL RT PIPELINE

Data Sheet for Check Meter (FM-001 / 002 at NRL Station)

Document Number :- P158-DSH-T004_RCB

Rev.	Date	Description	ORG	REVIEW	APPROVAL
CB	04.08.2023	Issued For Client Approval	AS	GS	AD
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ASSAM GAS COMPANY LIMITED

NGN LETEKUJAAN TERMINAL UPTO NRL IGGL RT PIPELINE

DATA SHEET FOR CHECK METER (FM - 001 / 002) AT NRL STATION

JOB NO. 1458

Document Number :- P158-DSH-T004_RCB

Sht. 1 of 2

Rev.

IA	CB			

UNIT SECTION NAME	Check Meter
TAG NUMBER	FM - 001 / 002
SERVICE	Natural Gas
QUANTITY	2 X 100 %

1. OBJECTIVE

This specification covers the minimum technical requirements for the design, engineering and supply of a check Metering (USM Meter Type) for Natural Gas (NG) service at NRL & IGGL Station.

2. ENVIRONMENTAL CONDITIONS **

Maximum Black Body Temperature due to solar radiation	65°C	
Min Ambient Air Temperature	16°C	
Max Ambient Air Temperature	40°C	
Relative Humidity (Max)	70 %	
Relative Humidity (Min)	66 %	
Max Wind Velocity	9.3 Kmph	
Average Wind Velocity	7.7 Kmph	
Max Rainfall	-	** Ref: https://mausam.imd.gov.in/

3. PROCESS SPECIFICATION

3.1 Battery Limit Conditions:

Parameters	Units	Values
Fluid	-	Natural Gas
Phase	-	Gas
Toxic	-	No
Pressure	kg/cm ² g	6.5 - 13.5
Temperature	°C	20 - 30 / 45
Volumetric Flow (Operating)	MMSCMD	0.19 - 0.28
Design Flow Rate	MMSCMD	0.5
Mol Wt	-	21.20
Critical Pressure	kg/cm ² g	44.91
Cp/Cv	-	1.265 - 1.298
Z Factor	-	0.9458 - 0.9730
Viscosity	cP	0.01105 - 0.01157
Density	kg/m ³	6.496 - 13.08

4. This specification covers the minimum technical requirements for the design, engineering and supply of Metering

Design pressure	kg/cm ² g	49
Design Temperature	°C	-29 / 65
Meter Range	-	By Vendor
Measurement Accuracy	%	0.15%
Allowable Pressure Drop	kg/cm ²	0.5 (max) across skid
Inlet/Outlet piping size	inch / inch	8" (One No) / 8" (One No) (*)
Inlet/Outlet piping spec	-	P3C (300#) / P3C (300#)

* Sizes mentioned are flanges (Inlet/Outlet). Diameter to be confirmed by vendor.

 	ASSAM GAS COMPANY LIMITED	JOB NO. 158			
	NGN LETEKUJAAN TERMINAL UPTO NRL IGGL RT PIPELINE	Document Number :- P158-DSH-T004_RCB			
	DATA SHEET FOR CHECK METER (FM - 001 / 002) AT NRL STATION	Sht. 2 of 2	Rev.		
		IA	CB		

UNIT SECTION NAME	Check Meter
TAG NUMBER	FM - 001 / 002
SERVICE	Natural Gas
QUANTITY	2 X 100 %

5 DESIGN REQUIREMENTS

- 5.1 Piping Specification**
- The meters shall be installed in 300#, Carbon steel piping system in accordance with Piping Material Specification, Piping Class P3C. The inlet and outlet connections shall be flanged 300# RF.
 - Flanged vent/drain connections shall be provided.
 - Piping shall be designed according to ASME B31.8.

6. PERFORMANCE GUARANTEE

- Metering Package design capacity of 0.5 MMSCMD.
- Vendor to ensure that the process fluid does not leak into atmosphere leading to hazards to the environment or Personnel.
- Accuracy of the metering to be confirmed by Vendor.
- Pressure drop across the metering at design flow rate shall be less than (0.5 kg/cm² Max.)
- Vendor to consider suitable MOC for USM meter based on its nature and corrosion allowance.

7. UTILITIES

- The vendor shall advise the requirement of utilities, consumption value & process conditions of such utilities required.
- Power Supply for 110V AC for electronic available.

8. GENERAL NOTES:

- 8.1** The metering system shall be supplied complete with inlet/outlet headers, meter tubes (inlet & outlet), USM meter, and associated instrumentation on a skid frame.
- 8.2** Details shown in the P&ID are minimum. Vendor to consider the required instruments/Valves, etc., in their scope.
- 8.3** Meter Size shall be confirmed by Vendor.
- 8.4** This specification covers the minimum technical requirements for the design, engineering and supply of Metering skid in the scope.
- 8.5** TE flanges shall be SS 600# w.r.t 300# class.
- 8.6** Vendor to mention the accuracy of flow meter with the flow below turndown flowrate (upto minimum flow rate)
- 8.7** Vendor shall supply the complete package of metering skid & associated piping,fitting & accessories suitable for gas service as per P&ID.
- 8.8** Metering panel shall be enabled remote condition based monitoring for USM meter & station computer. suitable for gas service as per P&ID.
- 8.9** The velocity limit for continuous operation shall not exceed 15 m/s, and for intermittent operation, it shall be feasible up to 20 m/s.
- 9.0** Maximum Supply Pressure at Source shall be 38 Kg/cm²g

9. REFERENCE DOCUMENTS

- 1. P158-00-PID-T001 (SHEET 3 OF 3) : P&ID for Check metering at NRL & IGGL station.



Inspection & Test Plan for USM Check Meter

DOCUMENT NO.
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NGN LETEKUJAAN TERMINAL UP TO NRL IGGL RT PIPELINE PROJECT

Inspection & Test Plan for USM Check Meter

Doc No.: P158-ITP-I006

CA	15.09.2023	Issued for Client review	SC	NC	AD
REV.	DATE	DESCRIPTION	ORG	REVIEW	APPROVED



Inspection & Test Plan for USM Check Meter

DOCUMENT NO.
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3.0	QAP FOR INSTRUMENTS	4

1.0 BACKGROUND

Assam Gas Company Ltd. (AGCL) is a 60-year-old Natural Gas transmission and distribution company, wholly owned by the Govt. of Assam with its registered office at Duliajan, Dist. Dibrugarh, Assam 786602.

The company transports Natural Gas through its integrated pipeline infrastructure to several market segments i.e., Power, Fertilizer, Petrochemicals, Industrial, Commercial and Domestic consumers primarily located in upper Assam. The present infrastructure of the company has a transportation capacity of about 6.0 MMSCM of gas per day.

AGCL plans to extend their existing pipeline to transport natural gas from NGN Letekujan Terminal up to NRL IGGL RT pipeline project of approx. 6.2 km length.

Pipeline Engineering Consultants Pvt. Ltd. has been appointed as Engineering, Procurement and Construction Management consultant by AGCL for Engineering, Procurement, RFP Preparation, Site Supervision and Project Management for the Project.

2.0 DEFINITION

Where used in this document, the following terms shall have the meanings indicated below, unless clearly indicated by the context to this order

PROJECT	NGN LETEKUJAAN TERMINAL UPTO NRL IGGL RT PIPELINE PROJECT
CLIENT/ OWNER	Assam Gas Company Limited
EPMC	Pipeline Engineering Consultants Pvt. Ltd. (PLECO) the party to act for and on behalf of OWNER for the Detailed Engineering Services and Project Management.
CONTRACTOR	Agency appointed by CLIENT/ OWNER for execution of assigned tasks
PURCHASER	Either of CLIENT, OWNER or EPMC
VENDOR/ MANUFACTURER	Party, which manufactures and supplies equipment and services to the OWNER or to CONTRACTOR

2.1 BRIEF DESCRIPTION OF PROJECT

The primary objective of the Project is to transport the volume of 0.19 - 0.28 MMSCMD of natural gas from NGN Letekujan terminal to NRL IGGL receiving station via newly proposed 8" x 6.2 km (approx.) pipeline:

Dispatch Terminal	Receiving Station	Size & length
NGN Letekujan	NRL IGGL	8" x 6.2 km



Inspection & Test Plan for Metering Skid

3.0 QAP FOR INSTRUMENTS

<p>INSTRUCTIONS FOR FILLING UP:</p> <ol style="list-style-type: none"> 1. QAP shall be submitted for each equipment separately with breakup of assembly / sub-assembly & part/component or for group of equipment having same specification. 2. Use numerical codes as indicated for extent of inspection & tests and submission of test certificates & documents. Additional codes & description for extent of inspection & test may be added as applicable for the plant and equipments. 3. Separate identification number with quantity for equipment shall be indicated wherever equipment having same specifications belonging to different facilities are grouped together. 4. Weight in kilogram must be indicated under column 5 for each item. Estimated weights may be indicated wherever actual weights are not available. <p>ABBREVIATION USED: CONTR: Contractor MFR: Manufacturer TPI: Third Party Inspection Agency *: Vendor / Bidder to provide P: Performer, R: Review; W: Witness</p> <p>EN 10204, Type 3.2 certificates shall be provided for bought out items. Those shall be inspected by TPI appointed by Vendor</p>							<p style="text-align: center;">CODES FOR EXTENT OF INSPECTION, TESTS, TEST CERTIFICATES & DOCUMENTS :</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">CODE DESCRIPTION</th> <th style="width: 25%;">CODE DESCRIPTION</th> <th style="width: 25%;">CODE DESCRIPTION</th> <th style="width: 25%;">CODE DESCRIPTION</th> </tr> </thead> <tbody> <tr> <td>1. Visual</td> <td>12. Routine Test as per relevant IS / other standard</td> <td>23. Short time rating</td> <td rowspan="32" style="vertical-align: top;">D1. Approved GA Drawing. D2. Approved single Line / schematic diagram D3. Test certificates D4. Approved Bill of materials D5. Un-priced P.O. copy D6. Calibration certificates of all measuring instrument and gauges.</td> </tr> <tr> <td>2. Dimensional</td> <td>13. Type test as per relevant IS / other standard</td> <td>24. Operational & functional Test</td> </tr> <tr> <td>3. Fitment & alignment</td> <td>14. Impulse Test</td> <td>25. Over speed Test</td> </tr> <tr> <td>4. Physical Test (Sample)</td> <td>15. Partial Discharge Test</td> <td>26. Flame proof Test</td> </tr> <tr> <td>5. Chemical Test (Sample)</td> <td>16. Heat run risk test / temper</td> <td>27. Clearance and creepage distance</td> </tr> <tr> <td>6. Ultrasonic Test</td> <td>17. Enclosure protection test</td> <td>28. Acceptance Test</td> </tr> <tr> <td>7. Magnetic Particle Test (MPT)</td> <td>18. Calibration</td> <td>29. Honing Test</td> </tr> <tr> <td>8. Radiography Test</td> <td>19. Noise & Vibration</td> <td>30. Hydro test/ Shell leak Test</td> </tr> <tr> <td>9. Dye Penetrant Test</td> <td>20. Test certificate of bought out components</td> <td>31. Pneumatic Seat leak Test</td> </tr> <tr> <td>10. Measurement of IR value</td> <td>21. Tank pressure test</td> <td>32. Impact test</td> </tr> <tr> <td>a) Before HV Test</td> <td>22. Paint shed vibration</td> <td></td> </tr> <tr> <td>b) After HV Test</td> <td></td> <td></td> </tr> <tr> <td>11. High voltage Test / Dielectric Test</td> <td></td> <td></td> </tr> </tbody> </table>										CODE DESCRIPTION	CODE DESCRIPTION	CODE DESCRIPTION	CODE DESCRIPTION	1. Visual	12. Routine Test as per relevant IS / other standard	23. Short time rating	D1. Approved GA Drawing. D2. Approved single Line / schematic diagram D3. Test certificates D4. Approved Bill of materials D5. Un-priced P.O. copy D6. Calibration certificates of all measuring instrument and gauges.	2. Dimensional	13. Type test as per relevant IS / other standard	24. Operational & functional Test	3. Fitment & alignment	14. Impulse Test	25. Over speed Test	4. Physical Test (Sample)	15. Partial Discharge Test	26. Flame proof Test	5. Chemical Test (Sample)	16. Heat run risk test / temper	27. Clearance and creepage distance	6. Ultrasonic Test	17. Enclosure protection test	28. Acceptance Test	7. Magnetic Particle Test (MPT)	18. Calibration	29. Honing Test	8. Radiography Test	19. Noise & Vibration	30. Hydro test/ Shell leak Test	9. Dye Penetrant Test	20. Test certificate of bought out components	31. Pneumatic Seat leak Test	10. Measurement of IR value	21. Tank pressure test	32. Impact test	a) Before HV Test	22. Paint shed vibration		b) After HV Test			11. High voltage Test / Dielectric Test		
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SI. No.	Item	Identification Number		Qty	Weight Kg	Exp Date of Inspection	MFR Name & Address	In-Process Stage			Final Inspection			Test certificate & Document to be submitted to CLIENT	Acceptance Criteria standards/ IS/BS/ASME/ Norms and documents	Remark / Sampling Plan																																												
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1.	Gauges	Refer P&ID	*	*	*	Client Approved	1, 2, 3, 4, 5-P	-	-	1, 2, 3, 18, 20-P	1, 2, 3, 18, 20-R, 24-W	1, 2, 3, 18, 20, 24-R	1, 2, 3, 4, 5, 18, 20, 24, D3, D6	D3, D6, Tech. spec	100%
2.	RTD	Refer P&ID	*	*	*	Client Approved	1, 2, 3, 4, 5-P	-	-	1, 2, 3, 18, 20-P	1, 2, 3, 18, 20-R, 24-W	1, 2, 3, 18, 20, 24-R	1, 2, 3, 4, 5, 18, 20, 24, D3, D6	D3, D6, Tech. spec	100%
3.	Transmitters	Refer P&ID	*	*	*	Client Approved	1, 2, 3, 4, 5-P	-	-	1, 2, 3, 18, 20-P	1, 2, 3, 18, 20-R, 24-W	1, 2, 3, 18, 20, 24-R	1, 2, 3, 4, 5, 18, 20, 24, D3, D6	D3, D6, Tech. spec	100%
4.	Thermowells	Refer P&ID	*	*	*	Client Approved	1, 2, 3, 4, 5-P	-	-	1, 2, 3, 18, 20-P	1, 2, 3, 18, 20-R, 24-W	1, 2, 3, 18, 20, 24-R	1, 2, 3, 4, 5, 18, 20, 24, D3, D6	D3, D6, Tech. Spec	100%
5.	Flow Computer	Refer P&ID	*	*	*	Client Approved	1, 2, 3, 4, 5-P	-	-	1, 2, 3, 18, 20-P	1, 2, 3, 18, 20-R, 24-W	1, 2, 3, 18, 20, 24-R	1, 2, 3, 4, 5, 18, 20, 24, D3, D6	D3, D6, Tech. Spec	100%
6.	Metering Panel	Refer P&ID	*	*	*	Client Approved	1, 2, 3, 4, 5-P	-	-	1, 2, 3, 18, 20-P	1, 2, 3, 18, 20-R, 24-W	1, 2, 3, 18, 20, 24-R	1, 2, 3, 4, 5, 18, 20, 24, D3, D6	D3, D6, Tech. Spec	100%
7.	FAT Procedure	-	-	-	-	Client Approved	-	-	-	P	R	R	FAT Procedure	Test record	100%
8.	SAT Procedure	-	-	-	-	Client Approved	-	-	-	P	R	R	SAT Procedure	Test record	100%



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9.	Factory Acceptance Test	As per approved P&ID, GAD, datasheets , FAT	*	*	*	Client Approved				1, 2, 3, 12, 24, Loop check, Power on, Calibr. Verificn.	1,2,3,12,24 Loop check, Power on, Calibr. Verificn.	1, 2, 3,12, 24 Loop check, Power on, Calibr. Verificn.	FAT Test Report	Approved FAT procedure and other relevant doc.	100%
10.	Site Acceptance Test	As per approved P&ID, GAD, datasheets , SAT procedure, FAT Report	*	*	*	Client Approved				1,2,3,12,24 Loop check, Power on, Calibr. Verificn.	1,2,3 ,12, 24, Loop check, Power on, Calibr. Verificn.	1, 2, 3, 12, 24 Loop check, Power on, Calibr. Verificn.	SAT Test Report	Approved SAT procedure and other relevant doc.	100%



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0	05.01.22	ISSUED AS STANDARD	KS	AD	AD	SK
Rev.	Date	Purpose	Prepared by	Reviewed by	Approved by	Approved by



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ABBREVIATIONS

AARH	:	Arithmetic Average Roughness Height
EDDL	:	Electronic Device Description Language
FDT / DTM	:	Field Device Tool / Device Type Manager
FISCO	:	Fieldbus Intrinsic Safe Concept
HART	:	Highway Addressable Remote Transducer
LAS	:	Link Active Scheduler
NIST	:	National Institute of Standards and Technology
NPT	:	National Pipe Thread
PID	:	Proportional, Integral and Derivative
SS	:	Stainless Steel



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1.0 GENERAL

1.1 Scope

1.1.1 This specification, together with the data sheets covers the requirements for the design, materials, nameplate marking, inspection, testing and shipping of Ultrasonic Flow meters and their accessories.

1.1.2 The standards referred to herein and mentioned below shall be of the latest editions unless otherwise specified:

AGA	American Gas Association, Gas measurement committee
	Report No. 8 Compressibility and Super-compressibility for Natural Gas and other Hydrocarbon Gas Transmission Measurement
	Report No. 9 Measurement of gas by Multipath Ultrasonic flow meters
ReportNo.10 Speed of sound in Natural Gas & other Related Hydrocarbon Gases	
API	American Petroleum Institute
	MPMS Manual of Petroleum Measurement Standards
	Chapter 1 Vocabulary
	Chapter 4 Proving Systems
	Chapter 5 Metering
Chapter 5.8 Measurement of Liquid Hydrocarbons by Ultrasonic Flow Meters using Transit Time Technology	
ASME	American Society of Mechanical Engineers
	B 1.20.1 Pipe Threads
	B 16.5 Steel Pipe Flanges and Flanged Fittings
	B 16.20 Ring-joint Gaskets and Grooves for Steel Pipe Flanges
B 16.47-B Large Diameter Steel Flanges	
EN	European Standard
	60947-5-6 Pulse generator requirements
	10204 Inspection documents for metallic products
IS/IEC	Indian Standards/International Electro-Technical Commission
	IS/IEC 60079 Electrical Apparatus for Explosive Gas Atmospheres.
	IS/IEC60529 Degree of Protection Provided by Enclosures (IP Code).
	IEC61000-4 Electronic compatibility for Industrial Process Measurement and Control Equipment
ISO	International Organization for Standardisation
	2186 Fluid Flow in Closed Conduits - Connections for Pressure Signal Transmissions between Primary and Secondary Elements
	5168 Measurement of Fluid Flow: Estimation of Uncertainty of Ultrasonic Flow meters
	6551 Cabled transmission of electric and/or electronic pulse data
	6569 Natural Gas - Rapid Analysis by Gas Chromatography
	6976 Natural gas - Calculation of Calorific Value, Density and Relative Density



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10723	Natural gas — Performance evaluation for On-line Analytical Systems
12765	Measurement of Fluid Flow in Closed Conduits — Methods using Transit Time Ultrasonic Flow meters
OIML	International Organisation of Legal Metrology
R 117	Measurement systems for liquids other than water

1.1.3 In the event of any conflict between this standard specifications, data sheets, statutory regulations, related standards, codes etc., the following order of priority shall govern:

- a) Statutory Regulations
- b) Job Specifications / Data Sheets
- c) Standard specification
- d) Codes and standards

1.1.4 In addition to compliance to purchaser's specifications in totality, vendor's extent of responsibility shall include the following:

- a) Purchaser's data sheets indicate the minimum acceptable materials of construction for body, trim and accessories of the Ultrasonic flow meter. Alternative superior material of construction shall also be acceptable provided vendor assumes complete responsibility for proper selection of offered materials for their compatibility with the process fluid and its operating and design conditions specified in the data sheets.
- b) Sizing of the Ultrasonic flow meter and indicating the velocity and accuracy at the specified flow conditions.
- c) Coordination and approvals from statutory authorities like weights and measures etc, wherever required.

1.2 Bids

1.2.1 Vendor's quotation shall be strictly as per the bidding instruction to the vendor attached with the Material Requisition.

1.2.2 Whenever a detailed technical offer for each item is specifically indicated, vendor's quotation shall include the following:

- a) Compliance to the specifications
- b) A detailed specification of each Ultrasonic meter having following details as a minimum. All the material specifications and units of measurement for various parts in the vendor's specification sheet shall be to the same standards as those indicated in the purchaser's data sheets.
 - i) Details regarding type, material of construction etc., for various parts of the Ultrasonic flow meter, meter runs, flow conditioner and its accessories.
 - ii) All the design characteristics and performance characteristics including meter accuracy, repeatability, velocity at operating flow and minimum detectable flow rate.
 - iii) Specification and type of cabling required between the meter and its associated receiver instrument/flow computer including the maximum permissible cable length.
 - iv) Maximum pressure loss through the meter and meter runs at maximum flow rate.
 - v) Upstream and downstream straight pipe length requirement for installation.

- c) Overall dimensions in millimetres of the Ultrasonic flow meter, meter runs and its accessories.
- d) Type test certificate from accredited laboratory.
- e) Certificate from regulatory authority for custody transfer application (whenever Custody Transfer application is specified in the data sheets).
- f) A copy of approval from local statutory authority, as applicable, such as Petroleum and Explosives Safety Organisation (PESO)/Chief Controller of Explosives (CCE) or Director General of Mine Safety (DGMS) in India, for the electronic instruments installed in electrically hazardous area along with
- g) Deviation on technical requirements shall not be generally entertained. In case vendor has some valid technical reason for not complying with the specific requirements due to superior alternatives and materials, tag wise deviation list must be provided along with the technical justification
- h) Catalogues in English giving detailed technical specifications; model decoding details and other information for the type of ultrasonic flow meter and its accessories covered in the bid.

1.2.3 Vendor shall also quote for the following:

- a) Two years' operational spares for Ultrasonic flow meter and its accessories covered in the bid.
- b) Any special tools needed for maintenance work on the Ultrasonic flow meter and its accessories. Vendor must confirm in their offer if no special tools are needed for maintenance of the offered Ultrasonic flow meter.
- c) Unit rate (per meter) for interconnecting cable between sensor unit & transmitter along with SS flexible metallic conduit in case of unarmoured cables
- d) Any Start-up and Commissioning spares, if required, as recommended by vendor.

1.3 Drawings and Data

1.3.1 Detailed drawings, data, catalogues and manuals required shall be submitted by vendor as per vendor data requirements attached with the requisition.

1.3.2 Final documentation consisting of design data, installation manual, operational and maintenance manual etc., submitted by the vendor after placement of purchase order, shall include the following, as a minimum:

- a) Specification sheet for each Ultrasonic flow meter, Meter Run including flow conditioner, if required, Meter electronics and its accessories
- b) Weight in kilograms of each Ultrasonic flow meter and its accessories, meter run with flow conditioners, if required, etc.
- c) Certified drawings for each Ultrasonic flow meter, meter runs with flow conditioner, if required, etc., which shall provide dimensional details, internal construction details, material of construction etc.
- d) Copy of type test certificates
- e) Proving procedure
- f) Detailed wiring diagrams
- g) Certificate of compliance to purchaser's specification as per clause 3.1 of EN 10204.
- h) Graphs of correction factors such as pressure, temperature, density and viscosity.

2.0 DESIGN AND CONSTRUCTION



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- 2.1 Flow meter Body and Trim
- 2.1.1 The Ultrasonic flow meter shall be based on transit time technology.
- 2.1.2 The design used shall provide maximum reliability, maximum on-line performance and minimum maintenance. It shall be immune to other impurities in the fluid stream.
- 2.1.3 The flow meter transducers shall be energized by the integral electronics to transmit and receive ultrasonic waves.
- 2.1.4 The meter design shall have the facility to remove /replace the transducers in situ under line operating condition. Failure or removal of one pair of transducers shall not cause the meter to lose all measurement function. Failure of any path shall generate an alarm identifying the affected path. Also transducers ports shall be designed in a way to reduce the possibility of liquid or solid accumulation.
- 2.1.5 It shall be possible to replace transducers without a change in meter performance. After replacement of transducers and a possible change of the associated software constants, the resulting shift in the meter's performance should not be more than the allowable repeatability of the meter.
- 2.1.6 The vendor shall comprehensively advise the impact of transducer failure on the performance and accuracy of the Ultrasonic flow meter. Ultrasonic flow meters and the meter runs/flow conditioners shall be rated for the maximum design pressure as indicated in the data sheets.
- 2.1.7 Ultrasonic flow meter spool inside diameter (ID) shall meet the specified pipe ID and internal surface roughness shall be as per API standard.
- 2.1.8 The meter shall be suitable for horizontal & vertical mounting. However, the flow direction shall be clearly stamped or cast on the body.
- 2.1.9 End connections:
- 2.1.9.1 Spool piece type Ultrasonic flow meters shall have flanged end connections. Weld joints, if any, shall be of radiographic quality.
- 2.1.9.2 Unless otherwise mentioned, end connection details shall be as below:
- a) Threaded end connections shall be to NPT as per ASME B 1.20.1
 - b) Flanged end connections shall be as per ASME B 16.5
 - c) Grooves of ring type joint flanges shall be octagonal as per ASME B 16.20 and groove finish shall be as follows:
63 AARH : 32 to 63 micro inch AARH
 - d) When Flanges are Raised Face (RF) type, the face finish shall be as per ASME B 16.5 and shall be as follows:
125 AARH : 125 to 250 micro inch AARH
- 2.1.10 The material of construction of Ultrasonic flow meter internals/wetted parts and body shall be as specified in the respective data sheets.
- 2.1.11 Meter Sizing:
- 2.1.11.1 All the calculations and units of measurement shall be in metric standard only.
- 2.1.11.2 Flare Ultrasonic flow meter shall be suitable for measuring flow with specified accuracy for velocity range from 0.3 m/s to 120 m/s, however, the flow measurement corresponding to 0.03 m/sec shall be detectable without ascertaining the accuracy.



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- 2.1.11.3 For Process application, Ultrasonic flow meter shall be selected ensuring the capability of measuring minimum flow with specified accuracy at a velocity of 0.5 m/sec within the meter body.
- 2.1.11.4 For cases where sizing and selection of flow meter is to be performed by vendor, vendor shall furnish the sizing calculations to justify the selection of Ultrasonic flow meters considering the density and viscosity of the fluid. Selected meter size shall ensure that flow meter operates within 85% of their standard range (not extended).
- 2.1.11.5 Overall pressure loss across the meter assembly including meter runs shall be within the permissible pressure loss specified in data sheet. Pressure drop calculation across the meter shall be furnished.
- 2.1.11.6 Unless otherwise specified in the data sheets, vendor to ensure the velocity in the Ultrasonic flowmeter and meter run shall not exceed maximum permissible velocity.
- 2.1.11.7 Vendor shall indicate the range of viscosities over which the measurement accuracy remains within limits.
- 2.1.11.8 Ultrasonic flowmeters shall be suitable for measuring the flow with the specified accuracy with upstream and downstream straight length of 10D and 5D respectively for both process and flare application. Required calibration analysis to establish the specified performance shall be carried out by the vendor and included in their offer.
- 2.2 Meters in Custody Transfer Applications
- 2.2.1 The design, construction and operation of Ultrasonic flow meters in Custody transfer applications shall conform to API standard (latest version) for Measurement of liquid Hydrocarbon by Ultrasonic flow meters using transit time technology and AGA Report 9 (latest version) for hydrocarbon Gas service
- 2.2.2 The average velocity of the fluid shall be measured along four acoustic paths as a minimum. Numerical calculation techniques shall then be used to compute the average axial flow velocity and volume flow rate at operating conditions through the meter.
- 2.2.3 Temperature and Pressure sensing devices shall be installed immediately downstream of the meter run to accurately represent the actual metering conditions and any calculation required for compensation of varying density.
- 2.2.4 Meter Runs:
- 2.2.4.1 Unless otherwise specified end connections for the upstream and downstream meter runs shall conform to this specification.
- 2.2.4.2 Flow Conditioners:
- Type of flow conditioner (tube or vane type or Flow profiler etc.) shall be as recommended by vendor best suitable for the application. All Ultrasonic flow meters shall be provided with meter run and flow conditioner as per purchaser's datasheet. Minimum upstream and downstream run lengths shall be 10D and 5D respectively, where D is the inside diameter of the run.
 - The straightening element shall be made out of a thin walled tube or light gauge metal vane. However, the design shall be rugged enough to resist the forward thrust due to high flows. The element shall have smooth leading and trailing edges.
 - For tube type flow straightener, the length to diameter ratio of each tube shall be at least 10:1
- 1.3 Meters in Process/Flare Applications
- 2.3.1 The ultrasonic flow meters shall be supplied in completely assembled condition with all the probes (sensor/transducer), nozzles for installation of these probes ready for installation on a pipeline or duly mounted on a spool piece.



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- 2.3.2 Spool piece type design shall be selected for meter sizes up to 16". For higher meter sizes, Insertion type design shall be used.
- 2.3.3 The number of probes required for a particular application and probe configuration shall be decided by the vendor. The same shall be decided such that measurement is considered across two acoustic paths as a minimum for process applications and single or more paths for flare applications. Supply of single or multipath flow meter shall be accordingly considered by vendor
- 2.3.4 Whenever the sensor / receiver probes are insertion type:
- a) The material of construction of all the wetted portions of probe shall be suitable for the specified process conditions.
 - b) The probes shall be inserted through flanged nozzles of minimum 2" size to ensure insertion and removal of probes. Threaded nozzles for insertion shall not be acceptable.
 - c) It shall be possible to insert or retract the probes on-line without process interruption. Suitable retraction assembly shall be supplied for insertion and removal of probes on-line. In case of Flare meters, Vendor shall mandatorily provide full bore ball valve, for isolation, with each probe. The location of probes shall be selected to avoid fouling.
- 2.3.5 For high temperature application, suitable arrangement shall be provided to protect the sensor from high temperature. Any additional mounting accessory, if necessary shall be supplied by vendor.
- 2.3.6 Ultrasonic signal frequency shall be dependent on the application. Accordingly, vendor to select suitable piezo-crystal probes meeting the specified requirements.
- 2.4 Meter Electronics
- 2.4.1 Ultrasonic flow meter's electronics system including power supplies, microcomputer, signal processing components and ultrasonic transducer excitation circuits, may be housed in one or more enclosures mounted locally or remotely to the meter and is referred to as the Signal Processing Unit (Transmitter). It shall be designed and installed to meet the specified hazardous area classification.
- 2.4.2 The transmitter/ signal processing unit shall be microprocessor-based electronics suitable for installation in the field under the ambient condition specified. Meter electronics shall be Weather proof to IP 65 and flameproof certified suitable to install in area classification. All field mounted items shall have enclosures suitable for the area classification indicated in purchaser's data sheets.
- 2.4.3 The transmitter/ signal processing shall have extensive diagnostic capability. Self-diagnostic feature should include monitoring the health of the transducers and signal quality. Meter parameters and factors set into the meter electronics shall be retained in non-volatile memory and shall be secured with password such that un-authorized changes are prohibited. Configuration software and firmware shall be provided.
- 2.4.4 For meter electronics, vendor shall ensure that the input/output signals and performance characteristics of individual instruments are compatible with each other.
- 2.4.5 The transmitters shall accept inputs from probes either directly or through pre-amplifier. The number of inputs shall be based on the number of paths selected for particular application.
- 2.4.6 The flow transmitter shall also accept inputs from pressure, temperature and/or density transmitters for accurate measurement at operating conditions (as applicable).
- 2.4.7 The cable entry sizes between the transmitter/ signal processing unit and preamplifier/ transducers shall be decided by vendor. All interconnecting cables and the weatherproof & flameproof cable glands shall be supplied by vendor accordingly. 2.4.8 Meter output signals from the meter electronics shall be without flying leads. Number of cable entries and their sizes for the output signals shall be as per purchaser's datasheets.



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- 2.4.9 Meter electronics shall be capable of providing the following output signals (as applicable):
- a) Individual 4-20 mA outputs for Mass flow rate (Kg/h), Volumetric flow rate (m³/h or Nm³/h), Pressure (Kg/cm²a), Temperature (°C), molecular weight, sound speed (m/s) as per the requirements mentioned in the purchaser's datasheets.
 - b) High-resolution dual pulse outputs to flow computers configurable for flow rate signals and shall be user selectable to be either same outputs or one signal dedicated to each direction of flow. The transmitters shall comply with the principles of ISO 6551 cabled transmission of electric and/or electronic pulse data. At least security level B as defined by ISO 6551 shall be provided and the checking facility shall be of type P.
 - c) Digital discrete outputs for direction of flow, trouble alarm and output data validation.
 - d) RS-485/422 communication port with MODBUS protocol for communicating with the control room mounted flow computer for measured data, meter diagnostics, test and health data. Vendor shall supply the signal interconnection cables as per purchaser's datasheets for Pulse Outputs and RS 485 serial link (armored cables) including connectors at both ends against each tag for communication between flow meter in field and flow computers mounted on control panel located at respective control room.
- 2.4.10 Whenever HART transmitters or field bus based transmitters are mentioned in purchaser's datasheets, the following features must be ensured:
- a) It shall allow multi master (primary and secondary) for configuration, calibration, diagnosis and maintenance. The primary could be the control system or host computer, and the secondary could be the hand held communicator.
 - b) It should be capable of implementing universal command
- 2.4.11 In addition to the requirements specified above, field bus based transmitter, wherever specified in the purchaser's data sheet, shall meet the following requirements:
- a) All instruments must satisfy the requirements of the field bus registration laboratory with applicable checkmark like foundation field bus, profibus NutZer organisationer(PNO), or as specified in the purchaser's data sheets.
 - b) All instruments shall have one analog input blocks, as a minimum. In addition, when specified the transmitter shall also have PID controller block.
 - c) All instruments must be interoperable and shall have valid interoperability test clearance like ITK latest version for foundation field bus or equivalent for profibus PA, as applicable.
 - d) The field bus instruments shall support peer-to-peer communication.
 - e) All instruments shall be polarity insensitive. Also transmitter shall be LAS capable.
 - f) The field bus instruments in hazardous area shall be certified as per entity concept or shall be FISCO approved as per the requirements specified in the purchaser's specification.
 - g) All instruments shall support EDDL or FDT/DTM requirements, as specified in data sheets.
 - h) Internal Software shall be configured by the vendor including the following information.
 - Serial Number
 - Device Tag (Tag No.)
 - Process Description



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i) All instruments shall be capable of supporting incremental Device Descriptor (DD for extra functionality and/or software revisions in Device Memory.

2.4.12 Meter electronics shall operate on 110/230 V AC $\pm 10\%$, 50 Hz $\pm 3\text{Hz}$ UPS or 24V DC and shall be protected from overload and from transients. Low power consumption is desired. Supply voltage fluctuation of ± 10 percent from the specified value and supply frequency fluctuation of ± 3 Hz from the specified value shall not affect the meter performance.

2.4.13 The design of electronic instruments shall be in compliance with the electromagnetic compatibility requirements as per IEC61000-4.

2.4.14 The meter transducers shall be intrinsically safe certified suitable for the specified area classification and weather proof to IP65 /and vendor shall supply necessary isolating barriers between the transducers and preamplifier/transmitter. However the transducer/sensor housing can be flameproof (Ex d) certified suitable for the specified area classification instead of intrinsically safe.

2.4.15 The transmitter's enclosure housing the electrical parts shall be suitable for the area classification indicated in the purchaser's data sheets. Unless otherwise specified, the enclosure shall conform to the following standards:

Weather proof housing - IP 65 as per IS/IEC 60529

Flame proof housing - EX (d) as per IS/IEC 60079

Flameproof housing shall also be made weather proof.

2.5 Performance Requirements

Vendor shall meet the accuracy requirements mentioned herein, and indicate the same in the offer with sizing calculations and back-up documentation. The minimum no. of paths, as defined for each application, shall be ensured.

2.5.1 For Custody Transfer and Pipeline Applications:

a) Liquids

a. Accuracy $\pm 0.15\%$ of reading

b. Repeatability $\pm 0.02\%$ of reading

b) Gases

a. Accuracy $\pm 0.3\%$ of reading

b. Repeatability $\pm 0.1\%$ of reading

3.0 NAMEPLATE

3.1 Each Ultrasonic flow meter and its accessory shall have a SS nameplate attached firmly to it at a visible place, furnishing the following information:

a) Tag number as per purchaser's data sheet.

b) Manufacturers serial no. and model no.

c) Manufacturer's name/trade mark.

d) Nominal end connection size and rating in ASME B16.5 class.

e) Meter Body and Probe material.

f) Calibrated range & units of measurement of flow.



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- g) Area classification in which the equipment can be used.
- h) Hazardous area certification number and marking.

4.0 INSPECTION AND TESTING

Purchaser reserves the right to inspect and witness testing at vendors works in-line with the Inspection Test Plan for Ultrasonic Flowmeter and approved quality documents. All these tests shall be completed by vendor and test reports shall be submitted to purchaser for scrutiny

5.0 SHIPPING

- 5.1 All threaded and flanged openings shall be suitably protected to prevent entry of foreign material.
- 5.2 The ultrasonic flow meter and accessories shall be packed separately.



**STANDARD SPECIFICATION
FOR
TEMPERATURE GAUGES AND THERMOWELLS**

I-SPC-005

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Rev.	Date	Purpose	Prepared by	Reviewed by	Approved by	Approved by



**STANDARD SPECIFICATION
TEMPERATURE GAUGES AND THERMOWELLS**

**SPECIFICATION NO.
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ABBREVIATIONS

AARH	:	Arithmetic Average Roughness Height
NPT	:	National Pipe Thread
PTC	:	Performance Test Code



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TEMPERATURE GAUGES AND THERMOWELLS**

**SPECIFICATION NO.
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STANDARD SPECIFICATION TEMPERATURE GAUGES AND THERMOWELLS

SPECIFICATION NO.
I-SPC-005 Rev. 0

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1.0 GENERAL

1.1 Scope

1.1.1 This specification, together with the data sheets, describes the requirements for the design, materials, nameplate marking, inspection, testing and shipping of temperature gauges and thermowells.

1.1.2 The related standards referred herein and mentioned below shall be of the latest edition of the following codes, standard practices and publications, unless otherwise specified:

ASME	American Society of Mechanical Engineers
B 1.20.1	Pipe Threads, General Purpose (Inch)
B 16.5	Pipe Flanges and Flanged Fittings
B 16.20	Metallic Gaskets for Pipe Flanges-Ring Joint, Spiral wound and Jacketed.
PTC 19.3 TW	Thermowells Performance Test Code
EN	European Standard
10204	Inspection documents for metallic products
13190	Dial Thermometers
IS/IEC	Indian Standards/International Electro-Technical Commission
IS/IEC60529	Degree of Protection Provided by Enclosures (IP Code).
IBR	Indian Boiler Regulations

1.1.3 In the event of any conflict between this standard specifications, data sheets, statutory regulations, related standards, codes etc., the following order of priority shall govern:

- a) Statutory Regulations
- b) Data Sheets
- c) Standard specification
- d) Codes and standards

1.1.4 In addition to compliance to purchaser's specifications in totality, vendor's extent of responsibility shall include the following:

- a) Purchaser's data sheets indicate the material of construction for sensing element, capillary, stem, thermowell etc. Alternate superior material of construction shall also be acceptable provided vendor assumes complete responsibility for the selected materials for their compatibility with the specified fluid and its operating conditions.
- b) Vendor shall carryout the vibration analysis of the thermowells as per ASME PTC 19.3 TW latest standard and shall provide suitable design for the thermowells wherever necessary and required as per data sheets.

1.2 Bids

1.2.1 Vendor's quotation shall be strictly as per the bidding instruction to the vendor attached with the Material Requisition.

1.2.2 All documentation submitted by the vendor including their quotation, catalogues, drawings, installation, operation and maintenance manuals etc. shall be in English language only.



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- 1.2.3 Vendor shall quote for two years' operational spares for each temperature gauge and its accessories, which shall include movement, pointer, glass cover plate etc. as a minimum.
- 1.3 Drawings and Data
- 1.3.1 Detailed drawings, data, catalogues and manuals required from the vendor are indicated by the purchaser in vendor data requirement sheets attached with the requisition.
- 1.3.2 Final documentation consisting of design data, installation manual and maintenance manual submitted by the vendor after placement of purchase order, as per vendor data requirement, shall include the following as a minimum:
- a) Certified drawings sheets for each gauge and its accessories, which shall provide dimensional details, internal constructional details, end connection details and material of construction.
 - b) Installation procedure for each gauge and its accessories.
 - c) Calibration and maintenance procedures including replacement of its internal parts wherever applicable.
 - d) Vibration analysis for thermowell wake frequency calculations.
 - e) Certificates from statutory body (IBR, wherever applicable) and test certificates.
 - f) Catalogues in English language.

2.0 DESIGN AND CONSTRUCTION

- 2.1 Temperature Gauges
- 2.1.1 Temperature gauges shall be of the separate socket type suitable for well installation. Upon assembly of components, the temperature gauge element shall firmly contact the bottom of the well. The gauge stem shall fit the well so that maximum heat transfer rate results.
- 2.1.2 Unless otherwise specified in the purchaser's data sheet, the temperature gauges shall be of bimetallic type.
- 2.1.3 Whenever filled system type temperature gauges are specified, the temperature gauge shall be gas filled only as per EN13190.
- Liquid Filled Temperature Gauges shall be with Full compensation only and not case compensation.
- 2.1.4 The range shall be selected in such a way that the operating temperature falls in the middle 30% of the full working range i.e. 35% to 65% of the offered range.
- 2.1.5 Unless otherwise specified, the temperature gauges shall have an over range protection of at least 110% upto temperature 500°C.
- 2.1.6 Data sheets indicate the minimum requirements of material of construction. Alternate material as specified in clause 2.2.1 of this specification shall also be acceptable.
- 2.1.7 Whenever temperature gauges are specified with capillary extension for remote installation, the capillary shall be of 304 Stainless Steel or better and protected by stainless steel flexible armour.
- 2.1.8 The gauge movement material shall be of stainless steel, as a minimum.
- 2.1.9 Cases and dials
- 2.1.9.1 The case of bimetallic type of gauges shall be all angles rotatable type.
- 2.1.9.2 The gauges shall be weatherproof to IP 65 as per IS/IEC 60529 as a minimum.



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- 2.1.9.3 The gauge dial shall be made of a suitable metallic material so that the finished dial shall be capable of withstanding a dry heat of 85°C for 10 hours and immersion in water at 85°C for 1 hour without cracking, blistering, warping or discolouration of the dial or paint on the dial.
- 2.1.9.4 The pointer stops shall be provided less than 5% below the minimum of the scale.
- 2.1.9.5 The dial cover shall be made out of shatter proof glass sheet of thickness of minimum 4.0mm.
- 2.1.9.6 Zero adjustment screw shall be external without opening the case.
- 2.1.9.7 Dial colour shall be white and size shall be 150 mm minimum unless otherwise specified.

2.1.10 Performance Requirements

Unless otherwise specified, the accuracy of temperature gauge shall be as per EN 13190 Class 1.

2.2 Thermowell

- 2.2.1 Unless otherwise specified, the thermowell material shall be 316 Stainless Steel, as a minimum. Alternate material as specified in the table below shall also be acceptable subject to meeting process conditions specified in the data sheet.

Sr. No.	Item	Specified Material of Construction	Alternate Material of Construction
1	Thermowell	ss 316	SS 316L, SS 316Ti
2	Case	ss 304	SS316
3	Capillary	ss 304	SS 316, SS 304L, SS316L, SS 316 Ti
4	Stem	ss 316 SS 321 for temperature above 600°C	SS 316L, SS 316Ti SS 321 for temperature above 600°C

- 2.2.2 Thermowells with immersion length up to 500mm shall be machined out of forged barstock. Built-up thermowell with welded well construction shall be considered for immersion length of greater than 500mm, unless specified otherwise in purchaser's datasheet.
- 2.2.3 The base of the thermowells shall be chosen to fit the instrument without air gap for minimizing measurement lag.
- 2.2.4 Thermowell flange material and rating shall be as specified in the purchaser's data sheet.
- 2.2.5 All thermowell weld joints shall be full penetration weld type only.
- 2.2.6 Thermowell immersion length shall be as specified in purchaser's data sheets. Where immersion length is not specified in the purchaser's data sheet, following shall govern;

Line Size	Immersion Length
From	4"to 6"280mm
From 8" to 20"	320mm
From 20" to 24" & Vessels/ Columns	400mm



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- a) Tag number as per purchaser's data sheets.
- b) Thermowell material as per purchaser's data sheets.
- c) Thermowell immersion length 'U'.

3.2.2 The following information shall be punched on the thermowell flange at a visible place:

- a) Nominal flange size in inches and rating in pounds.
- b) Flange material as per purchaser's data sheets.

4.0 INSPECTION AND TESTING

Purchaser reserves the right to inspect and witness testing at vendor's works as per Inspection Test Plan. All these tests shall be completed by the vendor and test reports shall be submitted to purchaser for scrutiny.

5.0 SHIPPING

- 5.1 Proper care shall be taken in shipping the temperature gauges, especially for the case glass and extension capillaries, where specified. All items shall be adequately packed to withstand shipping conditions, without damage.
- 5.2 All threaded and flanged openings shall be suitably protected to prevent entry of foreign material.
- 5.3 All thermowells in oxygen and chloride service shall be separately packed along with a certificate 'CERTIFIED FOR USE IN OXYGEN / CHLORINE SERVICE', as applicable.



**STANDARD SPECIFICATION
FOR
THERMOCOUPLES, RTDs AND THERMOWELLS**

I-SPC-006

0	08.01.22	ISSUED AS STANDARD	KS	AD	AD	SK
Rev.	Date	Purpose	Prepared by	Reviewed by	Approved by	Approved by



**STANDARD SPECIFICATION
THERMOCOUPLES, RTDs AND THERMOWELLS**

**SPECIFICATION NO.
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ABBREVIATIONS

AARH	:	Arithmetic Average Roughness Height
NPT	:	National Pipe Thread
PTC	:	Performance Test Code
RTD	:	Resistance Temperature Detector
SS	:	Stainless Steel



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1.0 GENERAL

1.1 Scope

1.1.1 This specification, together with the data sheets describes the requirements for the design, materials, nameplate marking, inspection, testing and shipping of thermo-couples, RTDs and thermowells.

1.1.2 The related standards referred herein and mentioned below shall be of the latest edition of the following codes, standard practices and publications, unless otherwise specified:

ASME	American Society of Mechanical Engineers
B 1.20.1	Pipe Threads, General Purpose (Inch)
B 16.5	Pipe Flanges and Flanged Fittings
B 16.20	Metallic Gaskets for Pipe Flanges
PTC 19.3	TW Performance Test Code-Temperature measurement

API	American Petroleum Institute
RP 551	Process Measurement Instrumentation.

EN	European Standard
10204	Inspection documents for metallic products

IS/IEC	Indian Standards/International Electro-Technical Commission
IS/IEC-60079	Electrical Apparatus for Explosive Gas Atmosphere
IS/IEC 60529	Degree of Protection provided by Enclosures (IP Code)
IEC-60751	Industrial Platinum Resistance Thermometers and Platinum temperature sensors
IEC-60584-1	Thermocouples—Part 1: EMF specifications & Tolerances

IS	Indian Standards
7358	Specifications for Thermocouples

1.1.3 In the event of any conflict between this standard specifications, data sheets, statutory regulations, related standards, codes etc., the following order of priority shall govern:

- a) Statutory Regulations
- b) Job Specifications / Data Sheets
- c) Standard specification
- d) Codes and standards

1.1.4 In addition to compliance to purchaser's specifications in totality, vendor's extent of responsibility shall include the following:

- a) Purchaser's data sheets indicate the material of construction for sensing element, thermowell etc. Alternate superior material of construction shall also be acceptable provided vendor assumes complete responsibility for the selected materials for their compatibility with the specified fluid and its operating conditions.
- b) Vendor shall supply the Thermowell meeting vibration analysis as per ASME PTC 19.3TW latest edition.

1.2 Bids



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- 1.2.1 Vendor's quotation shall be strictly as per the bidding instruction to the vendor attached with the Material Requisition.
- 1.2.2 All documentation submitted by the vendor including their quotation, catalogues, drawings, installation, operation and maintenance manuals etc. shall be in English language only.
- 1.3 Drawings and Data
 - 1.3.1 Detailed drawings, data, catalogues and manuals required shall be submitted by the vendor as per Vendor data requirement attached with the requisition.
 - 1.3.2 Final documentation consisting of design data, installation & maintenance manuals, test certificates & reports etc. shall be submitted by vendor after placement of Purchase order, as per vendor data requirement:

2.0 DESIGN AND CONSTRUCTION

- 2.1 Thermocouples
 - 2.1.1 The type of thermocouple shall be as specified in purchaser's data sheets. However when the type of thermocouple is not specified in purchaser's data sheet, following shall apply:

Copper-Constantan (ISA-Type-T)	:	(-) 200 to 200°C
Chromel-Constantan (ISA-Type-E)	:	200 to 600°C
Chromel-Alumel (ISA-Type-K)	:	600 to 1200°C
Platinum Rhodium-Platinum (ISA Type-S)	:	600 to 1600°C
Platinum Rhodium-Platinum Rhodium (ISA Type-B)	:	600 to 1700°C
 - 2.1.2 The thermocouple element shall be 18 AWG for Single type thermocouples and 20 AWG for Duplex type thermocouples, unless otherwise specified in purchaser's data sheet. Single or Duplex type thermocouples shall be specified in Purchaser's data sheet.
 - 2.1.3 The thermocouple properties and limits of error shall be as per IEC-60584-1.
 - 2.1.4 Thermocouple shall be minimum 316 Stainless Steel sheathed magnesium oxide insulated, ungrounded type, for all tags with operating temperature less than 350 deg C, unless otherwise specified. For tags where operating temperature is greater than or equal to 350 degC, sheath material shall be Inconel as a minimum. Sheath OD shall be selected to suit the thermowell ID, subject to minimum sheath OD as 1 mm less than the thermowell ID.
- 2.2 Resistance Temperature Detectors
 - 2.2.1 The type of RTD shall be as specified in purchaser's data sheet. In general RTD shall be 3 wire type with platinum element having 100 ohms resistance at 0°C, selected for temperature range of (-) 200 to 650°C.
 - 2.2.2 The element shall be of highly refined material of reference grade and shall have been stress relieved. RTD including its calibration shall be as per IEC-60751 to have standard electrical resistance & temperature coefficient of resistance.
 - 2.2.3 The wire shall be wound on a ceramic core and immobilised against strain or damage. The winding shall be of bifilar type. The leads shall be copper up to terminal block.
 - 2.2.4 The element shall be within a metal sheath, in a manner which provides good thermal transfer and protection against moisture. The sheath material shall be 316 Stainless Steel, unless otherwise specified. Sheath OD shall be selected to suit the thermowell ID, subject to minimum sheath OD as 1 mm less than the thermowell ID.



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- 2.3 Common Head assembly specifications for Thermocouples & RTDs
- 2.3.1 Temperature element assemblies shall be with threaded heads and shall be spring loaded. The heads shall consist of a case, screwed on cover and terminal block. The Temperature element shall be screwed to the terminal block. Separate screw shall be provided on the terminal block for terminating the incoming cables. There shall be an extra terminal in the terminal block connected to the head for grounding the shield.
- 2.3.2 Unless otherwise specified, the assembly shall confirm to the following standards;
- a) The heads shall be weatherproof to IP 65 as per IS/IEC-60529
- b) In case of flameproof construction, heads shall be flame proof as per IS/IEC-60079 and weather proof to IP 65 as per IS/IEC-60529
- 2.3.3 The case shall be suitable for mounting terminal blocks for single or duplex type Temperature element assemblies.
- 2.3.4 A heat resistant and moisture proof asbestos free gasket shall be fitted between the case and cover. Head support chain (between case and cover) material shall be of stainless steel.
- 2.3.5 The terminals shall be permanently and legibly identified for their polarity. The terminal block shall be permanently and legibly marked with the IEC letter code to designate the type of Temperature element.
- 2.3.6 For Duplex type Temperature element, one entry of the element head shall be provided with SS316 plug, unless otherwise stated in the Purchaser's datasheet.
- 2.4 Thermowells
- 2.4.1 Unless otherwise specified, the thermowell material shall be minimum 316 Stainless Steel. Alternate material as SS 316L / SS 316 Ti shall also be acceptable instead of SS 316 subject to meeting process conditions specified in the data sheet.
- 2.4.2 Thermowells with immersion length up to 500 mm shall be machined out of forged barstock. Built-up thermowell with welded wall construction shall be acceptable for immersion length of greater than 500 mm, unless specified otherwise in purchaser's datasheet.
- 2.4.3 The base of the thermowells shall be chosen to fit the instrument without air gap for minimizing measurement lag.
- 2.4.4 Thermowell flange material, rating and facing shall be as specified in the data sheet. Suitability of thermowell rating shall be verified as per the operating and design pressure/temperature conditions for individual tags as per ASME 16.5.
- 2.4.5 All thermowell weld joints shall be full penetration weld type.
- 2.4.6 Thermowell immersion length shall be as specified in purchasers data sheet. Where immersion length is not specified in purchaser's data sheet, following shall govern:

Line Size	Immersion Length
From 4"to 6"	280mm
From 8" to 20"	320mm
From 20" to 24"	400 mm
Vessels/Columns (side mounted)	400 mm
Above 24"& upto 42"	500 mm



STANDARD SPECIFICATION THERMOCOUPLES, RTDs AND THERMOWELLS

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Built-up thermowell shall be considered for line size above 42" and immersion length shall be as specified in the purchaser's data sheets. Immersion length is based on 200 mm length between flange face and outer wall of pipe and 200 mm length between flange face and inner wall of the vessel. Unsupported length shall be considered accordingly in the vibration analysis.

- 2.4.7 Vendor shall carry out the vibration analysis of thermowell as per ASME PTC 19.3TW latest edition and shall provide suitable design for the thermowells wherever necessary.

Thermowells shall be suitable for stresses due to stream velocity condition. Any design change necessary as a consequence to this vibration analysis shall be included and provided by vendor.

Modifications to meet wake frequency shall be in the following order of precedence:

- a) Maximum possible increase of thermowell OD for fitting into nozzle ID.
- b) Decrease of thermowell length by not more than 50 mm from that specified in purchaser's data sheet.
- c) Step design or any other proven design by vendor

For all such changes, vendor must obtain prior approval from purchaser before proceeding with the fabrication of thermowells.

- 2.4.8 All the thermowells in oxygen and chlorine service shall be thoroughly degreased using reagents like trichloro-ethylene or carbon tetrachloride.

3.0 NAMEPLATE

3.1 Thermocouple/RTD's

- 3.1.1 Each thermocouple / RTD assembly shall be provided with a stainless steel nameplate attached firmly to it, furnishing the following information:

- a) Tag number as per purchaser's data sheets.
- b) Thermocouple type/RTD element type (along with sensor. part number).
- c) Type of protection whether sheathed or beaded.
- d) Grounded or Ungrounded.

3.2 Thermowell

- 3.2.1 The following information shall be punched on the extension of the thermowell:

- a) Tag number as per purchaser's data sheets.
- b) Thermowell material as per purchaser's data sheets.
- c) Thermowell immersion length 'U'.

- 3.2.2 The following information shall be punched on the thermowell flange at a visible place:

- a) Nominal flange size in inches and rating in pounds.
- b) Flange material as per purchaser's data sheets.

4.0 INSPECTION AND TESTING

Purchaser reserves the right to inspect and witness testing at vendor's works as per Inspection Test Plan. All these tests shall be completed by the vendor and test reports shall be submitted to Purchaser for scrutiny.



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5.0 SHIPPING

- 5.1 Proper care shall be taken in shipping. All items shall be adequately packed to withstand shipping conditions, without damage.
- 5.2 All thermowells in oxygen and chlorine service shall be separately packed along with a certificate indicating 'CERTIFIED FOR OXYGEN/CHLORINE SERVICE', as applicable.
- 5.3 All threaded and flanged openings shall be suitably protected to prevent entry of foreign material.



**STANDARD SPECIFICATION
JUNCTION BOXES AND CABLE GLANDS**

**SPECIFICATION NO.
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ABBREVIATIONS

IP	:	Ingress Protection
NPT	:	National Pipe Thread
PVC	:	Poly Vinyl Chloride
SS	:	Stainless Steel
Sq.mm	:	Square millimeter (mm ²)



**STANDARD SPECIFICATION
JUNCTION BOXES AND CABLE GLANDS**

**SPECIFICATION NO.
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STANDARD SPECIFICATION JUNCTION BOXES AND CABLE GLANDS

SPECIFICATION NO.
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1.0 GENERAL

1.1 Scope

1.1.1 This standard specification, together with the data sheets describes the requirements for design, materials, nameplate marking, testing and shipping of junction boxes and cable glands which include the following types.

- a) Electrical junction boxes
- b) Cable glands
- c) Plugs
- d) Reducers/ Adaptors

1.1.2 The related standards referred herein and mentioned below shall be of the latest edition of the following codes, standard practices and publications, unless otherwise specified:

ASME	American Society of Mechanical Engineers
B 1.20.1	Pipe Threads, General Purpose (Inch)
API	American Petroleum Institute
RP 551	Process Measurement Instrumentation.
EN	European Standard
10204	Inspection documents for metallic products
IS/IEC	Indian Standards/International Electro-Technical Commission
IS-5	Colours for ready mixed paints and enamels.
IS/IEC-60079	Electrical Apparatus for Explosive Gas Atmosphere.
IS/IEC-60529	Degrees of Protection Provided by Enclosures. (IP Code)
IS	Indian Standards
7358	Specifications for Thermocouples

1.1.3 In the event of any conflict between this standard specifications, data sheets, statutory regulations, related standards, codes etc., the following order of priority shall govern:

- a) Statutory Regulations
- b) Data Sheets
- c) Standard specification
- d) Codes and standards

1.2 Bids

1.2.1 Vendor's quotation shall be strictly as per the bidding instructions to vendor attached along with the Material Requisition.

1.2.2 Deviation on technical requirements shall not be entertained.

1.2.3 All documentation submitted by the vendor including their drawings, installation manual etc shall be in English language only.

1.2.4 Statutory Approvals



STANDARD SPECIFICATION JUNCTION BOXES AND CABLE GLANDS

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Junction boxes and cable glands located in the hazardous area shall be certified by the local statutory authorities for their use in the specified hazardous area classification. In general following certification shall be given:

- i) For all flameproof Junction box and cable which are manufactured abroad and certified by any statutory authority like Laboratories Central Des Industries Electriques (LCIE), British Approval Service for Electrical Equipment in Flammable Atmospheres (Baseefa), Factory Mutual (FM), Underwriters laboratories (UL) etc. for compliance to ATEX directives or other equivalent standards. All these junction boxes and cable glands shall additionally have the approval of Petroleum and Explosives Safety Organisation (PESO), Nagpur, if installed in INDIA and the same is mandatory.
- ii) For all flame proof junction box and cable gland manufactured locally (indigenously), the testing shall be carried out by any of the approved test house like Central Institute of Mining & Fuel research (CIMFR)/Electronics Regional Testing Laboratory (ERTL) etc. The equipment shall in addition bear the valid approval from Petroleum and Explosives Safety Organisation (PESO), Nagpur and a valid BIS license.
- iii) Approvals other than above shall neither be offered nor will these be acceptable.

1.3 Drawings and Data

- 1.3.1 Detailed drawings, data, catalogues and manuals shall be submitted by the vendor as per vendor data requirement attached with the requisition.
- 1.3.2 Final documentation consisting of design data and installation manual submitted by the vendor after placement of purchase order. As per vendor data requirement, shall include the following, as a minimum;
 - a) Specification sheet for each junction box and its accessories like cable glands, plugs etc.
 - b) Installation procedure for junction boxes and its accessories.

2.0 DESIGN AND CONSTRUCTION

2.1 Junction Boxes

- 2.1.1 Junction boxes shall be either of the following type as specified in data sheets.

- a) Weather proof junction boxes.
- b) Weather proof and flameproof junction boxes

No other type of junction boxes shall be offered / supplied unless specifically indicated otherwise by Purchaser.

- 2.1.2 Unless otherwise specified, the enclosure shall conform to the following standards:

Weatherproof housing : IP 65 to IS/IEC-60529

Flameproof housing : Flameproof, Ex(d) as per IS/IEC-60079.

Flameproof housing shall also be made weatherproof

- 2.1.3 Number of cable entries shall be as per Purchaser's data sheet and their location shall be bottom in general for both multi pair and single pair cables. Side cable entries for branch cables shall only be considered when specifically indicated in the Purchaser's data sheets. Junction boxes with top entries shall not be offered. The size of cable entries shall be as per the cable gland sizes indicated in the data sheet.



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- 2.1.4 Multi-pair junction boxes shall be provided with telephone sockets and plugs for connection of hand-powered telephone set.
- 2.1.5 Electrical Junction Boxes
- a) The material of construction of junction boxes shall be followed as below:
- i) Enclosures : Cast light metal alloy
 - ii) Internal plate : Nickel plated steel/ Aluminium rails
- b) Weatherproof junction box shall have door with SS hinge and with Neoprene /Silicon rubber gasket, which shall be fixed to the box by SS countersunk screws.
- c) Flameproof junction box shall have detachable cover, which shall be fixed to the box by means of cadmium plated triangular head/hexagonal head screws of SS material
- d) Flameproof junction boxes for signal, alarm and control shall have the following warning engraved/integrally cast on the cover:
- "Isolate power supply elsewhere before opening"
- e) Power junction boxes (junction boxes for power supply cable / distribution) shall have either the warning cast or shall have warning plate with following marking:
- "Isolate power supply elsewhere before opening".
- t) Unless otherwise indicated in the job specification. Power junction boxes shall be suitable for incoming armoured Power cable up to 185 sq.mm conductor size; exact requirement of cable entry shall be specified in purchaser's datasheet.
- g) Terminals shall be spring loaded, vibration proof, clip-on type, mounted on nickel plated steel rails complete with end cover and clamps for each row.
- h) Terminals shall be non-hygroscopic type made up of unbreakable, fire-retardant, safe extinguishable, halogen free polyamide compound.
- i) The metal parts of terminals shall be of high quality (pure electrolytic) copper and shall be tin or nickel plated (of thickness up to 15 micron). The spring material for all terminals shall be chrome nickel spring steel of high tensile strength and of excellent corrosion resistance.
- j) All terminals used in signal alarm and control junction boxes shall be suitable for accepting minimum 4.0 sq.mm copper conductor, in general.
- k) Terminal used in power junction boxes / power supply distribution box shall be suitable for accepting conductor size of 4.0 Sq. mm to up to 50 sq. mm. Exact requirement shall be specified in purchaser's datasheet. Higher size of terminals shall be provided when indicated.
- Bus bar terminals shall be provided for cable size 50 sq. mm and above. Suitable size of lugs shall be provided to suit cable size specified.
- l) Number of terminals/ junction Box:
- Each junction shall have minimum of 30% spare terminal of those actually required to be utilised. Unless higher numbers of terminals are specified in the purchaser's data sheet, the number of terminals for various types of junction boxes shall be as follows:
- For 6 pair junction box: 24 Nos terminals

- For 12 pair junction box: 48 Nos terminals
 - For 6 triad junction box: 36 Nos terminals
 - For 8 triad Junction Box: 48 Nos terminals
 - For 3 way Junction Box: 12 Nos terminals
- m) Terminals shall be identified as per the type of input signal indicated in data sheets e.g. all terminals for intrinsically safe inputs shall be blue while others shall be grey in colour.
- n) Junction boxes shall be provided with external earthing lugs.
- o) Internal design of a Junction Box:
- Sizing shall be done with due consideration for accessibility and maintenance in accordance with the following guidelines:
- Following gap shall be maintained strictly when designing the junction box sizes:
- i) 50 to 60 mm gap between two terminal strips and sides of box parallel to terminal strip for up to 50 terminals and additional 25 mm for each additional 25 terminals.
 - ii) 100 to 120 mm between two terminal strips for up to 50 terminals and additional 25 mm for each additional 25 terminals.
 - iii) Bottom/top of terminal shall not be less than 100 mm from bottom/top of the junction box.

2.1.7 Painting

- a) Surface shall be prepared for painting. It shall be smooth and devoid of rust and scale.
- b) Two coats of lead-free base primer and two final coats of lead free, epoxy based paint shall be applied both for interior and exterior surfaces, powder coating shall also be acceptable. The colour shall be as specified in data sheets. However, following philosophy shall be followed, in general:
 - i) Light blue for all intrinsically safe junction boxes.
 - ii) Light grey for all others

2.2 Cable Glands, Plugs and Reducers/Adaptors

- 2.2.1 Cable glands shall be supplied by vendor as per the purchaser data sheets.
- 2.2.2 Cable glands shall be double compression type for use with armoured cables.
- 2.2.3 The cable glands shall be of nickel plated brass, as a minimum and shall be provided with PVC shrouds.
- 2.2.4 All the cable glands shall be weatherproof and flameproof (Ex'd') to gas group HA / 11B as a minimum, unless otherwise specified in data sheets.
- 2.2.5 Cable glands shall be supplied to suit the cable dimensions along with tolerances indicated in data sheets. Various components like rubber ring, metallic ring, metallic cone and the outer / inner nuts etc. shall be capable of adjusting to the indicated tolerances of cable dimensions.
- 2.2.6 Reducers / adaptors shall be supplied as per details indicated in data sheets. They shall be nickel-plated brass, as a minimum. These shall also be weatherproof and / or flame proof wherever specified.
- 2.2.7 Plugs shall be provided wherever specified. They shall be of nickel-plated brass.
- 2.2.8 Plugs shall be certified flameproof, when used with flameproof junction boxes.



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3.0 NAMEPLATE

Each Item covered under requisition i.e. Junction box, Cable glands, Adapters, Plugs etc shall have shall have proper identification as per details below:

3.1 For Junction boxes:

Two name plated shall be provided with an anodised aluminium sheet as below:

- i) Name plate- 1: It shall be permanently fixed on the JB at a visible place furnishing the following information:
 - a. Type of Junction box
 - b. Type of protection for use in hazardous area.
 - c. Manufacturer's serial number and model number.
 - d. Manufacturer's name/ trade mark.
 - e. Stamp of certifying agency with certificate number.
 - f. Provision of space for Tag number plate as per purchaser's data sheet to be permanently fixed at site with suitable provisions as per detail below.

ii) Name plate-2:

It shall be as per purchaser's data sheet to be fixed at site permanently with rivet type arrangement. It shall be supplied loose separately with a reference table identifying the Tag number of Junction box as per the requisition item number and data sheet

3.2 For cable Glands/ Adapter/ Plugs:

Each item shall be marked with Size, applicable area classification and type of thread i.e. NPT.

4.0 INSPECTION AND TESTING

Purchaser reserves the right to inspect and witness testing al vendor's works as per Inspection Test Plan. All these tests shall be completed by the vendor and test reports shall be submitted to purchaser for scrutiny.

5.0 SHIPPING

5.1 All threaded openings shall be suitably protected to prevent entry of foreign material.

5.2 All threaded components shall be protected with plastic caps to prevent damage of threads during shipping and handling.



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ABBREVIATIONS

GPA	:	Gas Processors Association
ASME	:	American Society of Mechanical Engineers
NFPA	:	National Fire Protection Association
FAT	:	Factory Acceptance Test
IEC	:	International Electro-technical Commission
IP	:	Ingress Protection
GC	:	Gas Chromatograph
USM	:	Ultrasonic Meter
ISO	:	International Organization for Standardization
NACE	:	National Association of Corrosion Engineers
NPT	:	Nominal Pipe Thread
SAT	:	Site Acceptance Test
SS	:	Stainless Steel



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1.0 SCOPE

This Standard Specification, together with the Data Sheets attached herewith, establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, painting, inspection and testing, documentation, marking, packing and shipping of Flow Computer along with its accessories.

2.0 DEFINITIONS

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.

3.0 REFERENCE DOCUMENTS

3.1 Codes & Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

AGA Report no. 3	Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids
AGA Report No. 7	Measurement of Gas by Turbine Meters



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AGA Report No. 9	Measurement of Gas by Multi-Path Ultrasonic Meters
AGA Report No. 10	Speed of sound in natural gas and other related hydrocarbon gases
ISO 6976	Natural gas - Calculation of calorific values, density, relative density and Wobbe index from composition
GPA 2172	Calculation of Gross Heating Value, Relative Density, Compressibility and Theoretical Hydrocarbon Liquid Content for Natural Gas Mixtures for Custody Transfer
GPA 2145	Table of Physical Properties for Hydrocarbons and Other Compounds of Interest to the Natural Gas Industry
IEC 60079-0	Explosive atmospheres - Part 0: Equipment - General requirements
IEC 60079-1	Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures “d”
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60801	Electromagnetic Compatibility For Industrial-process Measurement And Control Equipment - Radiated Electromagnetic Field Requirements
ASME B 1.20.1	Pipe Threads, General Purpose, Inch
ASME B 16.5	Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard
ASME B 16.20	Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and Jacketed
EN 10204	Metallic Products – Types of Inspection documents
NFPA 496	Purged and pressurized enclosures for electrical equipment

3.2 Order of Precedence

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- a. Data sheets
- b. Job Specifications
- c. Standard Specifications
- d. Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.



4.0 MATERIALS

Materials selected shall be in accordance with the Data Sheets and Standard Specifications. For corrosion service the material selected shall be in compliance with the requirements of NACE MR-0175 / ISO-15156 latest editions.

5.0 DESIGN

The flow Computer shall be either field mounted or installed in the control/ equipment room and should have operator interface for configuration and data display.

Flow computers shall perform all required calculations for custody transfer application using latest relevant AGA standards.

Field mounted flow computers, if located in hazardous area, shall be certified for use in classified area as per relevant sections of IEC 60079. Ingress protection for field mounted flow computers shall be IP65 in accordance with IEC 60529.

Flow computers in equipment room shall be rack (within panel)/ wall mountable as mentioned in datasheet. If wall mountable then the ingress protection shall be IP 54 in accordance with IEC 60529.

All software and firmware with licenses shall be in the name of owner. Manufacturer shall provide an undertaking to upgrade free of cost all software and firmware to the latest version and to incorporate all algorithm corrections and changes in line with latest industry standards for a period of ten years from the date of supply of the system

The offered flow computer shall be certified for custody transfer application from NMI/ PTB or equivalent.

The enclosure material of the flow Computers shall be manufacturer standard.

Flow computers shall be individual microprocessor based devices specifically designed to perform flow related calculations. Each flow computer shall be dedicated to a single meter run.

Measurement data inside the flow computer shall be protected against tampering via any serial port or networked connections.

Configuration and operating parameters shall be protected by either a hardware key lock switch or by multi-level password protection.

Field instruments from the meter run shall be directly connected to the flow computer to ensure signal integrity and to prevent tampering.

Flow computers shall remain unaffected by radio transmissions (Levels of permissible RFI shall be as per IEC 60801). Band-pass and / or band stop filters shall be fitted, as necessary.

5.1 Display Unit

LCD display shall be available in front panel of flow computers with at least 10 character display. Resolution of display shall be such that the time interval between rollovers of each total, when operating at maximum flow rate is greater than three calendar months.

The following data shall be available on front panel display as a minimum:-

- a. Gross/ Standard/ Mass/ Energy Volume Flow Rate
- b. Gross/ Standard/ Mass/ Energy Volume Total
- c. Stream downstream Temperature/ Pressure
- d. Standard Compressibility/ Compressibility (In use/ Calculated/ Keypad)



- e. Standard Density/ Density (In use/ Calculated/ Keypad)
- f. Calorific Values (In use/ Calculated/ Keypad)
- g. Gas Compositional Data
- h. AGA 8 variables, constants and results
- i. Meter Status (Flow/ No Flow/ Maintenance)
- j. Time/ Date
- k. Maintenance Mode (entry/ exit)
- l. Security Mode
- m. Meter Status and Diagnostics

Reset of any totals through front panel display shall be through suitable access privilege.

5.2 Security

Provision shall be available to view/ Modify data of flow computers through access privileges from front panel display.

Typically, four access levels shall be defined namely Administrator, Engineer, Technician and Operator.

Access control shall be available for the following

- a. Displays
- b. Reports
- c. Acknowledge Alarms
- d. Modify/ Change
- e. Diagnostics
- f. Remote Access
- g. Create/ Delete/ Modify users

Manufacturer shall define the access privileges and submit document to owner along with procedure for system administrator for review/ approval and it shall also be part of documentation.

5.3 Calculations

Flow computer will do volume/ flow calculation in standard metric units as per relevant AGA standard. Reference conditions for calculations shall be as specified in datasheet.

Super compressibility/ compressibility of gas shall be calculated as per AGA 8 (full version) using the composition available from gas chromatograph (GC).

Energy related calculations shall be in accordance with ISO 6976 and/ or GPA 2172 with tables from GPA 2145. It shall be possible for user to select either one of the standard or both for the calculations. Reference conditions shall be same as used for volume/ flow calculations.

For Ultrasonic meter, speed of sound (SOS) calculations as per AGA Report no 10 shall be available for comparing the SOS obtained from USM and SOS obtained from GC. Manufacturer shall inform the acceptable limit for the variance and incorporate necessary logics, alarms in the flow computer design.



Parameters and characteristics of flow meter required for computation shall be keyed into the flow computer. Any change in the parameters would require suitable privilege level passwords and shall be captured in audit trail. Manufacturer shall provide detailed procedure for changing of flow meter parameters in flow computer.

All calculations shall be using third party certified math blocks with programmed logics to meet the requirement. Certificates of math blocks shall be submitted to owner as part of documentation.

The following features shall be available as a minimum in all flow computers: -

- a. Read flow, temperature (deg C), Pressure (bar g)
- b. Read Gas chromatograph (Mole %)
- c. Distinguish grade of gas
- d. Log time and delivery of each grade of gas
- e. Calculate "Z"
- f. Indicated actual volume flow rate
- g. Standard volume flow rate
- h. Volume total
- i. Energy flow rate
- j. Energy total
- k. Hourly logs
- l. Daily logs
- m. Audit Logs
- n. Error log
- o. Line up meter via RTU, Check Meters (Prove), and use corrected meter factors
- p. Read USM alarm and diagnostic data.
- q. Should have one spare RS 232 / 485 Modbus port.
- r. Each flow computer will have dual TCP Ethernet Communication path to control system.
- s. Communicate with the GC controller via serial link using Modbus RTU protocol
- t. Control station flow rated based on local or remote set point from station control system.
- u. Should manage meter runs through station control system based on flow to maintain the system accuracy.
- v. Respond to orderly Shutdown and start-up of metering station in response to ESD.

5.4 Automatic Calibration Software

The calibration software (to be enabled using security code) in flow computer shall allow for the calibration of the following constituent components of the metering facility:-

- a. Pressure Transmitters
- b. Temperature Transmitters
- c. Differential pressure transmitters

The software shall guide each calibration by an instructive step-by-step procedure. Calibration software with the following features shall be provided:

- a. User editing of computer field and test equipment data



- b. Automatic test equipment certification check
- c. Viewing and printing of individual calibration test sheets
- d. Printing of complete set of individual week's test sheets

On completion of the procedure an output form shall be printed giving all details of "as found" values and "as left", in cases where adjustment and changes to instrument report is done and a remark column shall be provided where there is no change. The form shall print the current date and signature boxes. The report form sheet shall be alterable.

5.5 Historical Data, Alarms, Reports and Logs

The flow computer shall be able to store for future reference events, alarms and trend data.

Historical data storage shall comprise of last 30 days alarms and events, important measurement parameters for a period of one year based on FIFO basis. It should be possible to retrieve this data and be able to manipulate it to produce displays and reports from any of the workstations on the network.

There shall be three categories of alarm that shall be raised and logged by the flow computers. The generated alarms shall also be capable of being routed to a local dot matrix printer. The alarms are as below:-

a. Computer Alarms

This generally shall comprise of Cold Start, Warm Start, Battery Fail, RAM Fail, ROM Fail, Reset Required, Total Rollover etc.

b. System Alarms

This generally shall comprise of Temperature Under range/ Over range, Pressure Over Range/ Over Range, Dew Point Under Range/ Over Range, Moisture Under range/ Over Range etc.

c. Process Alarms

This generally shall comprise of Temperature Low/ High, Pressure Low/ High, Dew Point Low/ High, Moisture Low/ High etc.

5.6 Diagnostics and Error Handling

The flow computers shall have self-diagnostic feature and any failure in the computers or deviations beyond high-low limits of all inputs shall be displayed as an alarm and logged. Also an alarm contact shall be available for extension of the contact to the supervisory system. Alarms shall not reset automatically and must be acknowledged by operator before resetting.

In the case where the parameters received are deemed invalid, the flow computer shall alarm the incident and proceed with the last valid value in memory. This shall be true for all inputs such as the gas composition, specific gravity and heating value. Keypad default values shall not be used, unless specified by the Operator.

The memory content of the flow computer shall not be lost in the event of failure or interruption of the power supply. The equipment shall be provided with internal battery backup.

The flow computer shall have hardwired interfaces to the supervisory system for hardware failure and instantaneous corrected flow rate.

5.7 Power Supply



Manufacturer to note that the UPS power supply available shall be 110 V AC \pm 10%, 50 Hz \pm 3 %. Further rectifier / transformer if required to achieve the desired working voltage shall be provided by the manufacturer.

The system performance shall be within specifications even when the supply voltage varies by \pm 10% of specified value and supply frequency varies by \pm 3 HZ of specified value.

Manufacturer to ensure that there is no damage to any component of the offered system because of black outs / brown outs. Manufacturer to indicate steps to be taken for fail safe operation under power failure.

5.8 Electric Transients

The flow computer shall have provisions for protection against system errors and hardware damage resulting from electrical transients on power or signal wiring. These electrical transients include power line faults, lightning strikes, and lightning-induced surges on power or signal cables. The manufacturer shall clearly describe the method used to provide the electrical transient protection which shall comply with the guidelines of IEC 61000-2.

The flow computer shall operate satisfactorily not only independently, but also in conjunction with other equipment, which is placed nearby. The operation of flow computer shall not be adversely affected by interference voltages and fields reaching it from external sources, and also will not in itself, be a source of interference that might adversely affect the operation of other equipment.

Design of equipment, components and assemblies shall consider RFI/EMI control. The design shall ensure easy serviceability and also ensure that integrity of RFI/EMI protection features, such as screening, shall not degrade under normal maintenance conditions.

5.9 Communication Interfaces

The various types (hardwired, serial or Ethernet) and numbers of output shall be as defined in the datasheet.

Protocol for Ethernet and serial communication shall be Modbus RTU. Manufacturer shall furnish the complete Modbus database including message structures, frame structures, synchronizing / timing signals, memory locations for data addressability and interface software driver details for owner's review and approval prior to proceeding with software/ hardware configuration.

Flow computers shall be serially interfaced to gas chromatograph for transfer of gas compositions etc. Manufacturer shall be totally responsible for this interface and the same shall be demonstrated by manufacturer during FAT.

Hardwired digital outputs shall be potential free and analogue signals in 4 to 20 mA format shall be isolated type capable of driving 600 ohms load resistance. All outputs shall be user configurable.

Data available through Ethernet and serial communication shall be user configurable and shall be finalized with owner prior to implementation. Any addition or deletion to the data highway shall not require reconfiguration and/or programming and shall be capable of being accomplished while the flow computer is "on-line".

Upon failure of any data link, an alarm shall be generated to alert the user and shall be logged in system memory.

There shall be a dedicated communication port for connecting a laptop (not in scope of supply) for configuration, diagnostics, report generation etc. Software required for the same shall be included in the scope of supply.



Dedicated port for printer shall be available.

5.10 Name Plate

Each flow computer shall have a stainless steel name plate attached firmly to it at a visible place either by riveting or screwed to case, furnishing the following information:-

- a. Tag number as per owner's data sheet
- b. Manufacturer's name and trademark
- c. Model number and manufacturer's serial number
- d. Electrical classification and Ingress protection

6.0 FABRICATION AND PAINTING

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Flow Computer. Vendor shall submit the required Specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing herein.

7.0 INSPECTION AND TESTING

7.1 General Requirements

- i. The Manufacturer shall ensure all equipment used for inspection and testing purposes is calibrated and certified.
- ii. The Manufacturer shall record all inspection and testing activity on the appropriate inspection certificate.
- iii. The inspection and testing shall be carried out as per Company approved inspection and test plan (ITP) prior to marking and shipment of materials.

7.2 Testing of Materials

Manufacturer shall carry out all chemical and mechanical testing of materials in accordance with applicable material specification and requirement specified under section 5 of this specification.

7.3 Witnessed Inspection

- i. The flow computers shall be offered for pre dispatch inspection for following as minimum:-
 - a. Visual Inspection and Dimensional checks.
 - b. Performance test including simulation of all calculations and verification with third party certified software.
 - c. Demonstration of correct operation of all diagnostic and maintenance functions
 - d. Effects of variation in power supply voltage and frequency.
 - e. Review of all certificates and test reports.
- ii. In the event when witness inspection is not carried out by owner, manufacturer shall anyway complete the tests and test documents for the same shall be submitted to owner for scrutiny and approval prior to dispatch.

7.4 Factory Acceptance Testing (FAT)

Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the Flow Computer complete with the project approved tags, and highlighting the inspection



and testing requirements of all such devices. FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the Flow Computer.

FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place. FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

The FAT shall be consisting of the following as a minimum:

- a. Visual inspection
- b. Dimensional check
- c. Calibration
- d. Functional test

7.5 Site Acceptance Testing (SAT)

A SAT shall be carried out on completion of the installation of the equipment at site which shall be witnessed by the company / owner's representative. SAT shall be performed on the Flow Computer as per the approved test procedure. A comprehensive test procedure in compliance with the company specification shall be developed and issued to company / owner for review and approval.

The Site Acceptance Test (SAT), in general, shall demonstrate that the Flow computer functions correctly and properly in accordance with the specified requirements.

8.0 MARKING, PACKING AND SHIPMENT

- i. Proper care shall be taken in shipping complete system to ensure safety of the electronics, display units and exposed parts.
- ii. All items shall be packed in sea-worthy crates or boxes. Cable entries shall be protected with plastic caps to prevent damage/entry of foreign matter.
- iii. A packing list shall be prepared for each case and attached therein in a waterproof plastic sleeve. The data to be recorded on each packing list shall contain following:
 - a. Name and Address of Manufacturer;
 - b. Purchase Order number;
 - c. Case identification number;
 - d. Overall dimensions in meter;
 - e. Gross weight of the case;
 - f. Itemized list of the contents

9.0 SPARES AND ACCESSORIES

The following spare philosophy shall be followed in case it is not covered in Job Specification.

The Vendor shall include recommended Spare Parts List for start-up, pre-commissioning and two years operation as per the following;

- a. Itemized recommended spare parts list for start-up and pre-commissioning.
- b. Itemized recommended spare parts list for two years operation.

Vendor shall recommend accessories and special tools required for operation and maintenance of Flow Computer, for Company review.



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All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.

All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.

10.0 DOCUMENTATION

The following documentation shall be fulfilled by the Vendor, if it is not covered in Job Specification.

10.1 Documentation Required with Technical Bid

During bidding stage Vendor shall submit in his offer the following documents as a minimum:

- a. Standard Specification, Data Sheets;
- b. Bill of Materials including Vendor list, details of third party items;
- c. Catalogues and Manuals;
- d. Quality Assurance Plan;
- e. A list of accessory items together with Manufacturer's name and part number;
- f. Any other documents.

10.2 Documentation Required for Approval

Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval:

- a. Specifications, Data Sheets;
- b. Bill of materials including Vendor list, details for third party items;
- c. Catalogues, Manuals and relevant drawings and documents;
- d. Dimensional drawings;
- e. Calibration certificates;
- f. Material test certificates;
- g. Procedures for FAT;
- h. Quality Assurance Plan;
- i. Any Other documents.

10.3 Guarantee & Warranty

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company Specification.

Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility



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design .The cost of correction / replacement of any warranty items shall be borne by the Vendor, as per the purchase conditions of the Material / Purchase Requisition.

The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



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PRESSURE / DIFFERENTIAL PRESSURE
TRANSMITTER**

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ABBREVIATIONS

ANSI	:	American National Standards Institute
API	:	American Petroleum Institute
ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society of Testing and Materials
FAT	:	Factory acceptance Test
IEC	:	International Electro technical Commission
IP	:	Ingress Protection
IS	:	Indian Standard
ISO	:	International Organization for Standardization
NACE	:	National Association of Corrosion Engineers
NPT	:	Nominal Pipe Thread
SAT	:	Site acceptance Test
SS	:	Stainless Steel



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PRESSURE / DIFFERENTIAL PRESSURE
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1.0 SCOPE

This Standard Specification, together with the Data Sheets attached herewith, establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, painting, inspection and testing, documentation, marking, packing and shipping of Pressure Transmitter /Differential Pressure Transmitter along with its accessories.

2.0 DEFINITIONS

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.

3.0 REFERENCE DOCUMENTS

3.1 Codes & Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

American Society of Mechanical Engineers



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ASME B 16.5	Steel Pipe Flanges and Flanged Fitting
ASME B 16.20	Ring Joint Gaskets and Grooves for Steel Pipe Flanges
ASME B1.20.1	Pipe Threads
American Petroleum Institute (API)	
API RP 551	Process Measurements Instrumentation
International Electro technical Commission	
IEC-60529	Degree of Protection by providing Enclosures (IP Code)
IEC-60079-15	Electrical Apparatus with type of protection 'n'
IEC-60079-7	Electrical apparatus for explosive gas atmospheres increased safety 'e'
IEC-60605-1	Equipment Reliability Testing.
IEC-60068.2-13	Basic Environmental Testing Procedure for Electrical Components and Electronic Equipment.
Indian Standards	
IS 2147	Degree of Protection provided for Enclosures

3.2. Order of Precedence

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- a. Data sheets
- b. Job Specifications
- c. Standard Specifications
- d. Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.

4.0 MATERIALS

Materials requirements for Pressure/ Differential Pressure Transmitter shall be in accordance with the Data sheets and Company's Standard Specifications. For corrosion service the material selected shall be in compliance with the requirements of NACE MR-0175/ISO-15156 latest editions

Transmitter body studs shall be high tensile stainless steel or other corrosion - resistant material for higher stress levels.

5.0 DESIGN

5.1. General



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The Pressure / Differential Pressure Transmitters shall be used in all cases where a continuous transmission of a pressure measurement is required in the control room for use in a control loop, or for indication or data acquisition.

Pressure / Differential Pressure Transmitters shall have an electronic state-of-art capacitance or any other type of sensor meeting all functional requirements. Element material for Transmitters shall be SS316 as a minimum.

Diaphragm seal element with capillary shall be used for congealing, corrosive and highly viscous services.

All Transmitters shall have an integral output meter. Remote mounted meters may be provided if required in addition. All Transmitters shall have accuracy of $\pm 0.25\%$ of full scale deflection, unless otherwise specified.

Transmitter shall be capable of working with a minimum load of 600 ohms and at a 24V DC supply.

All electronic modules shall be designed for short circuit protection.

The change in output due to change in ambient temperature should be very minimum.

Electronic Transmitters shall have externally adjustable zero and span. Setting adjustment shall have locking adjustment.

5.2. Process Connection

Process connection for Transmitters shall be $\frac{1}{2}$ NPT or 2" flanged connection as per the Job Specification.

Process connection should be from bottom side.

3 Valve manifold in SS316 shall be used for Pressure Transmitter and 5 Valve manifold in SS316 shall be used for Differential Pressure Transmitter.

5.3. Equipment Protection

Transmitter shall be furnished with all necessary weather and anti-corrosion protection to prevent damage from saline and corrosive process atmosphere.

Over range protection shall be 130 % of range or maximum pressure whichever is higher.

5.4. Enclosure Class

In addition to weatherproof, the Pressure Transmitter enclosure shall be explosion-proof to NEMA-7 and certified by third party statutory bodies like UL/FM/BASIEFA or equal for use in hazardous area.

5.5. Range

Where possible, Pressure Transmitters shall use the same range selection as Pressure Gauges. However, the range of a Transmitter shall always be within the range of the local gauge used to monitor its output.

The normal pressure shall not be read at greater than 75 % of the Transmitter calibrated range for instruments reading steady pressure. For fluctuating service, the normal pressure shall be not more than 60 % of the range:

5.6. Name Plate

All transmitters shall be marked as per Manufacturer's standard and shall have a permanently attached stainless steel plate with the following, as a minimum detail:

- a. Tag number as per Data Sheet
- b. Manufacturer's name and trade mark



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- c. Area classification
- d. Adjustment range.
- e. Element material.
- f. Body material.
- g. Service

6.0 FABRICATION

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Pressure/ Differential Pressure Transmitter. Vendor shall submit the required specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing herein.

7.0 INSPECTION AND TESTING

Vendor shall perform all inspection and testing as per Job Specification requirements, and as per relevant codes, prior to shipment. The inspection and testing for Pressure Transmitter shall be carried out as per approved Inspection and Test Plan. Vendor shall submit the Inspection and Testing for Approval. Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process like hydro test, material test, hazardous area certification test, calibration test and any other before Factory Acceptance Testing (FAT).

7.1. Factory Acceptance Testing (FAT)

Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the Pressure/Differential Pressure Transmitter complete with the project approved tags, and highlighting the inspection and testing requirements of all such devices. FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the Pressure Transmitter.

FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place. FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

The FAT shall be consisting of the following as a minimum:

- a. Visual inspection
- b. Dimensional check
- c. Chemical and mechanical properties as per relevant material standards
- d. Calibration
- e. Functional test

A certificate to detail the results and records obtained during the FAT shall be made available for ratification by the Vendor on the date of test.

7.2. Site Acceptance Testing (SAT)



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A SAT shall be carried out on completion of the installation of the equipment at site which shall be witnessed by the Company / Owner's representative. SAT shall be performed on the Pressure / Differential Pressure Transmitter as per the approved test procedure. A comprehensive test procedure in compliance with the Company Specification shall be developed and issued to company / owner for review and approval.

The Site Acceptance Test (SAT), in general, shall demonstrate that the Pressure Transmitters functions correctly and properly in accordance with the specified requirements.

8.0 MARKING, PACKING AND SHIPMENT

Following FAT completion, Vendor responsible for the Pressure Transmitter shall ensure that all equipment and associated materials and accessories are designed properly, marked and packed, and secured for transit to site without damage.

Vendor shall provide and submit his standard "Marking, Packing and Shipping Procedures" for review by Company / Owner.

Vendor shall specify any conditions, normal or special, to be verified in intermediate storage and during transport.

Equipment shall be suitably packed including any dismantling, transit fastening and bracing necessary to prevent distortion or damage during transit.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the jobsite.

Preparation for shipment and packing will be subject to inspection and rejection by Company's inspectors. All costs occasioned by such rejection shall be to account of the Vendor.

9.0 SPARES AND ACCESSORIES

The following spare philosophy shall be followed in case it is not covered in Job Specification.

The Vendor shall include recommended Spare Parts List for start-up, pre-commissioning and two years operation as per the following;

- a. Itemized recommended spare parts list for start-up and pre-commissioning.
- b. Itemized recommended spare parts list for two years operation.

Vendor shall recommend accessories and special tools required for operation and maintenance of Pressure / Differential Pressure Transmitter, for Company review.

All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.

All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.

10.0 DOCUMENTATION

The following documentation shall be fulfilled by the Vendor, if it is not covered in Job Specification.

10.1. Documentation Required with Technical Bid

During bidding stage Vendor shall submit in his offer the following documents as a minimum:



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- a. Standard Specification, Data Sheets;
- b. Bill of Materials including Vendor list, details of third party items;
- c. Catalogues and Manuals;
- d. Quality Assurance Plan;
- e. Any other documents.

10.2. Documentation Required for Approval

Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval:

- a. Specifications, Data Sheets;
- b. Bill of materials including Vendor list, details for third party items;
- c. Catalogues, Manuals and relevant drawings and documents;
- d. Dimensional drawings;
- e. Calibration certificates;
- f. Material test certificates;
- g. Procedures for FAT;
- h. Quality Assurance Plan;
- i. Any Other documents.

10.3. Guarantee / Warranty

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company Specification.

Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility design. The cost of correction / replacement of any warranty items shall be borne by the Vendor, as per the purchase conditions of the Material / Purchase Requisition.

The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



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ABBREVIATIONS

ANSI	:	American National Standards Institute
ASME	:	American Society of Mechanical Engineers
IEC	:	International Electro technical Commission
NACE	:	National Association of Corrosion Engineers
HART	:	Highway Addressable Remote Transmission
PROM	:	Programmable Read only Memory
RTD	:	Resistance Temperature Detector
HHC	:	Hand Held Communicator
LCD	:	Liquid Crystal Display
IP	:	Ingress Protection



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1.0 SCOPE

This Standard Specification, together with the Data Sheets attached herewith, establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, painting, inspection and testing, documentation, marking, packing and shipping of Temperature Transmitter.

2.0 DEFINITIONS

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.

3.0 REFERENCE DOCUMENTS

3.1. Codes & Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

ANSI/ASME	ASME B 16.5	Steel Pipe Flanges and Flanged Fitting
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	ASME B 16.20	Ring Joint Gaskets and Grooves for Steel Pipe Flanges
	ASME B1.20.1	Pipe Threads
IEC-529		Degree of Protection by Provided by Enclosures
IEC-60529		Degrees of protection provided by Enclosures (IP Code)
IEC-60770		Transmitters for use in Industrial Process control systems
IEC-60751		Industrial Platinum resistance thermometer sensors
BS-5345		Electrical and Instruments in Hazardous Areas.
IS-2147		Degree of protection Provided for Enclosures for Low Voltage Switch gear and control gear
IS-2148		Flameproof Enclosures for Electrical Apparatus
NACE MR-01-75		Material Requirement- Sulfide stress cracking Resistant Material for oil Field Equipment (Latest)

3.2. Order of Precedence

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- a. Data sheets
- b. Job Specifications
- c. Standard Specifications
- d. Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.

4.0 MATERIALS

Materials selected shall be in accordance with the Data Sheets and Standard Specifications. For corrosion service the material selected shall be in compliance with the requirements of NACE MR-0175 / ISO-15156 latest editions.

5.0 DESIGN

5.1. General

The temperature element type shall be as specified in the Data Sheets unless otherwise specified. The Temperature Transmitters should be "SMART" type suitable for analog signal transmission using HART protocol and have a non-volatile memory, unless otherwise specified. A self-diagnostic facility shall be available. The Transmitters shall be certified for use in a hazardous area classified as mentioned in Data Sheet. The Vendor shall supply the extension cable between the temperature



element and the Transmitter. All field Transmitters shall have an accuracy of 0.25% of span and shall be provided with output meter / output gauge at the signal output. Burn out protection must be provided with Temperature Transmitters and trip amplifiers. Upscale or down scale protection shall be decided based on its application to ensure fail safe operation.

5.2. Element

If element is RTD, then RTD shall comply with IEC 60751. The RTD shall be three-wire type unless otherwise specified and shall have a resistance value of 100 ohms at 100°C.

5.3. Output

Transmitter output shall be 4-20 mA analog signals complying with HART protocol. The Transmitter power supply shall be normally 24 VDC, arranged for two wire transmission, with minimum power supply voltage of 12.5 VDC.

5.4. Electronics

The Transmitter electronics shall be solid state with appropriate smart circuitry. Printed circuit boards should be of a replaceable modular construction and shall be hermetically sealed or protected by a corrosion resistant coating. It should be supported against vibration in the case of plug-in type circuit boards. Signal wiring terminals and electronics shall be housed in separate compartments so that the electronics remain sealed during electrical connection to the signal cable. The electronics system shall be provided with environmental protection cover.

5.5. Calibration / Configuration

It shall be possible to perform on-line and remote set point configuration / calibration of the transmitter via a hand held communicator (HHC) The HHC shall be of easy to use and shall be suitable for use in the area classification specified in this Specification. The analog output of the transmitter shall not be affected during communication with the HHC. At least one number of hand held configurator shall be supplied as a minimum

5.6. Adjustments

The zero and span of the Transmitters shall be adjusted through a hand held communicator (HHC). A facility for engineering unit selection shall be available from the hand held communicator. The zero and span adjustments shall be non-interactive and continuously adjustable.

5.7. Indication

The Transmitters shall be provided with integral digital output indicator with 4 digits, LCD readout. The output meter scale meter shall cover the range specified in the Data Sheets, with selectable indication either in the specified engineering units or in percentage value.

5.8. Performance

The Transmitter accuracy, including the combined effect of linearity, hysteresis and repeatability shall be equal to or better than as stated in the Data Sheets. With reference to IEC 60770, errors shall be expressed as percentage of calibrated span, unless stated otherwise

5.9. Temperature Compensation

The Transmitter electronics shall include for the temperature compensation. The sensor characterization curve shall be stored in PROM.



5.10. Transmitter Housing

The instrument housing shall be low copper aluminium coated with epoxy paint. The epoxy coating shall be as per the industry standard, and shall be done on dry blast clean surface. The ingress protection for the enclosure shall be IP 65 as a minimum. No aluminium in its un-anodized form shall be used. No copper or its alloys shall be used except in its plated or tinned condition. No plastic shall be used except with a UV filter. The unit shall be supplied in housing suitable for outside (field) mounting in service conditions mentioned in the data sheets. Transmitters shall be installed in a sunshade for protection against direct sunlight.

5.11. CABLE ENTRY / CONNECTION

The electrical signal cable entry shall be M20. Unused cable entries shall be plugged off in compliance with the specified electrical safety rating. Signal wiring terminals shall be of the screw type.

5.12. TAGGING

Transmitters shall be provided with an identification plate, with all data clearly stamped on a corrosion resistant plate permanently attached to each instrument by means of rivets or pins and shall indicate, as a minimum, the following:

- a. Name of the Manufacturer or trademark.
- b. Instrument tag number.
- c. Serial number
- d. Year of manufacture
- e. Range & calibration (including units of measurement)
- f. Type of input
- g. Electrical safety (Type of Protection)
- h. Output signal.
- i. All information on the nameplate shall be die- stamped or deep engraved.

6.0 FABRICATION

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Temperature Transmitter. Vendor shall submit the required Specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing mentioned herein. Painting of Thermocouple & RTD shall be in accordance with Company Painting Specifications.

7.0 INSPECTION AND TESTING

Vendor shall perform all inspection and testing as per Job Specification requirements, and as per relevant codes, prior to shipment. The inspection and testing for Temperature Transmitter shall be carried out as per approved Inspection and Test Plan. Vendor shall submit the Inspection and Testing for Approval. Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process like hydro test, material test, hazardous area certification test, calibration test and any other before Factory Acceptance Testing (FAT).

7.1. Factory Acceptance Testing (FAT)

Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the Temperature Transmitter complete with the project approved tags, and highlighting the inspection and testing requirements of all such devices. FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the Temperature Transmitter.



FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place. FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

The FAT shall be consisting of the following as a minimum:

- a. Visual inspection
- b. Dimensional check
- c. Functional test
- d. Any other relevant test

A certificate to detail the results and records obtained during the FAT shall be made available for ratification by the Vendor on the date of test.

7.2. Site Acceptance Testing (SAT)

A SAT shall be carried out on completion of the installation of the equipment at site which shall be witnessed by the company / owner's representative. SAT shall be performed on the Temperature Transmitter as per the approved test procedure. A comprehensive test procedure in compliance with the company specification shall be developed and issued to company / owner for review and approval.

The Site Acceptance Test (SAT), in general, shall demonstrate that the Temperature Transmitter correctly and properly in accordance with the specified requirements.

8.0 MARKING, PACKING AND SHIPMENT

Following FAT completion, Vendor responsible for the Temperature Transmitter shall ensure that all equipment and associated materials and accessories are designed properly, marked and packed, and secured for transit to site without damage.

Vendor shall provide and submit his standard "Marking, Packing and Shipping Procedures" for review by Company / Owner.

Vendor shall specify any conditions, normal or special, to be verified in intermediate storage and during transport.

Equipment shall be suitably packed including any dismantling, transit fastening and bracing necessary to prevent distortion or damage during transit.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the jobsite.

Preparation for shipment and packing will be subject to inspection and rejection by Company's inspectors. All costs occasioned by such rejection shall be to account of the Vendor.

9.0 SPARES AND ACCESSORIES

The following spare philosophy shall be followed in case it is not covered in Job Specification.

The Vendor shall include recommended Spare Parts List for start-up, pre-commissioning and two years operation as per the following;

- I. Itemized recommended spare parts list for start-up and pre-commissioning.
- II. Itemized recommended spare parts list for two years operation.

Vendor shall recommend accessories and special tools required for operation and maintenance of Pressure Switch, for Company review.



All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.

All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.

10.0 DOCUMENTATION

The following documentation shall be fulfilled by the Vendor, if it is not covered in Job Specification.

10.1. Documentation Required with Technical Bid

During bidding stage Vendor shall submit in his offer the following documents as a minimum:

- a. Standard Specification, Data Sheets;
- b. Bill of Materials including Vendor list, details of third party items;
- c. Catalogues and Manuals;
- d. Quality Assurance Plan;

10.2. Documentation Required for Approval

Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval:

- a. Specifications, Data Sheets;
- b. Bill of materials including Vendor list, details for third party items;
- c. Catalogues, Manuals and relevant drawings and documents;
- d. Dimensional drawings;
- e. Calibration certificates;
- f. Material test certificates;
- g. Procedures for FAT;
- h. Quality Assurance Plan;
- i. Any Other documents.

10.3. Guarantee / Warranty

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company Specification.

Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility design. The cost of correction / replacement of any warranty items shall be borne by the Vendor, as per the purchase conditions of the Material / Purchase Requisition.

The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



STANDARD SPECIFICATION FOR INSTRUMENTATION CABLES

SPECIFICATION NO.
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ABBREVIATIONS

ASTM	:	American Society of Testing and Materials
AWG	:	American Wire Gauge
BS	:	British Standards
DC	:	Direct Current
DIN	:	Deutsches Institute for numbering
EPR	:	Ethylene Propylene Rubber
F&G	:	Fire and Gas
IEC	:	International Electro-technical Commission
IS	:	Indian Standards
PVC	:	Polyvinyl Chloride



**STANDARD SPECIFICATION FOR
INSTRUMENTATION CABLES**

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1.0 SCOPE

This Standard Specification, together with the Data Sheets attached herewith, establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, painting, inspection and testing, documentation, marking, packing and shipping of Cables along with its spares and accessories.

2.0 DEFINITIONS

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.

3.0 REFERENCE DOCUMENTS

3.1. Codes & Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

IEC-332-3 Part 3	Tests on bunched wires and cables
IEC 584-3 Part	Extension and compensating cables – Tolerances identification system

IEC-60332 Part 3	Tests on electric and optical fibre cables under fire conditions - Test for vertical flame spread of vertically mounted bunched wires or cables
IEC-60331	Fire-Resisting Characteristics of Electric Cables
ASTM D 2863	Test method for measuring the minimum oxygen concentration to support candle like combustion of plastics (Oxygen index)
BS-5308 Part 1	Specification for Polyethylene insulated cables
BS-5308 Part 2	Specification for PVC insulated cables
DIN-50049	Document on Material Testing
IS-1554 Part 1	PVC insulated (heavy duty) electric cables-working voltage up to and including 110 V
IS-2633	Method for testing uniformity of coating on zinc coated articles
IS-3975	Mild steel wires, formed wires and tapes for armouring cables
IS-5831	PVC insulation and sheath of electric cables
IS-8784	Thermocouple compensating cables

3.2. Order of Precedence

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- a. Data sheets
- b. Job Specifications
- c. Standard Specifications
- d. Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.

4.0 MATERIALS

Materials selected shall be in accordance with the Data Sheets and Company's Standard Specifications. Type and material of extension Cable shall be as per IS-5831 and IEC 584-3 where applicable.

Cable cores shall be of annealed electrolytic tinned copper conductor with PVC jackets conform to IS-5831. Insulation shall be Mica-glass / EPR or silicon rubber for F&G. signal/control Cables. Armouring shall be of galvanized steel wire / strip armour conforming to IS-1554. Screening / shielding shall be of black Aluminium backed Mylar / Polyester foil.

5.0 DESIGN

The following design requirement covers the general requirements of Instrument Cables and accessories etc., but for the exact requirements and applications, the relevant, specific job Specifications and design basis shall be referred and complied.

5.1. Signal and Control Cables

5.1.1. Type – I (Single Pair / Triad Shielded Cable)

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

Primary insulation shall be 85°C polyvinyl chloride (PVC) as per IS-5831 Type-C. Thickness shall be 0.5 mm minimum.

A pair or triad shall have twisted cores and number of twists shall be not less than 10 per meter. Colour of core insulation shall be black-blue in pair and black-blue-brown in a triad.

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

Inner and outer jacket shall be made of extruded flame retardant 90°C 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.

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.

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

Tolerance in overall diameter of cable shall be within ± 2 mm over offered value.

5.1.2. Type – II (Multipair / Multitriad Cable with Individual Pair Shield and Overall Shield)

a. 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.

b. Overall shield shall be of Aluminium backed up by Mylar / polyester tape helically applied with the metallic side down with either side 25% overlap or 100% coverage. Minimum shield thickness shall be 0.075 mm. Drain wire shall be similar to individual pair drain wire and shall be of the overall shield.

c. Overall twist of all pair / triads shall be as per Vendor's standard.

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

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

5.1.3. Type – III (Multipair / Multitriad Cable with Only Overall Shield)

a. These Cables shall be same as type-II cables except that the individual pair / triad shall not have shielding.

5.1.4. Type - IV (Multipair / Multitriad Cable with Individual Pair Shield and Overall Shield)

a. The Cable shall be same as Type II except conductor size shall be 1.5 mm² made of 7 stranded annealed electrolytic copper conductor. Each strand shall be of 0.53 mm dia.

5.1.5. Type – V (Multipair / Multitriad Cable with Overall Shield only)

a. The Cable shall be same as type IV except that the individual pair / triad shall not have the shielding.

5.2. Fire and Gas Cables shall be fire resistant and shall meet all the Specifications mentioned above and:

- a. Insulation shall be Mica-Glass / EPR or silicon rubber.
- b. The inner sheath shall be applied with a low smoke fire resisting compound.
- c. Suitable filler material (if necessary) shall be filled.
- d. Outer sheath shall be made up of low smoke, heat and oil resistant and flame retardant material.
- e. Circuit integrity of the Cable shall be maintained for a minimum period of 3 hours as per IEC-60331.
- f. The outer jacket colour shall be orange.

5.3. Thermocouple Extension Cables

Type and material of extension cable shall be as per IS-5831 and IEC-584-3 where applicable.

5.3.1. Type – I (Single Pair Shielded Cable)

- a. Each core shall be made of 16 AWG solid conductors.
- b. Primary insulation shall be 85°C polyvinyl chloride (PVC) as per IS 5831 Type C. Thickness shall be 0.5 mm minimum. Colour coding shall be as per IS-8784 Table-5.
- c. The cores of the pair shall be twisted and number of twists shall be not less than 10 per meter. The pair shall be shielded. Shield shall be Aluminium backed by Mylar / polyester tape bonded together 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 0.5 mm² multistrand bare tinned annealed copper conductor. The drain wire shall be continuous contact with Aluminium side of the shield.
- d. Inner and outer jacket shall be made of extruded flame retardant 90°C 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. Inner jacket and outer jacket colour shall be as per IS-8784. A rip cord shall be provided for inner jacket.
- e. Armour over inner jacket shall be of galvanized steel wire/flat as per IS-1554 Part-I.
- f. Tolerance in overall diameter of cable shall be within ± 2 mm over offered value.

5.3.2. Type – II (Multipair Cable with Individual Shield and Overall Shield)

- a. The Cable shall be same as single pair shielded cable except for following;
 - i. Each core shall be 20 AWG solid conductor.
 - ii. In addition to individual pair shield overall shield shall be provided. Overall shield shall be of Aluminium backed up by Mylar / polyester tape helically applied with metallic side down either side 25% overlap or 100% coverage. Minimum shield thickness shall be 0.075 mm. Drain wire shall be similar to individual pair drain wire and shall be in continuous contact with the aluminium side of the overall shield.
 - iii. Overall twist of all pair shall be as per Vendor's standard.
 - iv. A pair of communication wire shall be provided for multipair cables. Each wire shall be 0.5 mm² of plain annealed single or multistrand copper conductor with 0.4 mm thick 85°C PVC insulation. Insulation shall be green and red colour coded.
 - v. Pair identification shall be with numbers at interval of not more than 250 mm as per Vendor's standard.

5.3.3. Type – III (Multipair Cable with Individual Pair Shield and Overall Shield)



- a. The Cable shall be same as type II except conductor size shall be 16 AWG.

5.4. Electrical Characteristics

5.4.1. Cable parameters L/R ratio, capacitance shall conform to intrinsic safety requirements for IS cables. Limitations for cable parameter shall be as follows:

- a. 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 mm² conductors and 39.7 Ω /km at 20°C for cables with 0.5 mm² conductors.
- b. Mutual capacitance between any core and screen shall not exceed 250 pF/m at 1 KHz. Capacitance between any cores or screen shall not exceed 400 pF/m at 1 KHz.
- c. L/R ratio of adjacent core shall not exceed 40 μ H/ Ω for cables with 1.5 mm² conductors and 25 μ H/ Ω for cables with 0.5 mm² conductors.
- d. Electrostatic noise rejection ratio shall be minimum 76 dBA.
- e. Drain wire resistance including screen shall not exceed 30 Ω /km.
- f. Core inductance shall not exceed 4 mH/Km.
- g. Values shall be derived under the fault condition in the cable which produces the worst case parameters for intrinsic safe cables.

All Cables shall have insulation voltage rating of 600 / 1100 V.

5.5. Name Plate

All Instrument Cable shall be marked as per Manufacturer's standard and shall have a permanently attached stainless steel plate with the following, as a minimum detail:

- a. Tag number as per Data Sheet;
- b. Manufacturer's name;
- c. Details of the Cable;
- d. Length of the Cable in meters contained in the drum;
- e. Gross weight;
- f. Direction of rotation of drum for unwinding by means of an arrow;
- g. Purchase Order number.

6.0 FABRICATION AND PAINTING

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Cables. Vendor shall submit the required Specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing herein.

7.0 INSPECTION AND TESTING

Vendor shall perform all inspection and testing as per Job Specification requirements, and as per relevant codes, prior to shipment. The inspection and testing for Instrument Cables shall be carried out as per approved Inspection and Test Plan. Vendor shall submit the Inspection and Testing for Approval. Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process like hydro test, material test, hazardous area certification test, and any other before Factory Acceptance Testing (FAT).

7.1. Factory Acceptance Testing (FAT)



Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the Instrument Cables, complete with the project approved tags, and highlighting the inspection and testing requirements of all such devices. FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the Instrument Cables.

FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place. FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

The FAT shall be consisting of the following as a minimum:

- 7.1.1. Standard Type Test certificate shall be furnished for Cables similar to those being offered,**
- a. Cable shall be flame retardant to IEC-60332 part-III category A.
 - b. Cables required for F&G applications shall be as per IEC-60331.
- 7.1.2. Standard Routing Test (to be carried out by the manufacturer during various stages of manufacturing, test certificates shall be furnished)**
- a. Insulation resistance, voltage test and spark test as per 8S-5308 part-II and sheath test as per IS-5831;
 - b. Armor test as per IS-3975;
 - c. Cable capacitance, L/R ratio and inductance test;
 - d. Conductor resistance test in Ohms/km;
 - e. Thermo emf tests for thermocouple extension cables.
- 7.1.3. Standard Acceptance Test shall be carried out in the presence of Purchaser or his authorized representatives,**
- a. Continuity test;
 - b. Voltage test as per 8S-5308 part-II;
 - c. L/R ratio and capacitance values test;
 - d. Oxygen index test as per ASTM D 2863 latest edition;
 - e. Conductor resistance and drain wire resistance;
 - f. Dimensional check for overall diameter and under armor outer armor diameter;
 - g. Fire resistant test / certificate review (when specified);
 - h. Tests for uniformity of galvanization of armor as per IS-2633;
 - i. Check for drum length and overall length tolerances.
- 7.2. Site Acceptance Testing (SAT)**
- A SAT shall be carried out on completion of the installation of the Cables at site which shall be witnessed by the company / owner's representative. SAT shall be performed as per the approved test procedure. A comprehensive test procedure in compliance with the company specification shall be developed and issued to company / owner for review and approval.
- The Site Acceptance Test (SAT), in general, shall demonstrate that the Cables functions correctly and properly in accordance with the specified requirements. SAT mainly consists of the following inspections:
- a. Continuity test



- b. Conductor resistance and drain wire resistance
- c. Drum length and overall length tolerances
- d. Any other test, if required.

8.0 MARKING, PACKING AND SHIPMENT

Following FAT completion, Vendor ensure that all Cables, associated materials and accessories are designed properly, marked and packed, and secured for transit to site without damage.

Vendor shall provide and submit his standard "Marking, Packing and Shipping Procedures" for review by Company / Owner.

Vendor shall specify any conditions, normal or special, to be verified in intermediate storage and during transport.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the jobsite.

Cables shall be dispatched in wooden drums, securely battened with take-off end fully protected against damage

The ends of the Cable shall be sealed with suitable PVC / Rubber caps to prevent ingress of moisture.

Preparation for shipment and packing will be subject to inspection and rejection by Company's inspectors. All costs occasioned by such rejection shall be to account of the Vendor.

9.0 SPARES AND ACCESSORIES

The following spare philosophy shall be followed in case it is not covered in Job Specification.

The Vendor shall include recommended Spare Parts List for start-up, pre-commissioning and two years operation as per the following;

- a. Itemized recommended spare parts list for start-up and pre-commissioning.
- b. Itemized recommended spare parts list for two years operation.

Vendor shall recommend accessories and special tools required for operation and maintenance of Instrument Cables for Company review.

All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.

All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.

10.0 DOCUMENTATION

The following documentation shall be fulfilled by the Vendor, if it is not covered in Job Specification.

10.1. Documentation Required with Technical Bid

During bidding stage Vendor shall submit in his offer the following documents as a minimum:

- a. Standard Specification, Data Sheets;
- b. Bill of Materials including Vendor list, details of third party items;
- c. Catalogues and Manuals;



- d. Quality Assurance Plan;
- e. Any other documents.

10.2. Documentation Required for Approval

Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval:

- a. Specifications, Data Sheets;
- b. Bill of materials including Vendor list, details for third party items;
- c. Catalogues, Manuals and relevant drawings and documents;
- d. Dimensional drawings;
- e. Material test certificates;
- f. Procedures for FAT;
- g. Quality Assurance Plan;
- h. List for spare parts for start-up and for 2 years of operation.

10.3. Guarantee & Warranty

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company Specification.

Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility design. The cost of correction / replacement of any warranty items shall be borne by the Vendor, as per the purchase conditions of the Material / Purchase Requisition.

The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



STANDARD SPECIFICATION FOR INSTRUMENT TUBE FITTINGS

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ABBREVIATIONS

ANSI	:	American National Standards Institute
ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society of Testing and Materials
BS	:	British Standards
FAT	:	Factory Acceptance Test
IS	:	Indian Standards
ISA	:	Instrument Society of America
ISO	:	International Organization for Standardization
NACE	:	National Association of Corrosion Engineers
NPT	:	Nominal Pipe Thread
SAT	:	Site Acceptance Test
SS	:	Stainless Steel



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1.0 SCOPE

This Standard Specification, together with the Data Sheets attached herewith, establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, painting, inspection and testing, documentation, marking, packing and shipping of instrument tube fittings which includes the following types :-

- a. SS compression fittings (for SS tube)
- b. Brass compression fittings (for copper tube)

2.0 DEFINITIONS

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.

3.0 REFERENCE DOCUMENTS

3.1 Codes & Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

American Society of Mechanical Engineers



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ASME B1.20.1	Pipe Threads
ASME B 16.5	Steel Pipe Flanges and Flanged Fitting
ASME B 16.20	Ring Joint Gaskets and Grooves for Steel Pipe Flanges
ASME B16.11	Forged Steel Fittings -Socket Welding and Threaded

British Standards

BS-4368	Carbon and Stainless Steel Compression Couplings for Tubes - Part-IV
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Instrument society of America

ISA RP 42.1	Nomenclature for Instrument tubing fittings
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Indian Standards

IS-319	Specification for free cutting Brass Bars, Rods and Sections
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3.2 Order of Precedence

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- a. Data sheets
- b. Job Specifications
- c. Standard Specifications
- d. Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.

4.0 MATERIALS

Materials selected shall be in accordance with the Data Sheets and Standard Specifications. For corrosion service the material selected shall be in compliance with the requirements of NACE MR-0175 / ISO-15156 latest editions.

5.0 DESIGN

5.1 SS Tube Fittings

Nomenclature of all Tube Fittings shall be as per ISA RP 42.1.

Fittings shall be of flare less compression type and four - piece (for double compression type) construction consisting of two ferrules, nut and body suitable for use on SS tubes conforming to ASTM A 269 TP 316 with hardness in the range of RB 70 to 79.

All the parts shall be of SS 316.



Hardness of the ferrules shall be in the range of RB 85-90 so as to ensure a hardness difference of the order of 5 to 10 between Tube and Fittings, for better sealing.

Nuts and ferrules of a particular size shall be interchangeable for each type.

Spanner hold shall be metric.

Threaded ends of Fittings shall be NPT as per ANSI B 1.20.1.

Vendor shall ensure that the ferrules and nuts supplied for fittings shall be suitable for the sample Tube which shall be supplied during manufacture.

Specific techniques like Silver plating shall be used over threading in order to avoid jamming and galling.

5.2 Copper Tube Fittings

Nomenclature of all Tube Fittings shall be as per ISA RP 42.1.

Fittings shall be of flare less compression type and of three- piece construction consisting of ferrule, nut and body suitable for use on copper tubes conforming to ASTM B 68/B 68M hardness not exceeding RB 50.

All parts shall be manufactured from Brass as per IS 319 bar stock and nickel plated.

For better grip, Vendor shall maintain hardness difference between tube and ferrule and indicate the same along with the offer.

Nuts and ferrules of a particular size shall be interchangeable for each type.

Threaded ends of Fittings shall be NPT as per ANSI B 1.20.1.

Spanner hold shall be metric.

Vendor shall ensure that the ferrules and nuts supplied for fittings shall be suitable for sample tube which shall be supplied during manufacture.

5.3 Name Plate

No separate nameplates are required on the Fittings. However, a Manufacturer's name / trademark should be punched on a visible place on the body of each Fittings for easy identification.

6.0 FABRICATION AND PAINTING

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Instrument Tube Fittings. Vendor shall submit the required Specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing herein.

7.0 INSPECTION AND TESTING

Vendor shall perform all inspection and testing as per Job Specification requirements, and as per relevant codes, prior to shipment. The inspection and testing for Instrument Tube Fittings shall be carried out as per approved Inspection and Test Plan.

Type test for the products shall be according to 8S-4368 Part IV which shall necessarily include the following:-

- a. Hydrostatic proof pressure test
- b. Minimum hydrostatic burst pressure test
- c. Disassembly and reassembly test



- d. Minimum static gas pressure (vacuum) test
- e. Maximum static gas pressure test
- f. Hydrostatic impulse and vibration test.

The type test results shall be made available for scrutiny during inspection.

Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process like hydro test, material test, hazardous area certification test, calibration test and any other before Factory Acceptance Testing (FAT).

7.1 Factory Acceptance Testing (FAT)

Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the Instrument Tube Fittings complete with the project approved tags, and highlighting the inspection and testing requirements of all such devices. FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the Instrument Tube Fittings.

FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place. FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

The FAT shall be consisting of the following as a minimum:

- a. Hydrostatic Test: SS Tube Fittings shall be subjected to hydrostatic test at the following pressures.
 - For 6 mm Fittings, at 80 kg/cm².
 - For 1/2" Fittings, at 153 kg/cm² or 400 kg/cm² at 38°C, as specified in the Data Sheets. The ratings are based on usage in piping classes with flange ratings up to 600#, 900# and 1500# respectively.
 - Brass compression Fittings shall be subjected to hydrostatic test at the following pressure:
 - For 1/4" Fittings, at 10 kg/cm², 3/8 " at 80 kg/cm², at 38° C.
 - During and after the hydrostatic test, the tubes shall not show any leaks or rupture.
- b. Pneumatic Pressure Test: The Fittings shall be tested at 7 kg/cm² of dry air. During and after the test, tubes shall not show any leaks or rupture.
- c. Disassembly and Reassembly Test.
- d. Hardness verification. Test for hardness shall be done on parent material for the ferrules.
- e. Dimensional test report

A certificate to detail the results and records obtained during the FAT shall be made available for ratification by the Vendor on the date of test.

7.2 Site Acceptance Testing (SAT)

A SAT shall be carried out on completion of the installation of the equipment at site which shall be witnessed by the company / owner's representative. SAT shall be performed on the Instrument Tube Fittings as per the approved test procedure. A comprehensive test procedure in compliance with the company specification shall be developed and issued to company / owner for review and approval.

The Site Acceptance Test (SAT), in general, shall demonstrate that the Instrument Tube Fittings functions correctly and properly in accordance with the specified requirements.

8.0 MARKING, PACKING AND SHIPMENT



Following FAT completion, Vendor responsible for the Instrument Tube Fittings shall ensure that all equipment and associated materials and accessories are designed properly, marked and packed, and secured for transit to site without damage.

Vendor shall provide and submit his standard "Marking, Packing and Shipping Procedures" for review by Company / Owner.

Vendor shall specify any conditions, normal or special, to be verified in intermediate storage and during transport.

Equipment shall be suitably packed including any dismantling, transit fastening and bracing necessary to prevent distortion or damage during transit.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the jobsite.

Preparation for shipment and packing will be subject to inspection and rejection by Company's inspectors. All costs occasioned by such rejection shall be to account of the Vendor.

9.0 SPARES AND ACCESSORIES

The following spare philosophy shall be followed in case it is not covered in Job Specification.

The Vendor shall include recommended Spare Parts List for start-up, pre-commissioning and two years operation as per the following;

- a. Itemized recommended spare parts list for start-up and pre-commissioning.
- b. Itemized recommended spare parts list for two years operation.

Vendor shall recommend accessories and special tools required for operation and maintenance of Instrument Tube Fittings, for Company review.

All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.

All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.

10.0 DOCUMENTATION

The following documentation shall be fulfilled by the Vendor, if it is not covered in Job Specification.

10.1 Documentation Required with Technical Bid

During bidding stage Vendor shall submit in his offer the following documents as a minimum:

- a. Standard Specification, Data Sheets;
- b. Bill of Materials including Vendor list, details of third party items;
- c. Catalogues and Manuals;
- d. Quality Assurance Plan;
- e. Any other documents.

10.2 Documentation Required for Approval



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Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval:

- a. Specifications, Data Sheets;
- b. Bill of materials including Vendor list, details for third party items;
- c. Material test certificates;
- d. Procedures for FAT;
- e. Quality Assurance Plan;

10.3 Guarantee & Warranty

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company Specification.

Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility design. The cost of correction / replacement of any warranty items shall be borne by the Vendor.



**STANDARD SPECIFICATION
FOR
CONTROL PANEL AND ACCESSORIES

I-SPC-0017**

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Rev.	Date	Purpose	Prepared by	Reviewed by	Approved by	Approved by



**STANDARD SPECIFICATION FOR
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ABBREVIATIONS

AC	:	Alternating Current
DC	:	Direct Current
DPDT	:	Double Pole Double Throw
HRC	:	High Rupturing Capacity
LED	:	Light Emitting Diode
NPT	:	National Pipe Thread
PVC	:	Poly Vinyl Chloride



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1.0 SCOPE

1.1 General

1.1.1 This specification, together with the data sheets covers the requirements for the design, materials, fabrication, wiring, painting, nameplate marking, inspection & testing, shipment and site activities including installation of control panels and accessories.

1.1.2 The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the purchaser's enquiry-

ASME - American Society of Mechanical Engineer

B 1.20.1 : Pipe Threads, General Purpose (Inch)

B 16.5 : Pipe Flanges and Flanged fittings

B 16.20 : Metallic Gaskets for Pipe Flanges

API - American Petroleum Institute.

MPMS : Manual of Petroleum Measurement Standards

RP 552 : Transmission Systems

EN - European Standards

10204 : Inspection Documents For Metallic Products.

IS/IEC - Indian Standards/International Electro-Technical Commission

IS/IEC 60079 : Electrical Apparatus for Explosive Gas Atmosphere.

IS/IEC 60529 : Degree of Protection Provided by Enclosures (IP Code).

IEC-61000-4 : Electromagnetic Compatibility for Industrial : Testing and Measurement Techniques.

IS-5 : Colours for Ready Mixed Paints.

IS-2062 : Hot rolled Medium and High Tensile Structural Steel.

1.1.3 In the event of any conflict between this standard specification, data sheets, statutory regulations, related standards, codes etc., the following order of priority shall govern.

- a) Statutory Regulations
- b) Job Specification, Data Sheets
- c) Standard Specification
- d) Codes and Standards

1.1.4 In addition to meeting purchaser's specifications in totality, vendors' extent of responsibility shall also include the following.

Vendor shall be responsible for panel front arrangement including proper location and spacing of instruments and accessories like switches, push buttons, lamps, terminal blocks, supporting steel members, wiring raceways etc., from the point of view of accessibility and ease of maintenance based on the indicative drawings/schemes furnished by the purchaser.

1.2 Bids



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- 1.2.1 Vendor's quotation shall be strictly as per the bidding instructions to vendor attached with the Material Requisition.
- 1.2.2 Vendor's quotation, catalogues, drawings, installation, operation and maintenance manual etc. shall be in English language only.

1.3 Drawing and Data

- 1.3.1 Detailed drawings, data, catalogues and manuals required from the vendor are indicated by the purchaser in vendor data requirement sheets attached with the requisition.
- 1.3.2 Final documentation consisting of design data, installation manual, maintenance manual etc. submitted by the vendor after placement of purchase order shall include the following, as a minimum;
- a) Specification sheet for control panels, instruments and accessories.
 - b) Certified drawings for each control panel, which shall provide following details:
 - i) Control panel front arrangement drawing showing all dimensions including bezel/cut out dimensions.
 - ii) Loop wiring drawings showing the terminal numbers of each instrument/ accessory used in the wiring.
 - iii) Ladder drawings and relay wiring drawings showing terminal numbers for interlock/shutdown.
 - iv) Power supply distribution drawings with terminal numbers, incoming/ outgoing feeder size, fuse and isolator rating etc.
 - c) Vendor shall provide test certificates for all the tests indicated in Clause 4.0 of this specification.
 - d) Maintenance procedure including replacement of instruments and accessories in vendor scope.

2.0 DESIGN AND CONSTRUCTION

- 2.1 Control panel and accessories shall be designed and fabricated in accordance with the drawings/data sheets enclosed with the Enquiry. Applicable standards and codes shall include relevant sections of APT-MPMS APT BP 552
- 2.2 The design of the electronic instruments, relays etc. shall be in compliance with electromagnetic compatibility requirements as per IEC 61000-4.

2.3 Construction

- 2.3.1 Control panels shall generally be 2100 mm high and 1 000 mm deep and shall be mounted on 100mm high channel base. Width of the panels shall be 1200 mm or 800 mm in general (as indicated in material requisition), however it may vary as per actual requirements.
- 2.3.2 Panels shall be free standing type. Panels with instruments mounted on the front shall be Fabricated from 3 mm thick cold rolled steel sheet. If the same is not available, 4 mm thick Hot rolled steel sheet shall be used. All other panels shall be fabricated from 2mm thick cold Rolled steel sheet. Angle iron framework shall use a minimum section of 50 x 50 x 4 mm Angle. Panel painting procedure shall include blast cleaning, grinding, chemical cleaning, Surface finishing by suitable filler and two coats of high grade lacquer with wet blasting Wherever required. Two coats of paint in the panel colour shall be provided for non-glossy High satin finish. Final coat shall be given after assembly at site.



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For local control panel, Steel sheets for panels shall be cut on a squaring shears to ensure tight flush joint when butted together. Adjacent panels are bolted together with cadmium-plated bolts and nuts. Bolts or screw shall not be exposed on the face of the panel. Welded coupling of panel section is not allowed. Adjacent panels shall be assembled with face flush. Gaps or cracks shall not be visible from the front of assembled panels.

- 2.3.3 Where specified vendor to provide one digital clock on the panel front. Clock display shall be seven segments LED with AM/PM or 24-hour mode, which shall be field selectable. Display shall be visible from a distance of 7 metres arc covering an angle of minimum 120°.
- 2.3.4 All exposed surfaces in plain view shall be perfectly level, smooth and free from any protrusions and tool or clamp marks. All edges including cut outs shall be ground smooth.
- 2.3.5 Rear of each panel section shall have a steel framework assembled to it for supporting instruments, raceways and other accessories like power distribution boxes etc. Panel stiffeners shall be welded to the rear of the panel and shall not interfere with instrument installation. All structural shapes of steel members shall be as per IS-2062.
- 2.3.6 Enclosed cubicle panels shall have removable hinged doors (rear) for easy maintenance and Accessibility of the instruments. Doors shall be double leaved type with handle and shall be Provided with lock and key. Adequate illumination shall be provided inside the panel. All Light fittings shall be suitable for 240 V, 50 Hz AC. Power supply greater than 240 V shall Also not enter the control panel..
- 2.3.7 All cable entries to the panel shall be from panel bottom only using cable glands of adequate Size. Cable gland plate thickness shall be a minimum of 3 mm cold rolled cold annealed (CRCA) as a minimum. All unused cable entries must be plugged.
- 2.3.8 One telephone socket, and 110V 50 Hz/ 230V 50 Hz plug in outlets shall be provided for every three panel sections.
- 2.3.9 Semigraphic displays shall be screen printed as per approved drawings, on the front of fibre glass or back of transparent acrylic sheet as specified in material requisition and screwed to a steel backplate of indicated thickness. Semigraphic background colour shall be same as that of control panel.
- 2.3.10 Where specified LEDs shall be provided on the semigraphic section complete with all wiring brought to terminal boxes located on the framework of semigraphic section. A redundant power supply unit with 100% spare capacity for each power supply shall be provided by vendor for LEDs operation.
- 2.3.11 After completing fabrication of panels and semigraphics, semigraphics shall be erected and bolted to the top of the panel sections. Suitable angles and tees shall be provided between top of panel sections and bottom of semigraphic sections and at the top of semigraphics. Any defect/misalignment of the assembly shall be rectified before first coat of painting.
- 2.3.12 Lifting eyebolts shall be provided for each panel.
- 2.3.13 Normal mounting heights on panel of instruments (centre lines of instruments to floor) shall conform to the following, with minor adjustments depending upon instruments selected:

1	Instruments	Bottom Row Middle Row Top Row	1100mm 1350mm 1600mm
2	Annunciators	-	1950mm
3	Electrical push buttons, Selector switches, lamps, etc.	-	700mm



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- 2.3.14 The design of panel shall incorporate provision for expansion by installing adequate spare Capacity. Each panel shall be designed to accommodate the following additional equipment, As a minimum:
- 20% of panel front/inside mounted instruments including lamps, push buttons, switches, relays etc.
 - 20% additional power feeders each provided with switch fuse assembly.
 - 20% additional spare windows in alarm annunciators.
 - 20% spare cable entry points.

2.4 Local Control panel

Local Control panel and accessories shall be suitable for location in non air-conditioned building. Panel and associated accessories shall be designed to withstand environmental conditions at site. Panel in open areas shall be weatherproof to IP-55 as per IS/ IEC-60529. Gasketed glass doors shall be used for normal visibility wherever required.

2.4.1 Panels Located in Hazardous Area

2.4.1.1 Pressurised Panel

Pressurisation shall be as per NFPA-496 type X (for panels located in Zone-I) or Z (for panels located in Zone-2) in general. However, actual requirements shall be as specified in job specification. Vendor shall provide all the instrumentation and accessories being mounted on/inside the panel, including the pressurisation kit. Make/model of all instrumentation shall be subject to approval by owner. The pressurisation kit shall be complete with filter regulator, differential pressure purge rotameter and differential pressure indicator on front panel, differential pressure switch for alarm or power cut off as per area classification and for remote alarm in case of pressurisation failure. The control unit and other electrical components like pressurisation status, purge medium control solenoids etc. required for purging/ pressurisation of panel shall be flame proof. All incoming/outgoing contacts from panel shall be routed through the flameproof control unit, which will provide isolation of the contacts automatically during pressurisation failure in case of IEC-Zone-1 area, or manually through a switch for maintenance purpose. Pressurisation level adjustment should be possible externally without depressurising the panel. The atmospheric open end of differential pressure gauge/switch shall be provided with bug screen. No hazardous gas shall be piped inside the panel. All cutouts shall be properly gasketed for good pressurisation. An additional glass door opening at the front shall be provided for weather protection of instruments mounted on the front of the panel. All instruments shall be calibrated at shop before despatching the panel. Glass door, if any, shall be of shatterproof glass. Cable glands shall be double compression types. Instruments that are liable to get damaged during shipment shall be removed and despatched loose along with the panel.

2.4.1.2 Flame-proof Panel

These panels shall be duly certified by statutory authority, as mentioned in clause 1.2.2 of this specification, for safe use in specified hazardous area. Glass door if any shall be of shatterproof glass. All special tools shall be supplied for maintaining these panels. Cable glands shall be double compression types.

Weatherproof panel but with all electrical components and accessories flameproof. All electrical components and accessories shall be flame proof and duly certified by statutory authority as mentioned in clause 1.2.2 of this specification. Cable glands shall be double compression type

2.4.1.3 Pneumatic Panel



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2.4.1.3.1 Air Supply

- i) Each pneumatic instrument shall be fed through 1/4" isolation valve and air filter regulator.
Air reducing station shall be provided for panels housing more than ten instruments
- ii) Air pressure reducing station shall have two parallel branches each consisting of block valves, filter and regulator. Pressure relief valve and a pressure indicator shall be installed at the common outlet. Each branch of air reducing station shall be designed for full capacity.
- iii) Vendor shall furnish air supply piping from a point on the panel framework to the inlet side of the pressure reducing station or alternatively to the inlet side of individual pressure regulators. A flanged connection shall be provided on the framework to connect the inlet piping.
- iv) Fittings and 1/4" valves downstream of the filters at the air reducing station shall be of brass material. All headers shall be minimum 2" and shall be nickel-plated brass material.
- v) Air supply header shall be extended from downstream side of the main pressure reducing valves across the length of the panel.
- vi) The air header shall be installed with proper slope towards the dead end. A brass gate valve shall be provided at the dead end of the air header for cleaning or draining the header. Air reducing station shall not hinder access to bulk head fittings.
- vii) Where miniature type instruments are used, vertical sub-air headers for each panel shall be provided with 1/4" NPT (F) brass needle valves. In all cases 10% spare take-off points with needle valves shall be provided for future use.

2.4.1.3.2 Tubing

- i) Vendor shall supply and install all tubing between instruments to bulkhead fittings and from auxiliary items such as pressure switch rack mounted within panel.
- ii) All bulkhead union shall be suitable for 1/4" OD copper tube on either side. 10% spare bulkhead fittings shall also be furnished.
- iii) Tube fittings shall be compression, double ring ferrule type.
- iv) 6 mm OD x 1 mm thick bare wall copper tube shall be used for tubing inside the panel and accessories.
- v) PVC ducts shall be used for laying of tubing behind the panel, racks etc. Rubber grommets shall be provided wherever tubings are taken in and out of instruments, racks etc.
- vi) Spare pens/pointers in recording/indicating instruments shall also be tubed and connected to bulk head.

2.5 Painting

2.5.1 The entire surface of panels and accessories, comprising front, rear and sides shall be treated and painted as follows:

- a) All surfaces including structures shall be sand blasted and grinded until they are smooth and free of scale, rust etc.
- b) Chemical treatment shall be done to remove rust, oil, entrapped impurities and other foreign materials.



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- c) If necessary, suitable filler shall be applied to all pits and blemishes on the surfaces.
- d) The front surface of the panels shall be painted with three coats of sealing primer and surfacer. The entire surface shall be wet sanded between coats. Two coats of finish paint of high-grade lacquer enamel shall be given at shop.
- e) All other surfaces including those of accessories shall be painted with two coats of sealing primer and surfacer and two coats of lacquer enamel finish paint.
- f) A final coat of finish paint of high grade lacquer enamel shall be given at site after assembly and filling of front panel butt joints with suitable filler, to present a continuous panel surface.
- g) The finish of the final coat shall be of semi-gloss texture to minimise light reflection.

2.5.2 Unless otherwise specified, exterior portion of all panels and closed cabinets shall have a colour of light admiralty grey shade ISC No.697 as per IS-5 (RAL-7035). Panel rear surface, frame works and bulkhead plates/gland plates shall have a finish colour of light admiralty grey shade ISC No.697 as per IS-5 (RAL-7035). Channel base shall be of black colour.

2.6 Electrical System

2.6.1 General Requirements

2.6.1.1 All equipment and wiring in control room shall be of general-purpose type unless otherwise specified.

2.6.1.2 All wiring shall conform to API-MPMS, RP 552 and shall be as per approved drawings.

2.6.1.3 All wiring shall be housed in covered non flammable plastic raceways which shall be arranged for easy maintenance. Raceways shall have 50% spare capacity. Rubber/plastic gromets shall be used for wire entry into individual instrument cases and for entry/exit of cables through raceways.

2.6.1.4 Wires carrying measurement signals associated with thermocouple, resistance temperature detectors (RTD), pH Instruments and other low-level signals shall be routed in separate wire ways and not along with power cables. Power wiring and control wiring should be separated by not less than 150 mm. If they have to cross, the crossing should be as close to right angle as possible. Parallel runs of AC and DC wiring closer than 300mm shall be avoided.

2.6.1.5 All intrinsically safe wiring shall be routed in separate wire ways, separate from non- intrinsically safe and power wiring. The minimum separation shall be 150mm. Intrinsic safe raceways shall be light blue in colour.

2.6.1.6 Intrinsically safe terminals shall be adequately separated from non-intrinsically safe terminals. The minimum separation shall be 50 mm. Intrinsic safe terminals shall be light blue in colour.

2.6.1.7 Panel wiring for signal and controls shall be carried out using 600 V grade, 1.0 mm² stranded copper conductors with flame retardant PVC insulation. Power supply wiring between distribution box and individual instruments shall be done using 600 V grade, 1.5 mm² stranded copper conductors with flame retardant PVC insulation. All internal wiring will be supplied by the panel vendor.

2.6.1.8 Alarm wiring shall be through multicore cables between alarm terminal box and annunciator directly without any intermediate terminals. Raceways on panel to have sufficient space to accommodate such wiring. Vendor to install and wire all annunciators including signal lights, bull's eye lamp, push buttons, audible devices etc.

2.6.1.9 All wiring, external to main panel/racks (except for alarm annunciators), shall terminate in terminal boxes/terminal strips and their quantity and size shall be determined by vendor. Panel shall be supplied completely wired requiring only field connection at site.



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- 2.6.1.10 All terminals shall be of mechanical screw clamp type with pressure plates. Self-insulating crimping wire lugs shall be used for all terminations on terminal blocks, whereas forked tongue type or lug with eyehole type shall be used for termination on screwed terminals such as on relays, push buttons, lamp etc. Terminals shall be suitable to accept 2.5mm² size conductor, as a minimum. Terminal blocks shall be rated for 600 V. Separate set of terminals for accepting higher size of incoming power cables shall be provided. At least 20% spare terminals evenly distributed throughout the panels shall be provided.
- 2.6.1.11 Generally, no more than two wires shall be terminated on a single terminal. Additional terminals shall be used for looping if necessary. Use of shorting links for looping shall be avoided.
- 2.6.1.12 Where panel is located in hazardous area, all electrical components including junction boxes shall be flame proof and suitable for hazardous area specified in material requisition.
- 2.6.1.13 Terminals housings shall be sized with due consideration to accessibility and maintenance. Following guidelines shall be observed:
- 50 mm minimum space shall be provided between terminal strips and sides of the box parallel to the strip for up to 50 terminals and an additional 25 mm for each additional 25 terminals.
 - 100 mm minimum space to be provided between adjacent terminal strips for up to 50 terminals and an additional 25 mm for each additional 25 terminals.
 - 75 mm minimum space shall be provided between terminal strip and top or bottom of the box for upto 50 terminals and an additional 25 mm for each additional 50 terminals.
 - The bottom of any terminal strip shall not be lower than 300 mm from the gland plate unit in any cabinet.
- 2.6.1.14 All terminal strips shall be mounted on suitable anodised metallic or plastic stand off. Terminal strips shall be arranged group wise for incoming and outgoing cables separately.
- 2.6.1.15 Wire colour code for panel and accessory shall be as follows:
- | | |
|----------------------|--------|
| Power supply hot | Red |
| Power supply neutral | Black |
| Ground | Green |
| Alarm System | Yellow |
| Signal: IS | Blue |
| Signal: Non-IS | Grey |
- 2.6.2 Power Supplies
- 2.6.2.1 Main power distribution box shall have copper busbars suitable for required current rating. Bus bars shall be suitably insulated. Provision of reducing type of lugs is not acceptable. Main power supply box shall be provided with two pole circuit breakers of thermo-magnetic type.
- 2.6.2.2 Each section of main panel shall have a separate power supply distribution box with two pole toggle switches and glass cartridge fuses. Power supply to individual instruments shall be through DPDT isolation switch and HRC fuse. Vendor may provide two pole circuit breakers of suitable rating for power distribution.
- 2.6.3 Grounding



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- 2.6.3.1 Each panel section and accessory equipment in control room shall be provided with an earthing lug and shall be grounded to an earth bus bar to be provided by purchaser. All panel structure, racks, cabinets etc shall be connected to this power ground bus.
- 2.6.3.2 In addition to above, vendor shall also provide a separate instrument circuit ground bus along the panel length. This shall be electrically isolated from panel structure, equipment, incoming cable armour etc. This ground bus shall be typically 8 mm thick and 37.5 mm wide and of copper. All circuit grounds of electronic instrument, drain wires of alarm signal cables, intrinsic safety barrier insulated bus bar etc shall be connected to this ground bus by insulated copper conductor. Both ends of this bus bar shall have suitable terminals for further connection to ground electrode by purchaser. Creation of multiple grounds in a loop should be avoided.
- 2.6.4 Identification and Marking
- 2.6.4.1 All electrical terminals and equipment on the panel and other accessories shall be identified with appropriate tag, cable marker etc.
- 2.6.4.2 All terminals in a terminal strip shall be identified by their individual numbers located integral with the terminal itself.
- 2.6.4.3 Interconnecting multicables shall be identified by metal tags as indicated in cable schedules.
- 2.6.4.4 Wiring at terminals shall be identified by the terminal number and termination services at the other end of the wire. Wiring at instruments and accessories like alarm relays, push buttons etc shall be identified by the item tag number and terminals number and the termination service at the other end of the wire. Ferrule shall be used for this purpose.
- 2.6.4.5 Identification markers as mentioned above shall be indicated in vendor drawings.
- 2.6.4.6 For pneumatic panel, Air supply tubes and signal tubes etc shall be provided with PVC sleeves with inscription strips fitted on it at either end. Sleeves for air supply shall be in red while other sleeves shall be yellow in colour
- 2.6.5 Internal lighting shall be installed within panel using two fluorescent lighting fixtures to provide adequate lighting for maintenance of equipment. The location of lighting fixtures must not interfere with doors and other equipment and shall be accessible for fluorescent tube replacement. Lighting shall be operable through door switch in a suitable surface mount enclosure.

3.0 NAMEPLATE

- 3.1 Nameplates shall be provided for all front panel instruments and accessories. For sub miniature instruments, nameplate shall be written on the nameplate slip supplied along with the instrument. For other instruments and accessories (push buttons, lamps etc) nameplates with 1.5 mm thick black laminated plastic with white engraved letters shall be provided.
- 3.2 Front panel nameplates shall be fixed by means of chrome or nickel plated counter sunk screws. These nameplates shall be 25 mm high with 5 mm letter height, and provide information like tag number, service, multiplication factor etc. Rack nameplates to be fixed by suitable adhesives and shall generally be 15 mm high with 5mm letter height to indicate item tag number.
- 3.3 Front panel instruments shall also be identified by their tag numbers on nameplates fixed by adhesives on panel back surface.

4.0 INSPECTION AND TESTING



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Purchaser reserves the right to inspect and witness testing at vendor's works as per inspection test plan. All these tests shall be completed by the vendor and test report shall be submitted to purchaser for scrutiny.

5.0 SHIPPING

- 5.1 Each panel and accessory shall be suitably packed and protected from damage due to transportation, loading and unloading.
- 5.2 Each component part requiring identification for proper assembly at site shall be place wise marked.
- 5.3 Shipping breaks shall be provided as applicable to avoid panel damage during transportation.

6.0 SITE ACTIVITIES

- 6.1 Vendor shall furnish a detailed activity schedule covering various activities like installation of panel and accessories, laying of cables, wiring, interconnection, testing etc in consultation with engineer-in-charge.
- 6.2 Vendor shall install all panel and accessories in the control room as per final approved layout drawings.
- 6.3 Control panel and semi graphic shall be checked for proper alignment and defect, if any, shall be rectified.
- 6.4 Vendor shall install all panel-mounted instruments, alarm annunciators and other free issue items as per approved drawings.
- 6.5 Painting, wiring, cabling etc shall be done as per the respective clauses of this specification.
- 6.6 Functional tests for panel and accessories shall be carried out after actual installation, wiring, interconnection to the satisfaction of the engineer-in-charge.
- 6.7 Vendor shall assist field contractor for loop checking.
- 6.8 Vendor shall maintain the control room and workplace neat and clean. Minor civil work, if necessary, shall be carried out by vendor arising due to damage to flooring during panel installation.
- 6.9 Vendor shall arrange to draw and transport free issue material and is responsible for safe custody of the same.
- 6.10 Vendor shall prepare and furnish as built drawing for final record.

NGN LETEKUJAN TERMINAL UPTO NRL IGGL RT PIPELINE PROJECT

Datasheet for Manual Ball Valves

Document Number - P158-DSH-P012

Rev.	Date	Description	ORG	REVIEW	APPROVAL
IA	31.08.23	Issued for Internal Review	SS	SM	AD
TA	05.09.23	Issued with Tender	SS	SM	AD

	ASSAM GAS COMPANY LIMITED		JOB NO. P158		
	NGN LETEKUJAAN TERMINAL UPTO NRL IGGL RT PIPELINE PROJECT		Document Number - P158-DSH-P012		
	Data Sheet of 2 to 8 INCH Manual Ball Valve, Flanged End, Reduced Bore, Aboveground, 300# (P3C), Split Body Design		Sht. A	Rev.	
			IA	TA	
			31.08.23	05.09.23	

Sr. No.	GENERAL		
1	Valve Manufacturer		-
2	Tag Numbers		Refer P&ID
3	Company Specification No.		P-SPC-402
4	Category		-
5	Pipeline Line No.		Refer P&ID
6	Class		P3C
7	DESIGN AND TEST REQUIREMENTS		
8	Size		DN 50 (NPS 2") to DN 200 (NPS 8")
9	Type of Valve		Trunnion Mounted, Double Block and Bleed, Antistatic, Vent Drain/ Flush Connection with Anti Blowout Stem, Split Body Design
10	Type of Port (Full/ Reduced)		Reduced Bore
11	Design Temperature (°C)	Maximum	65
12		Minimum	-29
13	Corrosion Allowance (mm)		1.5
14	Installation (Aboveground/ Underground)		Aboveground
15	Design Factor		0.5
16	Service		Natural Gas (NG)
17	End Connection		Flanged
18	Flange Face Finish		RF/ 125 AARH
19	End Connection Standard		B-16.5
20	ASME Class		300#
21	Stem Extension Requirement		Not Required
22	Length of Stem Extension (If Required)		Not Required
23	Orientation of Stem		Perpendicular to Valve Axis
24	Type of Valve Operator		DN ≤ 100 mm (4") - Wrench / Lever - Pull Force 350N max. DN ≥ 150 mm (6") - Gear Operated
25	Valve Actuator Opening Time		Not Applicable
26	Requirement of Locking Mechanism (LO/ LC)		Refer P&ID
27	Length of Pup Piece (mm), (If Required)		Not Required
28	Actuator Specification No.		Not Applicable
29	Valve Design Pressure(kg/cm2)		49
30	Hydrostatic Test Pressure (kg/cm2) & Time		Body: 78.77 kg/cm2 & 30 Min Seat: 57.31 kg/cm2 & 30 Min.
31	Pneumatic Test Pressure (kg/cm2) & Time		7.0 kg/cm2 & 15 Min
32	Charpy Impact Test(°C)		Yes (at -29)
33	Fire Safe Design		API 6FA/ ISO 10497
34	Anti Static Testing Requirement		As per API 6D Latest Edition
35	Hardness Test		248 HV10 max
36	Painting		As per Painting Specification (Doc. No.: P-SPC-410) (Suitable for Industrial Corrosive Environment)
37	Valve Design		As per API 6D Latest Edition
38	Actuator Data Sheet No.		Not Applicable
39	CONNECTING PIPE DETAIL		
40	Outside Diameter (Inch)		2" to 8"
41	Thickness (mm)/ Schedule		Refer Piping Material Specification (P158-PMS-P401)
42	Pipe Material		Refer Piping Material Specification (P158-PMS-P401)
43	Design Code		ASME B31.8
44	ASME Rating		300#
45	Part Description	Material Specified	Material Offered by Bidder
46	Body	ASTM A216 GR. WCB/ ASTM A 105	
47	Ball (Single Piece, Solid Construction)	SS-304 / SS-316 (Solid) /(ASTM A105/ ASTM A216 Gr. WCB) + 0.003" ENP	
48		(AISI 4140 +0.003" ENP)/ AISI 410/ SS 304/ SS 316	
49	Seat Rings	Primary Devlon V/ PEEK with Secondary Metal to Metal	
50	Seat Seal	(AISI 4140 +0.003" ENP)/ AISI 410 (No Casting)/ SS 304 / SS 316 (NO CASTING)	
51	Stem	ASTM A216 GR. WCB / A105	
52	Trunnion	GRAFOIL/ PTFE V-RINGS + GRAFOIL	
53	Stem Seal	GRAFOIL / R-PTFE	
54	Body Seal	13% Cr. Steel/ SS 316 / SS 304	
55	Gland	ASTM A 193 Gr. B7 / ASTM A 194 Gr. 2H	
56	Stud Bolts/ Nut	Carbon Steel	
57	Handle/ Lever/ Hand Wheel		

	ASSAM GAS COMPANY LIMITED	JOB NO. P158			
	NGN LETEKUJAAN TERMINAL UPTO NRL IGGL RT PIPELINE PROJECT	Document Number - P158-DSH-P012			
	Data Sheet of 2 to 8 INCH Manual Ball Valve, Flanged End, Reduced Bore, Aboveground, 300# (P3C), Split Body Design	Sht. A	Rev.		
		IA	TA		
		31.08.23	05.09.23		
NOTES :					
1. This Data Sheet shall be read in conjunction with Piping Material Specification, valve Specification & other Tender Documents.					
2. Dimension / Input Data as & where marked " * " shall be supplied by Vendor.					
3. Manufacturer shall have valid API 6D license to use API monogram.					
4. Valve design shall ensure repair of stem seals / packing under full line pressure.					
5. 100.0 % Valve castings shall undergo Radiographic Examination.					
6. Valves shall have support foot & lifting lugs as per valve Specification.					
7. Valve design shall ensure repair of stem seals / packing under full line pressure.					
8. The Charpy Impact temperature shall be -29°C as specified in data sheet.					
9. A supplementary air seat test as per API 6D (Annex H, Para H.3.3 Type II) shall be carried out for all valves. A bubble tight seal is required without the use of any sealant. No leakage is allowed. Test pressure shall be held for at least 15 minutes.					
10. Gear operators, when provided, shall have a self-locking provision and shall be fully encased in water proof/ splash proof enclosure and shall be filled with suitable grease.					
11. For the manual operation of all valves, the diameter of the hand wheel or the length of operating wrench shall be such that under the maximum differential pressure, the total force required to operate the valve does not exceed 350N.					
12. Manufacturer shall also indicate the number of turns of hand wheel in case of gear operators (along with their offer) required for Operating the valve from full open to full close position. The numbers of turn shall not exceed 250 for valves sizes up to 24" and 450 for valve size above 24".					
13. Valve body & other pressure containing parts shall be designed as per ASME Sec-VIII Div-I. Minimum thickness shall not be less than ASME B16.34 + Corrosion Allowance as specified.					
14. For tag No./ Fluid Data/ Operating Data refer Process Document , P&IDs					
15. Bidder shall clearly write all / any deviation against each part material of valve in the space provided for. Wherever bidder agrees with company's spec bidder shall indicate "agreed".					
16. All Elastomeric material used for pressure tight sealing or drip sealing shall be of anti Explosive Decompression type and must be certified according to testing Procedures. Manufacturer shall submit test certificate confirming conformance with Anti Explosive Decompression. Manufacturer shall confirm the suitability of soft sealing and seating material for the pressure and temperature & service mentioned above in this data sheet.					
17. Bidder to Confirm that in offered valves, there shall not be any external leakage during fire and valve is capable of handling fire for the mentioned time as specified in API 6FA/ ISO 10497/API 6FD. Bidder also to confirm that in case of fire, the valve shall be unseated from the closed position against the high test pressure and moved to the fully open position i.e. In case of fire, valve shall complete one open-close cycle.					
18. Name plate material shall be minimum stainless steel. Making shall be as per MSS-SP-25.					
19. Minimum all pressure containing parts of the valve shall be provided with EN 10204-3.2 certificate.					
20. Vendor has to submit Fire Test Certificate qualifying the valves as per API 6FA/API 607/ ISO 10497 carried out in last 10 years shall be furnished.					

 ASSAM GAS COMPANY LTD <small>(A GOVT. OF ASSAM UNDERTAKING)</small> 	ASSAM GAS COMPANY LIMITED		JOB NO. P158		
	NGN LETEKUJAAN TERMINAL UPTO NRL IGGL RT PIPELINE PROJECT		Document Number - P158-DSH-P012		
	Data Sheet of 0.50 to 1.50 Inch Socket Welded, Aboveground, Manual Ball Valve, Rating 800#		Sht. D	Rev.	
			IA	TA	
			31.08.23	05.09.23	

Sr. No.	GENERAL		
1	Valve Manufacturer		-
2	Tag Numbers		Refer P&ID
3	Company Specification No.		P-SPC-402
4	Category		-
5	Pipeline Line No.		Refer P&ID
6	Class		P3C
7	DESIGN AND TEST REQUIREMENTS		
8	Size		DN 15 (NPS 0.50") to DN 40 (NPS 1.50")
9	Type of Valve		Split Body Design
10	Type of Port (Full/ Reduced)		Full Bore
11	Design Temperature (°C)	Maximum	65
12		Minimum	-29
13	Corrosion Allowance (mm)		1.5
14	Installation (Aboveground/ Underground)		Aboveground
15	Service		Natural Gas (NG)
16	Design Factor		0.5
17	End Connection		SW, 800 to B16.11
18	Flange Face Finish		Not Applicable
19	End Connection Standard		B-16.11
20	ASME Class		-
21	Stem Extension Requirement		-
22	Length of Stem Extension (If Required)		Not Required
23	Orientation of Stem		Not Applicable
24	Type of Valve Operator		Lever/ Wrench
25	Valve Actuator Opening Time		Not Applicable
26	Requirement of Locking Mechanism (LO/ LC)		As per P&ID
27	Length of Pup Piece/ Nipple (mm), (If Required)		Required as per Standard Specification Doc. No.: P-SPC-402
28	Operator Specification No.		Not Applicable
29	Valve Design Pressure(barg)		49
30	Hydrostatic Test Pressure (barg) & Time		Body: 209 kg/cm2 & 30 Min Seat: 152 kg/cm2 & 30 Min.
31	Pneumatic Test Pressure (barg) & Time		7.0 barg & 15 Min.
32	Fire Safe Design		API 6FA/ ISO 10497
33	Anti Static Testing Requirement		BS EN ISO 17292
34	Painting		As per Painting Specification (Doc. No.: P-SPC-410) (Suitable for Industrial Corrosive Environment)
35	Operator Data Sheet No.		Not Applicable
36	CONNECTING PIPE DETAIL		
37	Outside Diameter (Inch)		Size 0.50" to 1.50"
38	Thickness (mm)/ Schedule		Refer Piping Material Specification (P158-PMS-P401)
39	Pipe Material		Refer Piping Material Specification (P158-PMS-P401)
40	Design Code		BS EN ISO 17292
41	ASME Rating		-
42	Part Description	Material Specified	Material Offered by Bidder
43	Body	ASTM A216 GR. WCB/ ASTM A 105	
44	Ball (Single Piece, Solid Construction)	SS-304 / SS-316 (Solid) / (ASTM A105/ ASTM A216 Gr. WCB) + 0.003" ENP	
45			
46	Seat Rings	(AISI 4140 +0.003" ENP/ AISI 410/ SS 304/ SS 316	
47	Seat Seal	Primary Devlon V/ PEEK with Secondary Metal to Metal	
48	Stem	(AISI 4140 +0.003" ENP/ AISI 410 (No Casting)/ SS 304 / SS 316 (NO CASTING)	
49	Stem Seal	GRAFOIL/ PTFE V-RINGS + GRAFOIL	
50	Body Seal	GRAFOIL / R-PTFE	
51	Gland	13% Cr. Steel/ SS 316 / SS 304	
52	Stud Bolts/ Nut	ASTM A 193 Gr. B7 / ASTM A 194 Gr. 2H	
53	Handle/ Lever/ Hand Wheel	Carbon Steel	

- NOTES :**
- This Data Sheet shall be read in conjunction with Piping Material Specification, Valve Specification & other Tender Documents.
 - Dimension / Input Data as & where marked " * " shall be supplied by Vendor.
 - All test shall be as per BS EN12266.
 - Valve design shall ensure repair of stem seals / gland packing under full line pressure.
 - 100.0 % Valve castings shall undergo Radiographic Examination.
 - Valves shall be designed as per BS EN ISO 17292.
 - Wrench operated valves shall be supplied with wrench.
 - For the manual operator of all valves, the diameter of the hand wheel or the length of operating wrench shall be such that under the maximum differential pressure, the total force required to operate the valve does not exceed 350N.
 - Name plate material shall be minimum stainless steel. Marking shall be as per MSS-SP-25

	ASSAM GAS COMPANY LIMITED	JOB NO. P158			
	NGN LETEKUJAAN TERMINAL UPTO NRL IGGL RT PIPELINE PROJECT	Document Number - P158-DSH-P012			
	Data Sheet of 0.50 to 1.50 Inch Socket Welded, Aboveground, Manual Ball Valve, Rating 800#	Sht. D	Rev.		
		IA	TA		
		31.08.23	05.09.23		
10. Valve body & other pressure containing parts shall be designed as per ASME Sec-VIII Div.-I. Minimum thickness shall not be less than ASME B16.34.					
11. For tag No./ Fluid Data/ Operating Data refer Process Document , P&IDs					
12. Bidder shall clearly write all / any deviation against each part material of valve in the space provided for. Wherever bidder agrees with company's spec bidder shall indicate "agreed".					
13. All Elastomeric material used for pressure tight sealing or drip sealing shall be of anti Explosive Decompression type and must be certified according to testing Procedures. Manufacturer shall submit test certificate confirming conformance with Anti Explosive Decompression. Manufacturer shall confirm the suitability of soft sealing and seating material for the pressure and temperature & service mentioned above in this data sheet.					
14. Bidder to Confirm that in offered valves, there shall not be any external leakage during fire and valve is capable of handling fire for the mentioned time as specified in API 6FA/ ISO 10497/API 6FD. Bidder also to confirm that in case of fire, the valve shall be unseated from the closed position against the high test pressure and moved to the fully open position i.e. In case of fire, valve shall complete one open-close cycle.					
15. Vendor has to submit Fire Test Certificate qualifying the valves as per API 6FA/API 607/ ISO 10497 carried out in last 10 years shall be furnished.					



ASSAM GAS COMPANY LIMITED

JOB NO. P158

NGN LETEKUJAAN TERMINAL UPTO NRL IGGL RT
PIPELINE PROJECT

Document Number - P158-DSH-P012

Data Sheet of 0.50 to 1.50 Inch One EndSocket Welded and other End
Flanged, Aboveground, Manual Ball Valve

Sht. E

Rev.

IA

TA

31.08.23

05.09.23

Sr. No.	GENERAL			
1	Valve Manufacturer		-	
2	Tag Numbers		Refer P&ID	
3	Company Specification No.		P-SPC-402	
4	Category		-	
5	Pipeline Line No.		Refer P&ID	
6	Class		P3L	
7	DESIGN AND TEST REQUIREMENTS			
8	Size		DN 15 (NPS 0.50") to DN 40 (NPS 1.50")	
9	Type of Valve		Split Body Design	
10	Type of Port (Full/ Reduced)		Full Bore	
11	Design Temperature (°C)	Maximum	65	
12		Minimum	-45	
13	Corrosion Allowance (mm)		1.5	
14	Installation (Aboveground/ Underground)		Aboveground	
15	Service		Natural Gas (NG)	
16	Design Factor		0.5	
17	End Connection		SW, 800 to B16.11, Flanged to 16.5 (600#)	
18	Flange Face Finish		RF/ 125 AARH	
19	End Connection Standard		B-16.11 & B-16.5	
20	ASME Class		-	
21	Stem Extension Requirement		-	
22	Length of Stem Extension (If Required)		Not Required	
23	Orientation of Stem		Not Applicable	
24	Type of Valve Operator		Lever/ Wrench	
25	Valve Actuator Opening Time		Not Applicable	
26	Requirement of Locking Mechanism (LO/ LC)		As per P&ID	
27	Length of Pup Piece/ Nipple (mm), (If Required)		Required for one end as per Standard Specification Doc. No.: P-SPC-402	
28	Operator Specification No.		Not Applicable	
29	Valve Design Pressure(barg)		49	
30	Hydrostatic Test Pressure (barg) & Time		Body: 209 kg/cm ² & 30 Min	Seat: 152 kg/cm ² & 30 Min.
31	Pneumatic Test Pressure (barg) & Time		7.0 barg & 15 Min	
32	Fire Safe Design		API 6FA/ ISO 10497	
33	Anti Static Testing Requirement		BS EN ISO 17292	
34	Painting		As per Painting Specification (Doc. No.: P-SPC-410) (Suitable for Industrial Corrosive Environment)	
35	Operator Data Sheet No.		Not Applicable	
36	CONNECTING PIPE DETAIL			
37	Outside Diameter (Inch)		Size 0.50" to 1.50"	
38	Thickness (mm)/ Schedule		Refer Piping Material Specification (P158-PMS-P401)	
39	Pipe Material		Refer Piping Material Specification (P158-PMS-P401)	
40	Design Code		BS EN ISO 17292	
41	ASME Rating		-	
42	Part Description	Material Specified	Material Offered by Bidder	
43	Body	ASTM A352 GR. LCB/ ASTM A350 GR. LF2		
44	Ball (Single Piece, Solid Construction)	13% Cr. Steel/SS-304 / SS-316 (Solid) /(ASTM A350 Gr. LF2/ ASTM A352 Gr. LCB) + 0.003" ENP		
45				
46	Seat Rings	(AISI 4140 +0.003" ENP)/ AISI 410/ SS 304/ SS 316		
47	Seat Seal	Primary Devlon V/ PEEK with Secondary Metal to Metal		
48	Stem	(AISI 4140 +0.003" ENP)/ AISI 410 (No Casting)/ SS 304 / SS 316 (NO CASTING)		
49	Stem Seal	GRAFOIL/ PTFE V-RINGS + GRAFOIL		
50	Body Seal	GRAFOIL / R-PTFE		
51	Gland	13% Cr. Steel / SS 316 / SS 304		
52	Stud Bolts/ Nut	ASTM A 320 Gr. L7 / ASTM A 194 Gr. 4		
53	Handle/ Lever/ Hand Wheel	Carbon Steel		

NOTES :

- Bidder to submit Soft Seal details and type, grade & class selected with manufacturer's recommendation like Pressure-Temperature Curve/ Table for not to damage the soft seal during socket welding of valve ends at site.
- This Data Sheet shall be read in conjunction with Piping Material Specification, Valve Specification & other Tender Documents.
- Dimension / Input Data as & where marked " " shall be supplied by Vendor.
- All test shall be as per BS EN12266.

	ASSAM GAS COMPANY LIMITED		JOB NO. P158	
	NGN LETEKUJAAN TERMINAL UPTO NRL IGGL RT PIPELINE PROJECT		Document Number - P158-DSH-P012	
	Data Sheet of 0.50 to 1.50 Inch One EndSocket Welded and other End Flanged, Aboveground, Manual Ball Valve	Sht. E	Rev.	
		IA	TA	
		31.08.23	05.09.23	
5. Valve design shall ensure repair of stem seals / gland packing under full line pressure.				
6. 100.0 % Valve castings shall undergo Radiographic Examination.				
7. Valves shall be designed as per BS EN ISO 17292.				
8. Wrench operated valves shall be supplied with wrench.				
9. For the manual operator of all valves, the diameter of the hand wheel or the length of operating wrench shall be such that under the maximum differential pressure, the total force required to operate the valve does not exceed 350N.				
10. Adequacy for Length of pup piece/ Nipple shall be confirmed by manufacturer so as to avoid damage to seats during field welding or post weld heat treatment. These nipples shall be welded to the valve body by the manufacturer before fitting the packing's, seats & seals.				
11. Name plate material shall be minimum stainless steel. Marking shall be as per MSS-SP-25				
12. Valve body & other pressure containing parts shall be designed as per ASME Sec-VIII Div.-I. Minimum thickness shall not be less than ASME B16.34.				
13. For tag No./ Fluid Data/ Operating Data refer Process Document , P&IDs				
14. Bidder shall clearly write all / any deviation against each part material of valve in the space provided for. Wherever bidder agrees with company's spec bidder shall indicate "agreed".				
15. All Elastomeric material used for pressure tight sealing or drip sealing shall be of anti Explosive Decompression type and must be certified according to testing Procedures. Manufacturer shall submit test certificate confirming conformance with Anti Explosive Decompression. Manufacturer shall confirm the suitability of soft sealing and seating material for the pressure and temperature & service mentioned above in this data sheet.				
16. Bidder to Confirm that in offered valves, there shall not be any external leakage during fire and valve is capable of handling fire for the mentioned time as specified in API 6FA/ ISO 10497/API 6FD. Bidder also to confirm that in case of fire, the valve shall be unseated from the closed position against the high test pressure and moved to the fully open position i.e. In case of fire, valve shall complete one open-close cycle.				
17. Vendor has to submit Fire Test Certificate qualifying the valves as per API 6FA/API 607/ ISO 10497 carried out in last 10 years shall be furnished.				

NGN LETEKUJAAN TERMINAL UPTO NRL IGGL RT PIPELINE PROJECT

Datasheet for Check Valves

Document Number - P158-DSH-P013

Rev.	Date	Description	ORG	REVIEW	APPROVAL
IA	31.08.23	Issued for Internal Review	SS	SM	AD
TA	05.09.23	Issued with Tender	SS	SM	AD

 	ASSAM GAS COMPANY LIMITED		JOB NO. P158		
	NGN LETEKUJAAN TERMINAL UPTO NRL IGGL RT PIPELINE PROJECT		Document Number - P158-DSH-P013		
	Data Sheet for 8" Flanged End, Aboveground, Check Valve, 300# (P3C), Split Body Design		Sht. A	Rev.	
			IA	TA	
			31.08.23	05.09.23	

Sr. No.	GENERAL		
1	Valve Manufacturer		-
2	Tag Numbers/ Material Requisition item No.		Refer P&ID
3	Company Specification No.		P-SPC-402
4	Category		Station Piping Valves, Drain Lines & Vent Lines
5	Pipeline Line No.		Refer P&ID
6	Class		P3C
7	DESIGN AND TEST REQUIREMENTS		
8	Size		DN 200 (NPS 8")
9	Type of valve		Swing Check Type
10	Design Temperature (°C)	Maximum	65
11		Minimum	-29
12	Corrosion Allowance (mm)		1.5
13	Installation (Aboveground/ Underground)		Aboveground
14	Design Factor		0.5
15	Service		Natural Gas (NG)
16	End Connection		Flanged
17	Flange Face Finish		RF/ 125 AARH
18	End Connection Standard		B-16.5
19	ASME Class		300#
20	Stem Extension Requirement		Not Required
21	Length of Stem Extension (If Required)		Not Required
22	Orientation of Stem		Not Applicable
23	Type of Valve Actuator		Not Applicable
24	Valve Actuator Opening Time		Not Applicable
25	Requirement of Locking Mechanism (LO/ LC)		Refer P&ID
26	Length of Pup Piece/ Nipple (mm), (If Required)		Not Required
27	Actuator Specification No.		Not Applicable
28	Valve Design Pressure(barg)		49
29	Hydrostatic Test Pressure (kg/cm2g) & Time		Body: 78.77 kg/cm2 & 30 Min Seat: 57.31 kg/cm2 & 30 Min.
30	Pneumatic Test Pressure (barg) & Time		7.0 barg & 15 Min
31	Charpy Impact Test(°C)		Yes (at -29)
32	Fire Safe Design		Not Applicable
33	Valve Design		As per API 6D Latest Edition
34	Anti Static Testing Requirement		As per API 6D
35	Hardness Test		248 HV10 max
36	Actuator Data Sheet No.		Not Applicable
37	CONNECTING PIPE DETAIL		
38	Outside Diameter (Inch)		Size 8"
39	Thickness (mm)/ Schedule		As per Piping Material Specification (Doc. No.: P158-PMS-P401)
40	Pipe Material		As per Piping Material Specification (Doc. No.: P158-PMS-P401)
41	Design Code		ASME B31.8
42	ASME Rating		300#
43	Part Description	Material Specified	Material Offered by Bidder
44	Body	ASTM A216 GR. WCB/ ASTM A 105	
45	Cover	ASTM A216 GR. WCB/ ASTM A 105	
46	Disc	STELLITED-6	
47	Body Seat Ring	STELLITED-6	
48	Disc Hinge	13% Cr. Steel	
49	Hinge Pin	SS 304/ SS 316	
50	Cover Gasket	SP WIND SS 316 - CA FILLER	
51	Stud Bolts/ Nut	ASTM A 193 Gr.B7 / ASTM A 194 Gr. 2H	

NOTES :
1. This Data Sheet shall be read in conjunction with Tender Documents & Specifications.
2. Valve seat shall be non renewable and integral type.
3. 100.0 % Valve castings shall undergo Radiographic Examination.



TECHNICAL NOTES FOR PIPES

P-SPC-401

0	19.02.2022	ISSUED AS STANDARD SPECIFICATION	PNS	SM	AD	SK
Rev.	Date	Purpose	Prepared by	Reviewed by	Approved by	Approved by

ABBREVIATIONS

ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BM	Base Metal
BHN	Brinell hardness number
BIS	Bureau of Indian Standards
E.FS.W	Electric Fusion Weld
HAZ	Heat Affected Zone
HIC	Hydrogen Induced Cracking
IGC	Inter Granular Corrosion
IS	Indian Standard
LT	Low Temperature
MR	Material Requisition
MSS-SP	Manufacturers Standardization Society - Standard Practice
MPQT	Manufacturing Procedure Qualification Tests
MPS	Manufacturing Procedure Specification
NDT	Non-Destructive Testing
NACE MR	National Association of Corrosion Engineers: Material Requirement
NPS	Nominal Pipe Size
NPT	Nominal Pipe Thread
OD	Outside Diameter
OD/D	Outside Diameter, Specified
PMI	Positive Material Identification
PR	Purchase Requisition
SMYS	Specified Minimum Yield Strength
SS	Stainless Steel
RJ	Ring Joint
QOEC	Quick Opening End Closure
SAW	Submerged Arc Welded
SAWL	Submerged Arc Longitudinal Welded
SMAW	Shielded Metal Arc Welding
SMYS	Specified Minimum Yield Strength
SSPC	The Society for Protective Coatings





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1.0 GENERAL

1.1 All pipes and their dimensions, tolerances, chemical composition, physical properties, heat treatment, hydrostatic test and other testing and marking requirements shall conform to the latest codes and standards specified in the material requisition (MR). Supplier shall strictly comply with MR / PR and no deviations shall be permitted. Post Order Concession / Deviation is not applicable.

1.2 Testing

1.2.1 Test reports shall be supplied for all mandatory tests as per the applicable material specifications. Test reports shall also be furnished for any supplementary tests as specified in the MR & Clauses 1.10 & 1.11.

1.2.2 Material test certificates (physical property, chemical composition & heat treatment report) shall also be furnished for the pipes supplied.

1.2.3 Refer to P-ITP-001 & P-ITP-002 for Inspection & Test plans for welded pipes and seamless pipes respectively.

1.3 Manufacturing Processes

1.3.1 Steel made by acid Bessemer process shall not be acceptable.

1.3.2 All longitudinally welded pipes should employ only automatic welding.

1.4 Pipe shall be supplied in single or double random length of 4 to 7 and 7 to 14 meters respectively.

1.5 a. Seamless and E.R.W. pipes shall not have any circumferential seam joint in a random length. However, in case of E.FS.W pipe, in one random length one welded circumferential seam of same quality as longitudinal weld is permitted. This weld shall be at least 2.5 m from either end. The longitudinal seams of the two portions shall be staggered by 90°. Single random length in such cases shall be 5 to 7 m.

b. Unless otherwise mentioned in the respective material code, E.FS.W pipes < 36" shall not have more than one longitudinal seam joint and E.FS.W pipes ≥ 36" shall not have more than two longitudinal seam joints.

1.6 Pipes with screwed ends shall have NPT external taper pipe threads conforming to ASME / ANSI B1.20.1.

1.7 Pipe with bevelled ends shall be in accordance with ASME B16.25. Weld contours shall be as follows:

Material	Wall Thickness	Weld Contour
Carbon Steel (Except Low Temp. Carbon Steel)	Upto 22 mm	Figure 2 Type A
	>22mm	Figure 3 Type A
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Up to 10 mm	Figure 4
	> 10 mm & Up to 25 mm	Figure 5 Type A
	>25mm	Figure 6 Type A

1.8 Galvanized pipes shall be coated with zinc by hot dip process conforming to IS 4736 for pipes to Indian Standards and ASTM A53 for pipes to ASTM Standards.

1.9 All austenitic stainless steel pipes shall be supplied in solution annealed condition. All types of 321 or 347 stainless steel pipes shall be in a stabilized heat treated condition. Stabilizing heat treatment shall

be carried out subsequent to the normal solution annealing. Soaking time & holding temp. for stabilizing heat treatment shall be 4 hrs & 900°C respectively.

1.10 I.G.C. Test for Stainless Steels

1.10.1 For all austenitic stainless steel pipes inter-granular corrosion test shall have to be conducted as per following:

ASTM A262 Practice "B" with acceptance criteria of "60 mils / year (max.)".

OR

ASTM A262 Practice E: The bent specimen shall be examined under 20X magnification. The acceptance criteria is that there will be no crack or fissure in the bent specimen. The bent specimen shall also be subjected to metallographic examination at 250X magnification to ensure no crack or fissure. The photograph of the bent specimen along with comments shall be submitted for review.

1.10.2 When specifically asked for in MR for high temperature application of some grades of austenitic stainless steel (eg. SS 309, 310, 316, 316H etc.) ASTM A262 Practice "C" with acceptance criteria of "15 mils/year (max.)" shall have to be conducted.

1.10.3 For the IGC test as described in 1.10.1 & 1.10.2, two sets of samples shall be drawn from each solution annealing lot; one set corresponding to highest carbon content and the other set corresponding to the highest pipe thickness.

1.11 All welded pipes indicated as 'CRY0' & 'LT' in MR shall be impact tested per requirement & acceptance criteria of ASME B31.3. The impact test temperature shall be -196°C & -45°C for stainless steel and low temperature carbon steel respectively unless specifically mentioned otherwise in MR.

1.12 NACE / HIC Requirements

1.12.1 Pipes under "NACE" category and those designated as "HIC" shall meet the requirements given in NACE MR-0103 unless mentioned otherwise.

1.13 Specified heat treatment for carbon steel and alloy steel and solution annealing for stainless steel pipes shall be carried out after weld repairs. Number of weld repairs at the same spot shall be restricted to maximum two by approved repair procedure.

1.14 For black or galvanized pipes to IS 1239, the minimum percentage of elongation shall be 20%.

1.15 All $1\text{Cr}-\frac{1}{2}\text{Mo}$ and $1\frac{1}{4}\text{Cr}-\frac{1}{2}\text{Mo}$ seamless pipes shall be normalised and tempered.

1.16 For all welded alloy steel pipes with mandatory requirement of heat treatment and radiography, radiography shall be performed after heat treatment.

1.17 For Hydrogen service pipes following special requirements shall also be met:

1.17.1 All carbon steel pipes having wall thickness 9.53 mm (0.375") and above shall be normalised. Cold drawn pipes shall be normalised after the final cold draw pass for all thicknesses.

1.17.2 All alloy steel (Cr-Mo) pipes shall be normalised and tempered. The normalising and tempering shall be a separate heating operation and not a part of the hot forming operation. The maximum room temperature tensile strength shall be 100,000 prig.

1.17.3 For carbon steel Pipes, hardness of weld and HAZ shall be 200 BHN (max.). For alloy steel Pipes, hardness of weld and HAZ shall be 225 BHN (max.).

1.17.4 For all Carbon steel and Alloy steel pipes with wall thickness over 20mm, Charpy-V Notch impact testing shall be carried out in accordance with paragraph UG-84 of ASME Section VIII, Div-1 for weld

metal and base metal from the thickest item per heat of material and per heat treating batch. Impact test specimen shall be in complete heat treated condition and accordance with ASTM A370. Charpy V-notch test shall be conducted at -29°C for CS & -45°C for LTCS.

The average absorbed impact energy values of three full-sized specimens shall be 27 joules. The minimum impact energy value of any one specimen of the three specimens analysed as above shall not be less than 22 Joules.

1.18 For dual grades of SS where specified, chemical composition and mechanical properties of both grades specified shall be ensured.

2.0 ACCEPTABLE DEVIATIONS

2.1 Pipes to IS 3589 Gr.410 are acceptable in place of IS 3589 Gr.330.

2.2 Pipes of Grades SS317 of corresponding material are acceptable in place of Grades SS316 or SS316 (2.5 Mo min.).

2.3 Pipes of Grades SS317L of corresponding material are acceptable in place of Grades SS316L or SS316L (2.5 Mo min.).

2.4 Seamless pipes are acceptable in place of welded pipes except in the case of welded SS321 / SS321H pipes with nominal thickness greater than 9.53 mm.

3.0 HYDROSTATIC TEST

3.1 All pipes shall be hydrostatically tested.

3.2 The mill test pressure shall be as follows:

3.2.1 Seamless, E.R.W. & Spiral Welded

a) Carbon Steel

Material Std.	Test Pressure Std.
ASTM A106 Gr.B	ASTM A530
API 5L Gr.B, Seamless	API 5L
API 5L, E.R.W.	API 5L
API 5L, Spiral	API 5L
ASTM A333 Gr.3 & 6, Seamless	ASTM A530
ASTM A333 Gr.3 & 6, E.R.W.	ASTMA530

b) Searnless Alloy Steel

Material Std.	Test Pressure Std.
ASTM A335 Gr.P1, P12, P11, P22, P5, P9	ASTM A530
ASTM A268 TP 405, TP410	ASTM A530

c) Seamless Stainless Steel

Material Std.	Test Pressure Std.
ASTM A312 Gr.TP 304, 304L, 304H, 316, 316L, 316H, 321,347	ASTM A999

d) Seamless Nickel Alloy

Material Std.	Test Pressure Std.
ASTM B161 UNS N02200	ASTM B161
ASTM B165 UNS N04400	ASTM B165
ASTM B167 UNS N06600	ASTMB167
ASTM B444 UNS N06625	ASTMB444
ASTM B407 UNS N08800	ASTM B407
ASTM B423 UNS N08825	ASTM B423

e) Welded Nickel Alloy

Material Std.	Test Pressure Std.
ASTM B725 UNS N02200, N04400	ASTMB725
ASTM B517 UNS N06600	ASTMB517
ASTM B443/B474 UNS N06625	ASTMB474
ASTM B424/B474 UNS N08825	ASTM B474
ASTM B514 UNS N08800	ASTMB514

4.2.2 Electric Fusion Welded

a) Carbon Steel & Alloy Steel E.FS.W (16" & above)

Material Std.	Test Pressure Std.
API 5L Gr.B ASTM A671 Gr.CC65, 70 (Cl.32) ASTM A672 Gr.C60, 65, 70 (Cl.12,22) ASTM A671 Gr.CF60, 65, 66, 70 (Cl.32) ASTM A69 1 Gr.½Cr, 1 Cr, 1¼Cr, 2¼Cr, 5Cr, 9Cr (Cl.42)	P = 2ST/D S = 90% of SMYS Except for API 5L Gr.B S = 85% of SMYS For API 5L Gr.B T = Nominal Wall Thickness D = O.D of Pipe

b) Stainless Steel E.FS.W (2" to 6")

The hydrostatic test pressure in kg/cm² for the following materials shall be as given below:

Material Gr.1 : ASTM A312 TP 304 / 304H / 316 / 316H / 321 / 347 welded.

Material Gr. 2 : ASTM A312 TP 304L / 316L welded.

Size	Pipe Schedule : 10 S		Pipe Schedule : 40S		Pipe Schedule : 80S	
	Material Gr. 1	Material Gr.2	Material Gr. 1	Material Gr.2	Material Gr.1	Material Gr.2
2"	100	80	155	130	230	190
3"	80	60	155	130	230	190
4"	80	50	155	130	230	190
6"	65	35	90	75	155	130

c) Stainless Steel E.FS.W (8" and above).

Material Std.	Test Pressure Std.
ASTM A358 TP 304L, 304, 304H, 316L, 316, 316H, 321, 347 (Classes 1, 3 & 4)	P = 2ST/D S = 85% of SMYS T = Nominal Wall Thickness D = O.D of Pipe
ASTM A358 TP 304L, 304, 304H, 316L, 316, 316H, 321, 347 (Classes 2 & 5)	P = 2ST/D S = 72% of SMYS T = Nominal Wall Thickness D = O.D of Pipe

4.2.3 Carbon Steel Pipes to BIS Standards

Material Std.	Test Pressure Std.
IS 1239	IS 1239
IS3589	IS3589

4.3 Hydrostatic pressure testing shall be performed using iron free water, which is clean and free of silt. Maximum chloride content in water for hydrostatic testing for SS piping shall be 50 ppm.

5.0 MARKING AND DESPATCH

5.1 All pipes shall be marked in accordance with the applicable codes, standards and specifications. In addition the purchase order number, the item code & special conditions like "CRYO", "NACE", "H2" etc. shall also be marked.

5.2 Pipes under "CRYO", "NACE" & "H2" shall be painted with one circumferential stripe of colour red, light purple brown, canary yellow & white respectively for easy identification. Width of stripe shall be 12mm for pipe sizes less than 3" and 25mm for pipes 3" and above.

5.3 Paint or ink for marking shall not contain any harmful metal or metallic salts such as zinc, lead or copper which cause corrosive attack on heating.

5.4 Pipes shall be dry, clean and free from moisture, dirt and loose foreign materials of any kind.

5.5 Pipes shall be protected from rust & corrosion.

5.6 Rust preventive used on machined surfaces to be welded shall be easily removable with a petroleum solvent and the same shall not be harmful to welding.

5.7 Both ends of the pipe shall be protected with the following material:

Plain end	:	Plastic cap
Bevel end	:	Wood, Metal or plastic cover
Threaded end	:	Metal or plastic threaded cap

- 5.8** Pipes may be provided with plastic push-fit type end caps/ steel caps without belt wire.
- 5.9** Steel end protectors to be used on galvanized pipes shall be galvanized. Plastic caps can also be used as end protectors for galvanised pipe ends.

6.0 REFERENCES

- 6.1 P-ITP-001: Inspection & test plan for welded pipes.
- 6.2 P-ITP-002: Inspection & test plan for seamless pipes.



TECHNICAL NOTES FOR VALVES

P-SPC-402

0	02.02.2022	ISSUED FOR STANDARD SPECIFICATION	PNS	MD	AD	SK
Rev.	Date	Purpose	Prepared by	Reviewed by	Approved by	Approved by

ABBREVIATIONS

AARH	:	Arithmetic Average Roughness Height
ANSI	:	American National Standards Institute
API	:	American Petroleum Institute
ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society for Testing & Materials
BGO	:	Bevel Gear Operator
BHN	:	Brinell Hardness Number
BIS	:	Bureau of Indian Standards
BS	:	British Standard
BVIS	:	Bureau Veritas Industrial Services
BW	:	Butt Weld
CAT	:	Category
CS	:	Carbon Steel
DFT	:	Dry Film Thickness
DNV	:	Det Norske Veritas
DP	:	Dye-Penetrant
IBR	:	Indian Boiler Regulations
IGC	:	Inter Granular Corrosion
IS	:	Indian Standard
LT	:	Low Temperature
LTCS	:	Low Temperature Carbon Steel
MOV	:	Motor Operated Valve
MP	:	Magnetic Particle
MR	:	Material Requisition
NDT	:	Non-Destructive Testing
PMI	:	Positive Material Identification
PO	:	Purchase Order
PR	:	Purchase Requisition
RFQ	:	Request for Quotation
SCRD	:	Screwed
SS	:	Stainless Steel
SW	:	Socket Weld



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1.0 GENERAL

- 1.1 Vendor shall supply valves in accordance with the valve specification sheets along with auxiliaries, if any, such as gear operator, bypasses, drains, locking arrangements etc. wherever specified in the specification sheets, subject notes and other enclosures to the material requisition (MR).
- 1.2 Vendor shall quote in strict accordance with the valve data / specification sheets, subject technical notes and all other enclosures to the MR. For valves, no deviations whatsoever shall be accepted. Post Order Waiver/ Deviation format as mentioned in specification for Quality Management System Requirements from Bidder is not applicable for valves. Valves, if exceptions/ deviations become absolutely must, the same shall be requested as explained giving reasons for seeking such exceptions/ deviations.
- 1.3 **All codes and standards for manufacture, testing, inspection etc. shall be of latest editions as on issue date of RFQ.**

2.0 DOCUMENTATION.

- 2.1 All document submissions to PLECO.
- 2.2 For 'Cat-I' valves, no documents shall be submitted with the offer.
- 2.3 For 'Cat-IF valves, vendor shall submit the following documents with the offer:
- 2.3.1 Manufacturer's complete descriptive and illustrative catalogue / literature.
- 2.3.2 Detailed dimensioned cross section drawing with parts / material lists, weight etc.
- 2.3.3 Drawings for valves with accessories like gear operator, hydraulic / pneumatic operator, motor, extension bonnet, extended stems with stands, bypass etc. giving major salient dimensions.
- 2.3.4 One copy of the valve specification sheets signed as "Accepted" by the manufacturer. Deviations, if any shall be marked as applicable on the valve specification sheet.
- 2.3.5 If the valve is regretted or has no deviation, the manufacturer shall write clearly on valve specification sheets as "Regret" or "No Deviation".
- 2.3.6 For 'CAT-II' valves, if there is any deviation, the same shall be listed clause wise.
- 2.3.7 On failure to submit documents as specified in clauses above, the offer is likely to be rejected.
- 2.4 The following documents shall be submitted to PLECO after placement of the order:
- 2.4.1 For Cat-I valves to manufacturers' standard specified in MR/valve specification sheet, detailed dimensioned cross section drawing with parts, materials, weight, etc. shall be submitted for records/information.
- 2.4.2 For 'Cat-II' valves, Vendor shall submit for review drawings mentioned in clauses before start of manufacture. No other drawings shall be submitted for review.
- 2.4.3 Test report shall be supplied for all mandatory tests as per the applicable code. Test reports shall also be furnished for any supplementary tests as specified in clauses.
- 2.4.4 Material test certificates (physical properties, chemical composition & heat treatment report) of the pressure containing parts shall be furnished for the valves supplied. Material test certificates for the other parts shall also be furnished for verification during inspection.
- 2.5 In addition to submissions to PLECO, Catalogues/Drawings shall be in submitted in hard copies (6 sets) and soft copies (2 CDs/DVDs) along with delivery for Purchaser's record for all categories/types of valves.

3.0 DESIGN AND CONSTRUCTION

3.1 Valve shall be designed, manufactured, tested, inspected and marked as per the manufacturing standards, design codes and standards indicated in the respective valve specification sheets. Any conflict between the requisition, enclosures, specification sheets and referred standards/ codes shall be brought to the notice of the purchaser for clarifications and resolution, before proceeding with the manufacture. The purchaser's decision shall be final and binding to the vendor. The drawings submitted for review shall not include any deviations except as communicated in writing in Deviation permits. The Drawings shall be reviewed only for design and construction features.

3.2 All flanged valves shall have flanges integral (except forged valves) with the valve body. Flange face finish shall be normally specified in the valve specification sheet as 125 AARH etc. The interpretation for range of face finish shall be as follows:

- Stock Finish : 1000 p. in AARH max.
- 125 AARH : Serrations with 125 to 250 p in AARH
- 63 AARH : 32 to 63 p. in AARH

3.3 For all weld end valves with bevel end as per ASME B 16.25, the contour of bevel shall be as follows:

Material	Wall Thickness	Weld Contour
Carbon Steel (Except Low Temp. Carbon Steel)	Upto 22 mm	Figure 2 Type A
	>22mm	Figure 3 Type A
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Up to 10 mm	Figure 4
	> 10 mm & up to 25 mm	Figure 5 Type A
	>25mm	Figure 6 Type A

Valve ends shall match thickness of the connecting pipe. Sloping of inside contour of valves shall be done wherever necessary to achieve this.

3.4 For flanged valves with ring joint flanges the hardness shall be as follows:

Flange Material	Min. Hardness of Groove (BHN)
Carbon Steel	140
1% Cr to 5% Cr, 9% Cr	150
Type 304, 316, 321, 347	160
Type 304L, 316L	140

3.5 Following requirements for check valves shall be met over and above the valve specification sheet requirements:

3.5.1 Unless specified otherwise in the data sheet all check valves 3" & above (except in 900#, 1500# & 2500# rating) shall have a drain boss at location "G" (Refer Fig.No.1 of ASME B16.34) where pocket is formed in valve body. A tapped drain hole with plug shall be provided as per ASME B 16.34. Threads shall be as per ASME B 1.20.1 (Taper) NPT.

- 3.5.2 For heavy check valves, provisions shall be available for lifting by way of lugs, eye bolts and other such standard devices.
- 3.6** If an overlay weld-deposit is used for the body seat ring seating surface, the corrosion resistance of the seat ring base material shall be at least equal to the corrosion resistance of the material of the shell.
- 3.7** Following valve bypass requirements shall be met:
- 3.7.1 By-pass requirement for Gate valves shall be as follows unless otherwise mentioned.
- | | | |
|-----------------|---|------------------------|
| ASME 150 Class | : | On sizes 26" and above |
| ASME 300 Class | : | On sizes 16" and above |
| ASME 600 Class | : | On sizes 6" and above |
| ASME 900 Class | : | On sizes 4" and above |
| ASME 1500 Class | : | On sizes 4" and above |
| ASME 2500 Class | : | On sizes 3" and above |
- 3.7.2 The by-pass piping arrangement shall be such that clearance between main valve body and bypass assembly shall be the minimum possible for layout reasons. Vendor shall follow the sketch enclosed in Specification No. 6-44-0052-AI.
- 3.7.3 By-pass valve shall be a globe valve. The sizes shall be as under:
- | | | |
|---------------------------|---|--------|
| On main valve $\leq 4"$ | : | $1/2"$ |
| On main valve 6" to 8" | : | $3/4"$ |
| On main valve 10" & above | : | 1" |
- By-pass piping shall be of same metallurgy as main valve. The by-pass piping, fittings and valve tag numbers shall be as specified in Specification. In case details of by-pass arrangement for any Valve tag number is missing, Vendor shall bring the same to notice of PLECO and provide by-pass as per details specified.
- 3.7.4 Vendor shall supply the by-pass valve duly tested and fitted to the main valve. Valves with by-pass shall have the direction of flow marked on the main valve. By-pass attachment to the main valve body shall not be screwed. All fillet welds for by-pass installation shall be 100% examined by DP/MP test and Butt-weld joints shall be 100% examined by radiography.
- 3.8** Valve body / bonnet shall be forged / cast as specified. Forgings are acceptable in place of casting but not vice-versa.
- 3.9** Stem shall be forged or machined from forged / rolled bar. No casting is permitted. However, integral stem of cast material is acceptable for Plug valves.
- 3.10** Stellite / hardfacing by deposition, shall be minimum 1.6 mm.
- 3.11** Renewable seat rings shall be seal welded for valves of size 3" and above to prevent loosening in service.
- 3.12** For Low Temperature & Cryogenic valve requirements, refer Specification. Unless otherwise specified.
- 3.13** For Hydrogen service valve requirements, refer Specification. unless otherwise specified.

- 3.14 Valves under 'NACE' category shall meet the requirements specified in MR-0103 unless otherwise specified.
- 3.15 For all austenitic stainless steel valves Inter Granular Corrosion (IGC) test shall be conducted as per the following:
- 3.15.1 ASTM A262 Practice 'B' with acceptance criteria of '60 mils/year (max.)' for all materials - forged, rolled, wrought and casting.
- Or
- ASTM A262 Practice 'E' with acceptance criteria of 'No cracks as observed from 20X magnification' for all materials other than castings. 'Microscopic structure to be observed from 250X magnification' in addition.
- 3.15.2 When specifically asked for in MR for high temperature application of some grades of austenitic stainless steel (eg. SS309, 310, 316, 316H etc.) ASTM A262 Practice 'C' with acceptance criteria of '15 mils/year (max.)' shall be conducted.
- 3.15.3 For the IGC test as described in Clauses, two sets of samples shall be drawn from each solution annealing lot. One set shall correspond to the highest Carbon content and the other to the highest pressure rating. When testing is conducted as per practice 'E', photograph of the microscopic structure shall be submitted for record.
- 3.16 All types of 321 or 347 stainless steel valves shall be in a stabilised heat treated condition. Stabilising heat treatment shall be carried out subsequent to the normal solution annealing. Soaking temperature and holding time for stabilising heat treatment shall be 900°C and 4 hours respectively.
- 3.17 Spiral wound bonnet gaskets are to be provided with inner/outer ring except when encapsulated gaskets type body-bonnet joints are employed. Outer ring may be avoided in case of non-circular spiral wound gasket used in 150# valve provided the outermost layer of spiral touches the bolts ascertaining the centering.
- 3.18 All Stainless Steel Castings shall be solution heat treated.
- 3.19 **Only normalized and tempered material shall be used in the following specifications :**
- Castings** A217 Gr.WC1, A217 Gr.WC4, A217 Gr.WC5, A217 Gr.WC6, A217 Gr.WC9, A217 Gr.C5, A217 Gr.C12
- Forgings:** A182 Gr.F11 C1.2, A182 Gr.F12 C1.2
- 3.20 **Ball / Plug / Butterfly Valves**
- 3.20.1 As a prequalification, fire safe test as per API 607 / API 6FA / BS EN ISO 10497 (Supersedes BS 6755 Part II) shall be carried out on soft seated ball, plug & butterfly valves and also on lubricated plug valves. The test shall be witnessed and certified by a third-party inspection agency like Lloyds, BVIS, DNV or PLECO unless otherwise specified. The vendor has to submit test certificate for the particular design of the valve offered, if fire safe design is required as per the Valve Material Specification sheet.
- 3.20.2 Each valve shall be supplied with a lever / wrench except for gear operated / motor operated valves.
- 3.20.3 Soft-seated ball, plug & butterfly valves shall be supplied with antistatic devices.
- 3.20.4 BW / SW end ball valves shall have a 100 mm long seamless pipe nipple welded to each end of the valve. Nipples are to be welded prior to assembling Teflon seats / seals. Specifications of the nipples shall be as indicated in the MR.

- 3.20.5 The face-to-face dimensions of all ball valves shall be same as those of gate valves of the corresponding ANSI class (except 10" onwards in Class 150 where the face-to-face dimensions shall be as per API 6D long pattern).
- 3.20.6 The ball of ball valve shall not protrude outside the end flanges of valve.
- 3.20.7 Ball valves shall be of floating ball/trunnion mounted type as per following:
- | | | |
|----------------|----------------------------|-----------------------------------|
| 150# | 8" & below
10" & above | Floating ball Trunnion
mounted |
| 300# | 4" & below
6" & above | Floating ball Trunnion
mounted |
| 600#&
above | 1.5" & below
2" & above | Floating ball
Trunnion mounted |
- 3.20.8 Unless otherwise specified in the data sheets, bore of all reduced bore ball valves shall be limited to one size lower than the nominal bore.
- 3.21 The MOVs are to be installed in an open area and the actuators shall be suitable for all weather conditions. The testing of complete assemblies of MOVs along with the actuators shall be done by the supplier at his works.
- 3.22 Ends of flanged valves of 22" size shall match corresponding flanges to MSS-SP44 unless otherwise specified.
- 3.23 Yoke material shall be same as bonnet material where maximum temperature specified is more than 427°C.

4.0 OPERATION

4.1 Gear operation shall be provided as under:

Valve Type	Class	Size Requiring Gear-Operator
Gate Valve, Globe Valve & Diaphragm Valve	150 Class	1211 and larger
	300 Class	1211 and larger
	600 Class	10" and larger
	900 Class	6" and larger
	1500 Class	311 and larger
	2500 Class	311 and larger
Ball Valve / Plug Valve (Other than pressure balance plug valves)	150 Class	6" and larger
	300 Class	6" and larger
	600 Class	411 and larger
	900 Class	3" and larger
	1500 Class	311 and larger
Butterfly Valve	150, 300 Class	6" and larger

For sizes lower than these ranges, hand wheel / lever / wrench shall be provided. For pressure balance plug valves manufacturer's recommendation shall be acceptable provided the requirements specified in clause.

- 4.2 Gear operator shall be provided, with position indicators for open / close positions and with limit stops. (Limit stops are not applicable for gate and globe valves).
- 4.3 Where gear operator is not called for as per Clause but vendor recommends a gear operator, the same shall be highlighted.
- 4.4 Gear operator shall be so designed as to operate effectively with the differential pressure across the closed valve equal to the cold non-shock pressure rating.
- 4.5 Ball, plug and butterfly valves, shall have "Open" position indicators with limit stops.
- 4.6 Hand wheel diameter shall not exceed 750mm and lever length shall not exceed 500mm on either side. Effort to operate shall not exceed 35 Kg at hand wheel periphery. However, failing to meet the above requirements, vendor shall offer gear operated valve and quote as per clause

5.0 INSPECTION AND TESTING

- 5.1 Every valve shall be subjected to all the mandatory tests and checks called in the respective codes / data sheet by PLECO inspection or any third party as approved by the purchaser. For IBR valves refer clause.
- 5.2 Every valve, its components and auxiliaries must be subjected to all the mandatory tests and checks called for in the respective codes, data sheets etc. by the manufacturer.
- 5.3 Though the extent of inspection shall be as under, exact extent withhold points shall be decided by PLECO regional inspection office and recorded in the form of inspection plan. In case of third party inspection, the inspection plan shall be approved by the purchaser.

Forged Valves:

1. Visual and dimensional inspection.
2. Review of material test certificates.
3. Any mandatory or supplementary test.
4. Hydrostatic test on 10% valves selected on random basis.
5. Strip check is required for 1% of total ordered quantity of Gate & Globe valves (min. 1 No.) for each Valve sheet no., however, strip check is not required for CS/ Brass/ Bronze material valves with 13% Cr/ Brass/ Bronze trims.

Cast Steel Valves:

1. Visual and dimensional inspection.
2. Review of material test certificates.
3. Review of radiographs/radiographic reports or any other NDT tests wherever applicable as per data sheet.
4. Any mandatory or supplementary test.
5. Hydrostatic test 100% for body, 10% other test.
6. Strip check is required for 1% of total ordered quantity of Gate & Globe valves (min. 1 No.) for each Valve sheet no., however, strip check is not required for CS/ Brass/ Bronze material valves with 13% Cr/ Brass/ Bronze trims.

Samples for strip check shall be selected at random and shall generally be in the highest size in the lot.

5.4 In case of motor operated or actuator operated valves, functional / operational checks as per the requirements of the specifications shall be made on each valve.

6.0 RADIOGRAPHY OF CAST VALVES

6.1 Valve castings shall undergo radiographic examination as specified below.

Material	Rating	Size Range	Radiography
All	150#	24" and below	NIL **
		26" and above*	100%
	300#	16" and below	NIL **
		18" and above	100%
	600# & above	All sizes	100%

* No radiography is required for valves of size 26" and above in cooling water service.

**For sizes 24" & below in 150# and 16" & below in 300#, radiography percentage if specifically mentioned in individual valve material spec sheet shall govern.

Radiography specified as random 10% or 20% etc. in the respective valve data sheet implies 10% or 20% etc. of number of valves ordered against each item number with a minimum of one valve against each item.

6.2 Radiography procedure, areas of casting to be radiographed shall be as per ASME B 16.34 and acceptance criteria shall be as per ASME B 16.34 Annexure-B. However, for areas of casting to be radiographed for types of valves not covered in ASME B 16.34, vendor shall radiograph castings in line with ASME B 16.34.

6.3 For random radiography wherever specified in individual data sheets, the sampling shall be per size of the quantity ordered for each foundry.

6.4 Radiography wherever specified in the data sheets or as per clause shall be done by X-ray γ-ray to get the required sensitivity.

7.0 IBR CERTIFICATION

7.1 For valves described "IBR", valves shall be in accordance with the latest IBR (Indian Boiler Regulation) including the requirements specified in the specification.

7.2 For SW / BW end carbon steel valves under IBR, the chemical composition shall conform to the following:

Carbon (Max) : 0.25%
Others (S, P, Mn) : As per IBR

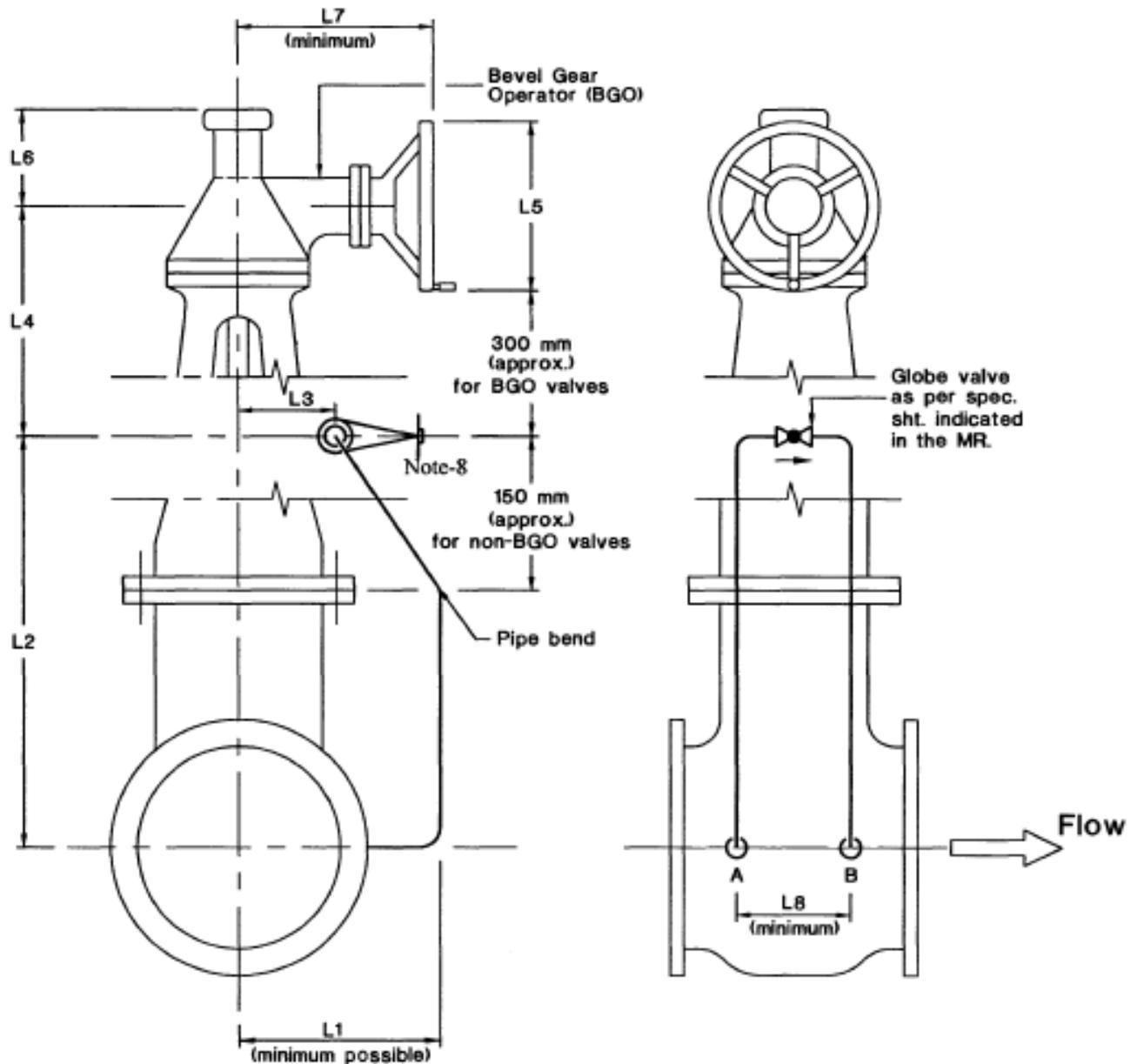
7.3 Valves coming under the purview of "IBR"(Indian Boiler Regulations) shall each be individually accompanied by IBR certificate original in Form III-C duly approved by IBR authority / local authority empowered by the Central Boiler Board of India. Photocopy of original certificate duly attested by the local boiler inspector where the supplier is located is the minimum requirement for acceptance.

7.4 All "IBR" valves shall be painted red in body-bonnet / body-cover joint.

8.0 MARKING

- 8.1 Valve markings, symbols, abbreviations etc. shall be in accordance with MSS-SP-25 or the standard referred in specification sheet as applicable. Vendor's name, valve rating, material designation, nominal size, direction of flow (if any) etc. shall be integral on the body.
- 8.2 Each valve shall have a corrosion resistant tag giving size, valve tag / code no., securely attached to the valve body.
- 8.3 Paint or ink for marking shall not contain any harmful metal or metal salts such as zinc, lead or copper which cause corrosive attack on heating.
- 8.4 Carbon Steel / Alloy Steel valves shall be painted with one coat of inorganic zinc silicate (minimum DFT 65 to 75 microns).
- 9.0 DESPATCH**
- 9.1 Valve shall be dry, clean and free from moisture, dirt and loose foreign materials of any kind.
- 9.2 Valves shall be protected from rust, corrosion and any mechanical damage during transportation, shipment and storage.
- 9.3 Rust preventive on machined surfaces to be welded shall be easily removable with a petroleum solvent or shall not be harmful to welding.
- 9.4 Each end of valve shall be protected with the following materials:
- | | | |
|----------------|---|-----------------------|
| Flange Face | : | Wood or Plastic Cover |
| Bevelled End | : | Wood or Plastic Cover |
| SW & SCRD. End | : | Plastic Cap |
- 9.5 End protectors of wood / plastic to be used on flange faces shall be attached by at least three bolts and shall not be smaller than the outside diameter of the flange. However, plastic caps for SW & SCRD end valves shall be press fit type.
- 9.6 End protectors to be used on bevelled end shall be securely and tightly attached.
- 9.7 For special service valves additional requirement for despatch shall be as prescribed in data sheet.

BYPASS PIPING ARRANGEMENT



NOTES:

1. The orientation & location of handwheel of bevel gear operator & the bypass arrangement shall be strictly as per this sketch.
2. The bypass connection ends shall be socket welded up to 600# and butt welded for 900# and above rating.
3. The bypass arrangement shall be properly clamped to & supported by the body of the main valve.
4. Basic design of bypass shall be to MSS-SP-45.
5. Material of bypass pipe & 90° elbows shall be same or equivalent to the body material as indicated in Specification.
6. This sketch is applicable for both BGO & NON-BGO Valves.
7. Vendor shall furnish dimensions L1 to L8.
8. Stem shall not be horizontal in the case of CRYO Valves

SPECIFICATIONS FOR BYPASS PIPING, FITTINGS AND VALVES

Class (Main Valve Sht.no.)	Pipe	Fittings	Bypass Valve Sht.no.
A1A(51301), A3A(51321), A9A(51301), A10A(51301), A11A(51301), A33A(51301), B1A(51401), B9A(51401), D1A(51501), D9A (51501)	ASTM A106 Gr.B (SMLS) 0.5"-0.75": SI 60 1.0"-1.5": XS	ASTM A105 0.5"-0.75": SW 6000# 1.0"-1.5": SW 3000#	52001
A6A(51301), B6A(51401)	ASTM A106 Gr.B (SMLS) 0.5"-0.5" : xxS 0.75"-1.5": S160	ASTMA105 0.5"-0.5" : SW 9000# 0.75"-1.5": SW 6000#	52001
A13A(51301), B13A(51401)	ASTM A106 Gr.B (SMLS) 0.5"-1.5" : xxS	ASTM A105 0.5"-1.5" : SW 9000#	52001
A2A(51302), B2A(51402), D2A (51502)	ASTM A106 Gr.B (SMLS)- IBR 0.5"-0.75": S160 1.0"-1.5" : XS	ASTM A105 - IBR 0.5"-0.75": SW 6000# 1.0"-1.5": SW 3000#	52002
A4A (51303), B4A (51403), D4A (51503)	ASTM A333 Gr.6 (SMLS)- LT 0.5"-0.75": SI 60 1.0"-1.5" : XS	ASTM A350Gr.LF2- LT 0.5"-0.75": SW 6000# 1.0"-1.5": SW 3000#	52003
ASA (51304), BSA (51404), DSA (51504)	ASTM A106 Gr.B (SMLS) -H2 0.5"-0.75": S160 1.0"-1.5": XS	ASTM A105 - H2 0.5"-0.75": SW 6000# 1.0"-1.5": SW 3000#	52004
A7A (51307)	ASTM A106 Gr.B (SMLS) 0.5"-0.75" : S160 1.0"-1.5": XS	ASTM A105 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52007
A16A (51311), B16A (51411), D16A (51511)	ASTM A106 Gr.B (SMLS)- NACE 0.5"-0.5" : xxS 0.75"-1.5": S160	ASTM A105 - NACE 0.5"-0.5" : SW 9000# 0.75"-1.5": SW 6000#	52011
A19A (51313), B19A (51413), D19A (51513)	ASTM A106 Gr.B (SMLS) 0.5"-0.75" : S160 1.0"-1.5": XS	ASTM A105 0.5"-0.75": SW 6000# 1.0"-1.5": SW 3000#	52013
E1A (51601), F1A (51701)	ASTM A106 Gr.B (SMLS) 0.5"-1.5" : S160	ASTM A234 Gr.WPB/ ASTM A105 0.5"-1.5": BW, S160	52101
E2A (51602), F2A (51702)	ASTM A106 Gr.B (SMLS) - IBR 0.5"-1.5" : SI 60	ASTM A234 Gr.WPB/ ASTM A105 - IBR 0.5"-1.5": BW, S160	52102
E3A (51604), F3A (51704)	ASTM A106 Gr.B (SMLS) - H2 0.5"-1.5" : S160	ASTM A234 Gr.WPB/ ASTM A105 - H2 0.5"-1.5" : BW, S160	52104
E4A (51605), F4A (51705)	ASTM A106 Gr.B (SMLS) 0.5"-1.5": SCH XXS	ASTM A234 Gr.WPB/ ASTM A105 0.5"-1.5": BW, SCH xxS	52105
E19A (51613), F19A (51713)	ASTM A106 Gr.B (SMLS) 0.5"-1.5": SCH XXS	ASTM A234 Gr.WPB/ ASTMA105 0.5"-1.5" : BW, SCH xxS	52113
ASY (51384), A33Y (51384)	ASTM A106 Gr.B (SMLS) 0.5"-1.5": SI60	ASTM A105 0.5"-1.5" : SW 6000#	52085

Class (Main Valve Sht.no.)	Pipe	Fittings	Bypass Valve Sht.no.
A1D (51330), B1D (51430), D1D (51530)	ASTM A335Gr.PI I(SMLS) 0.5"-0.75": SI60 1.0"-1.5": XS	ASTM A182 Gr.F1 1C1.2 0.5"-0.75": SW 6000# 1.0"-1.5": SW 3000#	52030
D2D (5153 I)	ASTM A335Gr.PI I (SMLS) - IBR 0.5"-0.75": S160 1.0"-1.5": XS	ASTM A182 Gr.F11Cl.2 - IBR 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52031
BSD (51432), DSD (51532)	ASTM 335Gr.PI I(SMLS)- H2 0.5"-0.75" : SI60 1.0"-1.5": XS	ASTM A182 Gr.FI ICl.2 - H2 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52032
BIE (51433)	ASTM A335Gr.P22(SMLS) 0.5"- 0.75": SI60 1.0"-1.5": XS	ASTM A182 Gr.F22Cl.3 0.5"-0.75": SW 6000# 1.0"-1.5": SW 3000#	52033
DSE (51534)	ASTM A335Gr.P22(SMLS) - H2 0.5"-0.75" : S160 1.0"-1.5": XS	ASTM A182 Gr. F22Cl.3 - H2 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52034
A4F (51336), B4F (51436)	ASTM A335 Gr.PS(SMLS) 0.5"- 0.75": SI60 1.0"-1.5": XS	ASTM A182 Gr.PS 0.5"- 0.75": SW 6000# 1.0"-1.5" : SW 3000#	52036
B3F (51436)	ASTM A335 Gr.PS(SMLS) 0.5"-1.5" : xxs	ASTM A182 Gr.PS 0.5"- 1.5" : SW 9000#	52036
A4G (51339), B4G (51439)	ASTM A335 Gr.P9(SMLS) 0.5"- 0.75" : SI60 1.0"-1.5": XS	ASTM A182 Gr.F9 0.5"- 0.75": SW 6000# 1.0"-1.5": SW 3000#	52039
F2D (51731)	ASTM A335 Gr.PI I (SMLS) - IBR 0.5"-1.5" : S160	ASTM A234Gr.WP1 ICU/ AI 82 Gr.FI I Cl.2 - IBR 0.5"-1.5": BW, S160	52131
ESE (51634)	ASTM A335 Gr.P22(SMLS) - H2 0.5"-0.75" : SI60 1.0"-1.5": XS	ASTM A234Gr.WP22Cl. I/ AI82 Gr.F22Cl.3 - H2 0.5"-0.75": BW, SI60 1.0"-1.5" : BW, XS	52134
AIK (51345), A3K (51345), BIK (51445), DIK (51545)	ASTM A312 TP304(SMLS) 0.5"- 0.75": 80S 1.0"-1.5": 40S	ASTM A182 Gr.F304 0.5"-1.5" : SW 3000#	52045
A2K (51346), B2K (51446), D2K (51546)	ASTM A312 TP304(SMLS) - CRYO 0.5"-0.75": 80S 1.0"-1.5": 40S	ASTM AI 82 Gr.F304 -CRYO 0.5"-1.5" : SW 3000#	52046
B4K (51448), BSK (51448)	ASTM A312 TP304H (SMLS) 0.5"-1.5": 80S	ASTM A182 Gr.F304H 0.5"-1.5": SW 3000#	52048



Class (Main Valve Sht.no.)	Pipe	Fittings	Bypass Valve Sht.no.
A6K (51350), B6K (51450)	ASTM A312 TP304L (SMLS)0.5"-0.75" : 80S 1.0"-1.5": 40S	ASTM A182 Gr.F304L 0.5"-1.5": SW 3000#	52050
A1M (51361), BIM (51461)	ASTM A312 TP31 6(SMLS)0.5"-0.75" : 80S 1.0"-1.5": 40S	ASTM A182 Gr.F316 0.5"-1.5": SW 3000#	52061
B5M (51462)	ASTM A312 TP316H (SMLS) -H2 0.5"-0.75" : 80S 1.0"-1.5": 40S	ASTM A182 Gr.F316H - H2 0.5"-1.5": SW 3000#	52062
B3M (51463)	ASTM A312 TP321(SMLS)0.5"-0.75": 80S 1.0"-1.5": 40S	ASTM A182 Gr.F321 0.5"-1.5": SW 3000#	52063
A1N (51366), BIN (51466)	ASTM A312 TP 316L (SMLS)0.5"-0.75" : 80S 1.0"-1.5": 40S	ASTM A182 Gr.F316L 0.5"-1.5": SW 3000#	52066

SPECIAL REQUIREMENTS FOR LOW TEMPERATURE & CRYOGENIC VALVES

1.0 SCOPE

All valves of Low Temperature Carbon Steel (LTCS) and all grades of austenitic SS (CRYO) material are categorized as cryogenic valves. All these valves shall have extended bonnet as per BS 6364 except check valves.

Following qualification criteria shall be met by the valve vendors to quote valves for cryogenic services:

2.0 QUALIFICATION CRITERIA

- i) Both cryogenic test (clause) and reference list (clause) together shall be considered for vendor qualification and vendor shall furnish the same, along with his offer.
- ii) Vendors who do not have cryogenic test reports and reference list covering valves of all sizes, materials and ratings required by MR, should confirm / furnish the following for consideration of their offer:
 - a. Evidence of having conducted successfully at least one cryogenic test as per BS 6364. Test certificate shall be furnished with the offer.
 - b. Vendor shall confirm to conduct cryogenic test per clauses for the remaining valves not later than 12 weeks from the date of purchase order.
 - c. Vendor shall also furnish reference list for valves supplied for non-cryo service if reference list referred in 2.2.1 does not cover all the sizes of MR.

Offers of vendors who do not comply with above requirements would be rejected.

2.1 Cryogenic Test

Vendors to furnish copies of cryogenic test certificate for tests conducted as per details given below:

- 2.1.1 Test shall be as per BS 6364.
- 2.1.2 Test temperature, unless specifically called for otherwise in the individual MR, shall be -45°C for LTCS and -196°C for all grades of austenitic stainless steel.
- 2.1.3. Tests carried out on a particular size of one type of valve, pressure rating and material shall qualify all sizes equal to and below the test valve size for the same type, pressure rating and material. In case of austenitic SS any one grade would qualify for all other grades of austenitic SS.
- 2.1.4. Tests should have been witnessed and certified by any one of the following third party inspection agencies; M/s Lloyd, BV, DNV, TUV or PLECO/ CPLECO.
- 2.1.5. Cryogenic test need not be conducted for every order. Test conducted previously and witnessed by inspection agencies listed above shall be considered acceptable and need not be repeated.

2.2 Reference List

Vendor shall furnish reference list for valves supplied for cryogenic service indicating the name of client, year of supply, size, material, pressure rating, type of valve and quantity.

2.3 Post Order Testing Procedure

- 2.3.1. Before conducting post order testing, vendor shall submit the following for approval:
 - a. Test procedure (as per BS 6364).

b. Cross-section drawing of the valve with material of construction.

c. Schematic of test rig (as per BS 6364) with complete details.

- 2.3.2. Test has to be conducted irrespective of the service on largest size for each type of valve and for each material and class rating. Vendor shall offer one, two or three valves for selection of test valve by inspector depending upon whether quantity of largest valve in the order is one, two or three and more than three respectively.

In the event of failure of the test valve to meet the specification requirements, the vendor shall conduct test on two more valves. These two valves which pass test successfully, are of lower size, then the qualification will be valid only to sizes upto which test has been conducted successfully.

- 2.3.3. In case of non-conductance of cryogenic test(s) within 12 weeks or failure in the test(s) conducted after receipt of order, the owner reserves the right to invoke any of the provisions of the purchase order including cancellation of the purchase order at the risk and cost of vendor.

- 3.0** Bonnet extension, wherever specified in the valve sheet to BS 6364 shall be for "non cold box application" unless otherwise specified in the MR. Even if not called for in valve sheet, valves indicated as "LT" or "CRYO" shall be supplied with bonnet extension.

- 4.0** Bonnet and Gland extension joints shall be of butt welded/integrally cast construction.

- 5.0** Repair welding procedure for austenitic stainless steel valves in "CRYO" service shall have to be qualified for impact test as per ASME B31.3. Minimum acceptable impact energy shall be 20 J or lateral expansion of 0.38 mm at temperature of -196°C.

- 6.0** Wherever impact test of SS studs / nuts is called for in the data sheet, the impact value shall be 27 J at the intended service temperature specified in the data sheets.

SPECIAL REQUIREMENTS FOR HYDROGEN SERVICE

1.0 GENERAL

- 1.1 These requirements are applicable for valves used in Hydrogen service. These are in addition to the requirements described in "Technical Notes for Valves" Spec. No. 6-44- 0052, and shall be read in conjunction with this specification.
- 1.2 All cast valve flanges & bodies with flange rating of Class 900 or greater shall be examined in accordance with paragraphs 7.2 through 7.5 of Appendix-VII of ASME SEC-VIII, DIV.1, regardless of casting quality factor.
- 1.3 Body / bonnet / cover joints & stuffing box of all valves shall have low emission. One valve per metallurgy, per rating, per size shall be helium leak tested as per ASME Sec.V, Subsection A, Article 10 (Detector Probe Technique), Appendix IV at a minimum of 25% of the allowable (rated) cold working pressure. Selection of valves for helium leak test shall be at random. Test duration shall be as follows:

Test Duration in Minutes					
Nominal Size	Pressure Class				
	Upto 300	600	800 & 900	1500	2500
Upto 2"	3	6	9	12	12
3" to 6"	6	9	12	15	18
8" to 16"	9	9	12	15	18
18" to 24"	9	12	15	18	21

The valve shall show no leakage. No leakage is defined as a total leakage rate of less than 0.0001 ml/s of helium.

- 2.0 Only normalized and tempered material shall be used in the following specifications:
Castings A217 Gr.WC1, A217 Gr.WC4, A217 Gr.WC5, A217 Gr.WC6, A217 Gr.WC9, A217 Gr.C5, A217 Gr.C12
Forgings A182 Gr.F11 C1.2
- 3.0 **CS & AS VALVES**
- 3.1 Bend test and Magnetic Particle inspection of the entire surface of body and bonnet casting shall be in accordance with ASTM A217. Supplementary requirement S3 & S4 evaluation of magnetic particle, inspection shall be in accordance with MSS-SP-53 except that no linear discontinuities shall be allowed.
- 3.2 The Brinell hardness of heat-treated casting shall not exceed 200 BHN for carbon steel & 225 for alloy steel.
- 3.3 Repair to defective casting shall be outlined in writing to the purchaser before repair starts. Repair method to be approved prior to welding.
- 3.4 Casting shall be preheated to a minimum of 400°F prior to welding and all Chromium-Molybdenum alloys shall be postweld heat treated after welding is complete. Stress relieving is essential for welds.
- 3.5 Carbon steel shall be normalised and alloy steels shall be normalised & tempered.



- 3.6 Dye Penetrant test of welds shall be in accordance with ASTM B165 Procedure B-2. Interpretation as per Appendix-8 of ASME-VIII Div. 1.
- 3.7 The tensile stress for AS shall be less than 100,000 psi.
- 3.8 Charpy V-notch impact testing is to be done for valve material (average 20 ft-lb for set of 3 [minimum value 15 ft-lb] at 30°F).
- 3.9 For radiography and acceptance criteria for valve castings, refer Cl. 4.2.
- 4.0 **SS VALVES**
- 4.1 Valve casting shall be in solution heat treated and pickled condition.
- 4.2 Critical body and bonnet casing section typically defined by ASME B 16.34 shall be radiographed and shall meet ASTM E446 (upto 2" thick) Category A, B & CA Level 2, Category CB, OC & CD Level 3, Category D, B & F Level 0. For wall thickness 2" to 4.5" comparable plates of ASTM E186 shall be used. ASTM E94 and ASTM E142 shall be used for recommended practice & controlling quality of radiography as guide. The entire surface of all castings shall be dye-penetrant inspected after pickling.
- 4.3 Welds shall be 100% radiographed and evaluated in accordance with paragraph 344.5 of ASME B31.3 with a minimum casting quality factor of 0.95. Dye Penetration test shall be as per ASTM E165 Procedure B-2, Interpretation as per Appendix-8 of ASME-VIII Div.I.



**TECHNICAL NOTES FOR
FLANGES, SPECTACLE BLINDS AND DRIP
RINGS**

**SPECIFICATION NO.
P-SPC-406**

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FOR
FLANGES, SPECTACLE BLINDS
AND DRIP RINGS
P-SPC-406**

0	16.02.2022	ISSUED AS STANDARD SPECIFICATION	PNS	SM	AD	SK
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TECHNICAL NOTES FOR FLANGES, SPECTACLE BLINDS AND DRIP RINGS

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ABBREVIATIONS

AARH	:	Arithmetic Average Roughness Height
ANSI	:	American National Standards Institute
API	:	American Petroleum Institute
ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society for Testing & Materials
AWWA	:	American Water Works Association
BHN	:	Brinell Hardness Number
HIC	:	Hydrogen Induced Cracking
IGC	:	Inter Granular Corrosion
IS	:	Indian Standard
MR	:	Material Requisition
MSS	:	Manufacturer's Standardization Society
NACE MR	:	National Association of Corrosion Engineers: Material Requirement
PMI	:	Positive Material Identification



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1.0 GENERAL

- 1.1 All items, their dimensions, tolerances, chemical composition, physical properties, heat treatment and testing etc. shall conform to the latest codes and standards specified in the requisition. Supplier shall strictly comply with MR / PR and no deviations shall be permitted. Post Order Concession / Deviation from Bidders is not applicable.
- 1.2 Testing
- 1.2.1 Test reports shall be supplied for all mandatory tests as per the relevant material specifications. Test reports shall also be furnished for any supplementary tests as specified in the requisition & Clauses 1.11, 1.12 & 1.15.
- 1.2.2 Material test certificates (physical property, chemical composition & heat treatment report) shall also be furnished for the flanges supplied.
- 1.2.3 Refer to specification no. P-ITP-008 for Inspection and Test plans for flanges, spectacle blinds & drip rings.
- 1.3 Ends of weld neck flanges shall be bevelled to suit the schedule / thickness of matching pipe, as specified in the requisition.
- 1.4 Bevel end details for welding neck flanges shall be as per ASME B16.25. Contour of bevel end shall be as follows:

Material	Wall Thickness	Weld Contour
Carbon Steel (Except Low Temp. Carbon Steel)	Upto 22 mm	Figure 2 Type A
	>22mm	Figure 3 Type A
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Upto 10 mm	Figure 4
	> 10 mm & Upto 25 mm	Figure 5 Type A
	>25mm	Figure 6 Type A

- 1.5 Bore of socket weld flanges & reducing blind flanges shall suit the outside diameter and schedule / thickness of matching pipe.
- 1.6 Bore of slip-on flanges shall suit the outside diameter of matching pipe.
- 1.7 Flange face finish shall be normally specified in the requisition as serrated finish, 125 AARH etc. The interpretation for range of face finish shall be as follows:
- Stock Finish : 1000 μ in AARH max
- Serrated Finish/125 AARH : Serrations with 125 to 250 μ in AARH
- 63 AARH : 32 TO 63 μ in AARH
- 1.8 Galvanized flanges shall be coated with zinc by hot dip process conforming to IS 4736 / ASTM A153.



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1.9 Ends of screwed flanges unless otherwise specified shall have taper threads as per ASME / ANSI B1.20.1.

1.10 For ring joint flanges, blinds and spacers the hardness shall be as follows:

Flange Material	Min. Hardness of Groove (BHN)
Carbon Steel	140
1% Cr to 5%, 9% Cr	150
Type 304,316,321,347	160
Type 304L, 316L	150

1.11 For ring joint flanges, blinds and spacers, the hardness shall be recorded in the test report.

1.12 NACE / HIC Requirements

1.12.1 Flanges, blinds, drip rings under "NACE" category and those designated as "HIC" shall meet the requirements given in NACE MR-0103 unless otherwise specified.

1.13 All austenitic stainless steel flanges shall be supplied in solution annealed condition.

1.14 I.G.C. Test for Stainless Steels:

1.14.1 For all austenitic stainless steel flanges, blinds, drip rings & Fig.8 flanges intergranular corrosion test shall have to be conducted as per following:

ASTM A262 Practice 'B' with acceptance criteria of "60 mils / year (max.)".

OR

ASTM A262 Practice E: The bent specimen shall be examined under 20X magnification. The acceptance criteria is that there will be no crack or fissure in the bent specimen. The bent specimen shall also be subjected to metallographic examination at 250X magnification to ensure no crack or fissure. The photograph of the bent specimen along with comments shall be submitted for review.

1.14.2 When specifically asked for in requisition for high temperature application of some grades of austenitic stainless steel (like SS309, 310, 316, 316H etc.) ASTM A262 Practice 'C' with acceptance criteria of "15 mils / year" shall have to be conducted.

1.14.3 For the IGC test as described in 1.14.1 & 1.14.2 two sets of samples shall be drawn from each solution treatment lot; one set corresponding to highest carbon content and the other corresponding to the highest rating / thickness.

1.15 All types of 321 or 347 stainless steel flanges shall be in a stabilized heat-treated condition. Stabilizing heat treatment shall be carried out subsequent to the normal solution annealing. Soaking temperature and holding time for stabilizing heat treatment shall be 900 C and 4 hours respectively.

1.16 For dual grades of SS where specified, chemical composition and mechanical properties of both grades specified shall be ensured.

1.17 AWWA C207 flanges shall be ring type.



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- 1.18 Where ever two sizes have been specified in the MR for flanges, it shall be considered a reducing flange.
- 1.19 All $1\text{Cr} - \frac{1}{2}\text{Mo}$ and $1\frac{1}{4}\text{Cr} - \frac{1}{2}\text{Mo}$ flanges shall be normalised and tempered.
- 1.20 Ring Joint Fig - 8 Flanges, Spacers & Blinds shall be female type only.
- 1.21 The handle for spacers & blinds for classes 900# & above shall be designed by the vendor. The handle may be integral or attached to the line blank / spacer by welding. In case of attachment by welding heat treatment & welding shall be in accordance with B31.3.
- 1.22 For Hydrogen service following special requirements shall also be met:
- All carbon steel flanges having wall thickness 9.53 mm and above shall be normalised. The normalising heat treatment shall be a separate heat treatment operation and not a part of the hot forming operation.
 - All alloy steel (Cr-Mo) flanges shall be normalised and tempered. The normalising and tempering shall be a separate heat treatment operation and not a part of the hot forming operation.
 - For all carbon steels and alloy steels with wall thickness over 20 mm, Charpy-V Notch impact testing shall be carried out in accordance with paragraph UG-84 of ASME Section VIII, Div-1 per heat of material and per heat treating batch. Impact test specimen shall be in accordance with ASTM A370. Impact energies at -29 C shall average greater than 27J (20 ft-lb) per set of 3 specimens, with a minimum of 20J (15ft-lb).

2.0 ACCEPTABLE DEVIATIONS

- 2.1 Blind Flanges and Spacers & Blinds if specified as plate materials are acceptable in forging materials also in the corresponding material grades.
- 2.2 Flanges/Spectacle Blinds/Drip rings of Grades SS317 of corresponding material are acceptable in place of Grades SS316 or SS316 (2.5Mo min.).
- 2.3 Flanges/Spectacle Blinds/Drip rings of Grades SS317L of corresponding material are acceptable in place of Grades SS316L or SS316L (2.5Mo min.).

3.0 MARKING AND DESPATCH

- 3.1 All items shall be legibly and conspicuously stamped in accordance with the requirements of applicable ASME, API and MSS Standards. In addition, purchase order number & special conditions like "IBR", "CRYO", "NACE" "H2" etc. shall also be stamped.
- 3.2 All items coming under the purview of "IBR", "CRYO", "NACE" & "H2" (hydrogen) shall be painted with one stripe of colour red, light purple brown, canary yellow & white respectively for easy identification. Width of stripe shall be 25 mm and it shall be painted longitudinally across the complete thickness of flange other than hub.
- 3.3 Paint or ink for marking shall not contain any harmful metal or metal salts such as zinc, lead or copper which cause corrosive attack on heating.
- 3.4 All items shall be dry, clean and free from moisture, dirt and loose foreign materials of any kind.
- 3.5 All items shall be protected from rust, corrosion and mechanical damage during transportation, shipment and storage.



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- 3.6 Rust preventive on machined surfaces to be welded shall be easily removable with a petroleum solvent and the same shall not be harmful to welding.
- 3.7 Each end of flange shall be protected with the following materials:
- | | | |
|--------------------|---|------------------------------|
| Flange face | : | Wood, metal or plastic cover |
| Bevelled end | : | Wood, metal or plastic cover |
| Threaded end | : | Plastic plug |
| Socket welding end | : | Plastic cover or plug |
- 3.8 Each size of flanges, blinds, etc. shall be supplied in separate packaging's marked with the purchase order number, item code number, material specification, size and rating.



**TECHNICAL NOTES FOR
BUTT WELDED, SOCKET WELDED AND
SCREWED FITTINGS**

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ABBREVIATIONS

AARH	:	Arithmetic Average Roughness Height
ANSI	:	American National Standards Institute
API	:	American Petroleum Institute
ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society for Testing & Materials
BHN	:	Brinell Hardness Number
BHN	:	Brinell Hardness Number
CS	:	Carbon Steel
DP	:	Dye Penetrant
HAZ	:	Heat Affected Zone
HIC	:	Hydrogen Induced Cracking
IGC	:	Inter Granular Corrosion
IS	:	Indian Standard
LT	:	Low Temperature
MP	:	Magnetic Particle
MR	:	Material Requisition
MSS	:	Manufacturer's Standardisation Society
NACE	:	National Association of Corrosion Engineers
MR	:	Material Requirement
NB	:	Nominal Bore
PMI	:	Positive Material Identification
PO	:	Purchase Order
PR	:	Purchase Requisition
SMYS	:	Specified Minimum Yield Strength
SS	:	Stainless Steel



TECHNICAL NOTES
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1.0 GENERAL

1.1 Chemical composition, physical properties, tests, dimensions and tolerances, heat treatment and marking shall conform to the applicable latest codes / standards / specifications as specified in the material requisition (MR). Supplier shall strictly comply with MR / PR and no deviations shall be permitted. Post Order Concession / Deviation is not applicable.

1.2 Testing

1.2.1 Test reports shall be supplied for all mandatory tests as per the material specifications. Test reports shall also be furnished for any supplementary tests as specified in the MR & Clauses 1.7, 1.8, 1.9, 1.10 & 1.11. Material test certificates (physical properties, chemical composition & heat treatment report) shall also be furnished for fittings supplied.

1.2.2 Refer to specification no.P-ITP-011 for Inspection and Test plan for forged, seamless and welded fittings.

1.3 All fittings shall be seamless in construction unless otherwise specified. If fittings are specified as welded, the same shall conform to clause 1.7.

1.4 Outside diameters and wall thickness (unless otherwise mentioned) of butt welded fittings shall be in accordance with ASME B36.10 and ASME B36.19 as applicable.

1.5 For reducing butt weld fittings having different wall thicknesses at each end, the greater wall thickness of the fitting shall be employed and inside bore at each end shall be matched with the specified inside diameter.

1.6 Bevelled ends for all fittings shall conform to ASME B16.25. Contour of bevel shall be as follows:

Material	Wall Thickness	Weld Contour
Carbon Steel (Except Low Temp. Carbon Steel)	Up to 22 mm	Figure 2 Type A
	>22mm	Figure 3 Type A
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Up to 10 mm	Figure 4
	> 10 mm & up to 25 mm	Figure 5 Type A
	>25mm	Figure 6 Type A

1.7 Welded Fittings

1.7.1 All welded fittings shall be double welded. Inside weld projection shall not exceed 1.6 mm. Welds shall be ground smooth at least 25 mm from the ends.

1.7.2 For fittings made out of welded pipe, the welded pipe shall be double welded type & shall be manufactured with the addition of filler metal.

1.7.3 Welded tees / Lateral Tees shall not be of fabricated (stub-in / stub-on) type unless otherwise specified in the MR.

1.7.4 All welded fittings shall be normalized & 100% radiographed by X-ray on all welds made by fitting manufacturers & also on the parent materials.



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- 1.7.5 Welded pipes employed for manufacture of fittings shall be made by automatic welding only.
- 1.7.6 Specified heat treatment for carbon steel & alloy steel fittings shall be carried out again after weld repairs.
- 1.7.7 Irrespective of the material code requirement, all welded fittings indicated in the MR as "Cryo"& "LT" shall meet impact test requirements of ASME B31.3. The impact test temperature shall be -196°C & -45°C for stainless steel & carbon steel respectively unless specifically mentioned otherwise in the MR.
- 1.8 Stainless Steel Fittings
- 1.8.1 All stainless steel fittings shall be supplied in solution heat treated condition.
- 1.8.2 Solution annealing for stainless steel fittings shall be carried out again after weld repairs.
- 1.8.3 For all stainless steel fittings Inter Granular Corrosion (IGC) test shall have to be conducted as per the following:
ASTM A262 Practice "B" with acceptance criteria of "60 mils / year (max.)".
Or
ASTM A262 Practice E: The bent specimen shall be examined under 20X magnification. The acceptance criteria is that there will be no crack or fissure in the bent specimen. The bent specimen shall also be subjected to metallographic examination at 250X magnification to ensure no crack or fissure.
- 1.8.4 When specifically asked for in MR for high temperature application of some grades of austenitic stainless steel (eg. SS309, 310, 316, 316H etc.) ASTM A 262 Practice "C" with acceptance criteria of "15 mils / year" shall have to be conducted.
- 1.8.5 For the IGC test as described in Clauses 1.8.3 & 1.8.4, two sets of samples shall be drawn from each solution treatment lot, one set corresponding to the highest carbon content and other set to the highest fitting thickness. When testing is conducted as per ASTM A 262 Practice "E", the photograph of the bent specimen along with comments shall be submitted for review.
- 1.8.6 For dual grades of SS where specified, chemical composition and mechanical properties of both grades specified shall be ensured.
- 1.9 NACE / HIC Requirements
- 1.9.1 Fittings under "NACE" category or those designated as "HIC" shall meet the requirements of NACE MR-0103 unless otherwise specified.
- 1.10 Thickness / schedule lower or higher than specified for the finished product shall not be accepted.
- 1.11 The gasket contact surfaces of stub ends shall be flat with face finish specified in the requisition. Interpretation on the specified face finish is as follows:
125 AARH : Serrations with 125 to 250 μ in AARH
- 1.12 Seamless stub ends shall not have any welds on the body. Stub ends shall be long pattern type.
- 1.13 Galvanized fittings shall be coated with zinc by hot dip process conforming to IS 4736 / ASTM A153.
- 1.14 Threaded ends shall have NPT taper threads in accordance with ASME / ANSI B1.20.1 up to 1.5" NB & IS 554 from 2" to 6" NB.



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AND SCREWED FITTINGS

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- 1.15 Unless and otherwise specified in the MR, all socket welded and screwed fittings shall be in accordance with ASME B16.11 to the extent covered in the specification except for unions which shall be in accordance with MSS-SP-83.
- 1.16 Special fittings like weldolet, sockolet, sweepolet etc., the dimensions of which are not covered in ASME, MSS-SP & PLECO Standards, shall be as per manufacturer's std. Contours of these fittings shall meet the requirements of ASME B31.3. Manufacturer shall submit drawings / catalogues of these items for records after acceptance of offer.
- 1.17 Length of all long half couplings shall be 100 mm unless otherwise specified in the MR.
- 1.18 For reducers to manufacturers' standard, length of reducer shall not be less than 0.7D where D is the outside diameter of the larger end.
- 1.19 All seamless pipes employed for manufacturing of fittings shall be required to have undergone hydrostatic test to ASTM A 530. Welded pipes employed for manufacture of fittings shall be tested as given below:

Welded Pipe Employed For Manufacture Of Welded Fittings.	Test Criteria
ASTM A671 Gr. C65,70 (Cl.32) ASTM A672 Gr. C60,65,70 (Cl.12, 22) ASTM A671 Gr. CF60,65,70,66 (Cl.32) ASTM A691 Gr. ½Cr, 1 Cr, 1¼Cr, 2¼Cr, 5Cr, 9Cr (Cl.42), 91 (Cl.42)	P = 2ST / D S = 90% of SMYS. T =Norn. Wall Thickness D = 0.D. of Pipe.
API5L ASTMA358 TP 304, 304L, 304H, 318, 318L, 318H, 321,347 (Cl.1, 3, 4)	P = 2ST / D S = 85% of SMYS. T =Norn. Wall Thickness D = 0.D. of Pipe.
ASTMB725	ASTMB725
ASTM B517	ASTMB517
ASTM B514	ASTM B514

1.20 The bevel ends of all butt weld fittings shall undergo 100% MP / DP test.

1.21 Abbreviations for ends of swages and nipples shall be as follows:

PBE	:	Plain Both Ends
TBE	:	Threaded Both Ends
TOE	:	Threaded One End
TSE	:	Threaded Small End
TLE	:	Threaded Large End



- 1.22 All types of SS321 or SS347 fittings shall be in stabilized heat treated condition. Stabilizing heat treatment shall be carried out subsequent to normal solution annealing. Soaking temperature and holding time for stabilizing heat treatment shall be 900°C and 4 hours respectively.
- 1.23 For Hydrogen service fittings following special requirements shall also be met:
- a. All carbon steel fittings having wall thickness 9.53 mm (0.375") and above shall be normalised. Cold drawn fittings shall be normalised after the final cold draw pass for all thicknesses. In addition, fittings made from forgings shall have Carbon - 0.35 % max. and Silicon - 0.35 % max. The normalising heat treatment shall be a separate heating operation and not a part of the hot forming operation.
 - b. All alloy steel (Cr-Mo) fittings shall be normalised and tempered. The normalising and tempering shall be a separate heating operation and not a part of the hot forming operation. The maximum room temperature tensile strength shall be 100,000 psi.
 - c. For carbon steel fittings, hardness of weld and HAZ shall be 200 BHN (max.). For alloy steel fittings, hardness of weld and HAZ shall be 225 BHN (max.).
 - d. For all Carbon steel and Alloy steel fittings with wall thickness over 20 mm, Charpy-V Notch impact testing shall be carried out in accordance with paragraph UG-84 of ASME Section VIII, Div-1 for weld metal and base metal from the thickest item per heat of material and per heat treating batch. Impact test specimen shall be in complete heat treated condition and accordance with ASTM A370. Impact energies at -29°C shall average greater than 27J (20 ft-lb) per set of three specimens, with a minimum of 20J (15 ft-lb).
- 1.24 For all welded alloy steel fittings with mandatory requirements of heat treatment and radiography, radiography shall be performed after heat treatment.
- 1.25 All 1Cr-0.5Mo & 1.25Cr-0.5Mo fittings shall be normalized and tempered. All 2.25Cr-1Mo, 5Cr-0.5Mo, 9Cr- 1 Mo & 9Cr-1Mo-V welded fittings shall be normalized and tempered.
- 1.26 Fitting material as per ASTM A234 Gr.WP5 / WP9 / WP91, wherever specified, shall be as per 'C1.1', unless otherwise specified.
- 1.27 Materials designated as structural steel grades like IS 2062, SA 36 etc. or similar specification are not permitted for manufacture of fittings.

2.0 ACCEPTABLE DEVIATIONS

- 2.1 Seamless fittings are acceptable in place of welded fittings, however, welded fittings are not acceptable in place of seamless fittings. Forged fittings are acceptable in place of wrought fittings. However, wrought seamless fittings are acceptable in place of forgings only in case of swages.
- 2.2 Fittings of Grades SS317 of corresponding material are acceptable in place of Grades SS316 or SS316 (2.5Mo min.).
- 2.3 Fittings of Grades SS317L of corresponding material are acceptable in place of Grades SS316L or SS316L (2.5Mo min.).

3.0 MARKING AND DESPATCH

- 3.1 Each fitting shall be legibly and conspicuously stamped in accordance with the requirements of applicable standards along with special condition like "Cryo", "NACE" and "H2" etc.



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- 3.2 Steel die marking with round bottom punch may be permitted on body of butt weld CS & lower alloy steel fittings, but for SS & higher alloy steel fittings, the same should be marked by electro-etching only.
- 3.3 Paint or ink for marking shall not contain any harmful metals or metal salts such as Zinc, Lead or Copper which causes corrosive attack on heating.
- 3.4 Fittings shall be dry, clean and free of moisture, dirt and loose foreign materials of any kind.
- 3.5 Fittings shall be protected from rust, corrosion and mechanical damage during transportation, shipment and storage.
- 3.6 Rust preventive used on machined surfaces to be welded shall be easily removable with a petroleum solvent and the same shall not be harmful to welding.
- 3.7 Fittings coming under the purview of "CRYO", "NACE" & "H2"(hydrogen) shall be painted with one circumferential stripe of colour red, light purple brown, canary yellow & white respectively for easy identification. Width of stripe shall be 12mm for sizes less than 3" and 25mm for sizes 3" and above. Stripe shall be located centrally for elbows, diagonally for caps, at the larger end for reducing fittings, longitudinally for couplings and at one end near to the bevel /socket /screwed end for other fittings.
- 3.8 Each end of fitting shall be protected with a wood, metal or plastic cover.
- 3.9 Each size of fitting shall be supplied in separate packaging marked with the purchase order number, item code number, material specification, size and schedule / thickness / rating. For small quantities, fittings of different sizes may be packed in separate packing size-wise and these packing may be packed in a bigger package / container clearly identifying the contents.

4.0 REFERENCES

P-ITP-011 : Inspection & test plan for forged, seamless and welded fittings



TECHNICAL NOTES FOR GASKETS

P-SPC-408

0	21.02.2022	ISSUED AS STANDARD SPECIFICATION	PNS	SM	AD	SK
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ABBREVIATIONS

AARH	:	Arithmetic Average Roughness Height
BHN	:	Brinell Hardness Number
CS	:	Carbon Steel
DP	:	Dye Penetrant
MR	:	Material Requisition
PMI	:	Positive Material Identification
RJT	:	Ring Type Joint



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**1.0 GENERAL**

- 1.1 All gaskets shall confirm to the codes / standards and specifications given in the requisition. Supplier shall strictly comply with MR / PR stipulations and no deviations shall be permitted.
- 1.2 Process of manufacture, dimensions and tolerances not specified in requisition shall be in accordance with the requirements of the manufacturer's standards.
- 1.3 Testing
- 1.3.1 Test reports shall be supplied for all mandatory tests for gaskets as per the standards specified in the requisition.
- 1.3.2 Chemical composition and hardness of RTJ gaskets shall also be furnished in the form of test reports on samples.
- 1.3.3 For Spiral wound material following shall be furnished:
- a. Manufacturer's test certificate for filler material and spiral material as per the relevant material specifications.
 - b. Manufacturer's test certificate for raw materials and tests for compressibility / sealability & recovery as per the relevant material specifications.
- 1.3.4 PMI shall be performed as per the scope.
- 1.3.5 Refer ITP for 'Inspection & Test Plan for Gaskets'.
- 1.4 Full face gaskets shall have bolt holes punched out.
- 1.5 Filler material for spiral wound gaskets shall not have any colour or dye.
- 1.6 All spiral wound gaskets shall be supplied with Outer ring. Material of the outer ring shall be CS unless otherwise specified in the MR.
- 1.7 Inner rings shall be provided for all Spiral Wound Gaskets. For spiral wound gaskets, material of Inner Compression ring shall be same as Spiral Strip material.
- 1.8 Hardness of metallic RTJ gaskets shall not exceed the values specified below unless otherwise specified in MR:

Ring Gasket Material	Maximum Hardness (BHN)
Soft Iron	90
Carbon steel	120
5 Cr. 1/2 Mo	130
Type 304, 316, 321, 347	140
Type 304L, 316L	135
Inconel UNS N06625	200
Incoloy UNS N08825	190
Duplex SS UNS S32205, S31803	230

- 1.9 Face finish of metallic RTJ gaskets shall be 32 to 63 AARH.
- 1.10 Gaskets of different types and sizes shall be placed in separate shipping containers and each container clearly marked with the size, rating, material specification and item code.



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- 1.11 All items shall be inspected and approved by PLECO Inspector or any other agency authorized by PLECO.
- 1.12 Any additional requirements specified in the requisition, shall be fully complied with.
- 1.13 Non-metallic ring gaskets as per ASME B16.21 shall match flanges to ASME B16.5 upto 24" and to ASME B16.47B above 24" unless specified otherwise.
- 1.14 Spiral wound gasket as per ASME B16.20 shall match flanges to ASME B16.5 upto 24" and to ASME B16.47B above 24" unless specifically mentioned otherwise.
- 1.15 The following abbreviations have been used in the Material Requisition for Spiral Wound Gaskets:
- (I) : Inner Ring
 - (O) : Outer Ring
 - GRAFIL : Grafoil Filler

2.0 REFERENCES

Inspection & Test Plan for Gaskets



TECHNICAL NOTES FOR BOLTS AND NUTS

P-SPC-409

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ABBREVIATIONS

ASME	:	The American Society of Mechanical Engineers
ASTM	:	The American Society for Testing and Materials
MR	:	Material Requisition
PMI	:	Positive Material Identification
SS	:	Stainless Steel



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**1.0 GENERAL**

- 1.1 The process of manufacture, heat treatment, chemical & mechanical requirements and marking for all stud bolts, m/c bolts, jack screws & nuts shall be in accordance with the codes/standards and specifications given in the requisition. The applicable identification symbol in accordance with the material specification shall be stamped on each bolt and nut. Supplier shall strictly comply with MR/PR stipulations and no deviations shall be permitted.
- 1.2 Testing
 - 1.2.1 Test reports shall be supplied for all mandatory tests as per the relevant material specifications.
 - 1.2.2 Material test certificate shall also be furnished. (Heat Analysis, Product Analysis and Mechanical Requirement)
 - 1.2.3 PMI shall be performed as per the scope.
 - 1.2.4 Stress Rupture Test as detailed in ASTM A453 shall be carried out for all ASTM A453 bolting material irrespective of the temperature.
 - 1.2.5 Refer Inspection & Test Plan for Bolting Material.
- 1.3 All bolting shall be as per ASME B 18.2.1 for studs, M/c bolts and jackscrews and ASME B18.2.2 for nuts.
- 1.4 Threads shall be unified (UNC for up to 1" dia and 8UN for > 1" dia) as per ASME B1.1 with class 2A fit for studs, M/c bolts and jackscrews and class 2B fit for nuts.
- 1.5 Stud bolts shall be threaded full length with two heavy hexagonal nuts unless otherwise specified. Length tolerance shall be in accordance with the requirement of Table D2 of Annexure-D of ASME B 16.5.
- 1.6 The nuts shall be double chamfered, semi-finished, heavy hexagonal type and shall be made by the hot forged process and stamped as per respective material specification.
- 1.7 Heads of jackscrews and m/c bolts shall be heavy hexagonal type. Jackscrew end shall be rounded.
- 1.8 Each size of studs & m/c bolts with nuts and jackscrews shall be supplied in separate containers marked with size and material specifications. 'CRYO' shall be marked additionally in case 'CRYO' is specified in the requisition.
- 1.9 All items shall be inspected and approved (stage-wise) by PLECO inspector or any other agency authorized by PLECO.
- 1.10 The heat treatment for stud bolts & nuts shall be as per code unless mentioned otherwise.
- 1.11 All austenitic stainless steel bolts, nuts, screws shall be supplied in solution annealed condition unless specified otherwise in the material specification.
- 1.12 Any additional requirements specified in the requisition shall be fully complied with.
- 1.13 Stud bolts, nuts & jackscrews shall be impact tested wherever specified in the material specification and also where the material specification is indicated as "CRYO". For S.S. nuts and bolts minimum impact energy absorption shall be 27 Joules and test temperature shall be -196°C unless mentioned otherwise. For other materials impact energy and test shall be as per respective code.
- 1.14 Bolts/nuts of material of construction B7M / 2HM shall be 100% Hardness tested as per supplementary requirement S3 of ASTM A193.



- 1.15 When specified as galvanized, the studs, M/C bolts and nuts shall be 'hot dip zinc coated' in accordance with requirements of 'class C' of 'ASTM A 153'. As an alternative, electro-galvanizing as per IS 1573, 'Service Grade Number 2' is also acceptable.
- 1.16 All Stud Bolts of Bolt diameter size 1" and above shall be provided with three nuts irrespective of whatever has been specified elsewhere in the MR.
- 1.17 Bolting shall be protected by non-corrosive oil or grease before dispatch to prevent rusting.
- 1.18 For stud bolt diameters not covered in ASTM A320, mechanical properties shall match the values specified for the matching grades and stud bolt diameters in ASTM A193.
- 1.19 In cases where the lengths of Stud / Machine bolts specified in the MR are not multiples of 0.25", the length supplied shall be equal to the specified length rounded up to the next higher 0.25".
- 1.20 All Specialties mentioned in item description like "LT", "H2", etc. other than "CRYO" & "NACE" shall be ignored.

2.0 ACCEPTABLE DEVIATIONS

- 2.1 'Nuts' to ASTM A194 Gr.7 are acceptable in place of ASTM A194 Gr.4.
- 2.2 Stud Bolts to ASTM A453 Gr.660 CLB are acceptable in lieu of ASTM A453 Gr.660 Cl.A and vice versa.

3.0 REFERENCES

Inspection & Test Plan for Bolting Material



STANDARD SPECIFICATION FOR PAINTING

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STANDARD SPECIFICATION FOR PAINTING

P-SPC-410

0	04.01.22	ISSUED AS STANDARD SPECIFICATION	RK	MD	AD	SK
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1.0 GENERAL

- 1.1 This technical specification shall be applicable for the work covered by the contract, and without prejudice to the provisions of various codes of practice, standard specifications etc. It is understood that contractor shall carry out the work in all respects with the best quality of materials and workmanship and in accordance with the best engineering practice and instructions of Engineer-In-Charge.

Wherever it is stated in the specification that a specific material is to be supplied or a specific work is to be done, it shall be deemed that the same shall be supplied or carried out by the contractor. Any deviation from this standard without written deviation permit from appropriate authority will result in rejection of job.

1.2 SCOPE

- 1.2.1 Scope of work covered in the specification shall include, without being limited to the following.

- 1.2.2 This specification defines the requirements for surface preparation, selection and application of primers and paints on external surfaces of equipment, vessels, machinery, piping, ducts, steel structures, external & internal protection of storage tanks for all services, MS Chimney without Refractory lining and Flare lines etc. The items listed in the heading of tables of paint systems is indicative only, however, the contractor is fully responsible for carrying out all the necessary painting, coating and lining on external and internal surfaces as per the tender requirement.

1.2.3 Extent of Work

- 1.2.3.1 The following surfaces and materials shall require shop, pre-erection and field painting:

- a. All un-insulated C.S. & A.S. equipment like columns, vessels, drums, storage tanks (both external & internal surfaces), heat exchangers, pumps, compressors, electrical panels and motors etc.
- b. All un-insulated carbon and low alloy piping, fittings and valves (including painting of identification marks), furnace ducts and stacks.
- c. All items contained in a package unit as necessary.
- d. All structural steel work, pipe, structural steel supports, walkways, handrails, ladders, platforms etc.
- e. Flare lines, external surfaces of MS chimney with or without refractory lining and internal surfaces of MS chimney without refractory lining.
- f. Identification colour bands on all piping as required including insulated aluminium clad, galvanised, SS and nonferrous piping.
- g. Identification lettering/numbering on all painted surfaces of equipment/piping insulated aluminium clad, galvanized, SS and non-ferrous piping.
- h. Marking / identification signs on painted surfaces of equipment/piping including hazardous service.

- i. Supply of all primers, paints and all other materials required for painting (other than Owner supplied materials)
- j. Over insulation surface of equipments and pipes wherever required.
- k. Painting under insulation for carbon steel, alloy steel and stainless steel as specified.
- l. Painting of pre-erection/fabrication and Shop primer.
- m. Repair work of damaged pre-erection/fabrication and shop primer and weld joints in the field/site before and after erection as required.
- n. All CS Piping, equipments, storage tanks and internal surfaces of RCC tanks in ETP plant.

1.2.3.2 The following surfaces and materials shall not require painting in general. However, if there is any specific requirement by the owner, the same shall be painted as per the relevant specifications:

- a. Un-insulated austenitic stainless steel.
- b. Plastic and/or plastic coated materials
- c. Non-ferrous materials like aluminum.

1.2.4 Documents

1.2.4.1 The contractor shall perform the work in accordance with the following documents issued to him for execution of work.

- a. Bill of quantities for piping, equipment, machinery and structures etc.
- b. Piping Line List.
- e. Painting specifications including special civil defence requirements.

1.2.5 Unless otherwise instructed, final painting on pre-erection/ shop primed pipes and equipments shall be painted in the field, only after the mechanical completion, testing on systems are completed as well as after completion of steam purging wherever required.

1.2.6 Changes and deviations required for any specific job due to clients requirement or otherwise shall be referred to PLECO for deviation permit.

2.0 CODES & STANDARDS

Without prejudice to the specifications of the contract, the following codes and standards shall be followed for the work covered by this contract.

IS: 5 Colors for ready mixed paints and enamels.

RAL DUTCH International Standard for colour shade (Dutch Standard)

IS: 101 Methods of test for ready mixed paints and enamels,

IS: 161 Heat resistant paints.

- IS: 2074 Specifications for ready mixed paint, red oxide zinc chrome priming.
- IS: 2379 Color code for identification of pipelines.
- IS: 2932 Specification for enamel, synthetic, exterior (a) undercoating. (b) Finishing.

3.0 CONDITIONS OF DELIVERY

Packaging

Every recipient will be fitted with a hermetically-sealed lid with an opening that is sufficiently large to allow the contents to be stirred: the outside and inside are protected against oxidation, and, the lid, are marked with a strip of color identical to the contents.

4.0 COMPOSITION OF THE PAINT PRODUCTS USED

a) Quality

The composition and quality of the products may not differ from batch to batch. A batch is all of the products of a specified manufacture. If the analyses of products bring to light that the composition does not conform to the specifications of the paint manufacturer, the OWNER may refuse to use this batch of products. The paint products must comply with the following conditions

- They must have the viscosity necessary for the described use and the established condition: use of the brush - paint roller (spray gun only for special cases and in the workshop)

b) Quality control - Sampling

While the works are in progress on the construction site, the OWNER may carry out sampling on the paint being used for the purpose of checking conformity. The paint products must be made available free of charge to the laboratory or the approved supervisory body in sufficient quantities so that all the tests can be carried out on the same batch.

If analyses reveal a non-conformity in the composition of the products used (tolerance of $\pm 3\%$ of the dosage of every component), the OWNER may refuse application of the product under consideration, halt the work and have the nonconforming product already applied removed.

Before proceeding the work, a product that does conform will be required. The only Purpose of the analysis is to reveal any nonconformity of the composition of the products. Their purpose is therefore not to assess the quality of the different components. The analyses concerned are not acceptance tests of the products supplied and in no way affect the obligations of the contractor specified in the contract towards the OWNER.

5.0 IDENTIFICATION

Every recipient will bear the following information:

- Name of the manufacturer
- Date and number of manufacture
- Name of the product type
- Batch no
- Net weight of the produced or the contents of the recipient
- Date of the expiry.

At the time of delivery, this packaging must bear labels in conformity with the legal stipulations in force.

Leaving the site after work

After completion of a job a general clean-up shall be carried out by the Contractor to remove all debris, materials or irregularities that his work has brought to the site so that it is left tidy:

The restoration work includes among other things:

- The removal of abrasives.
- The removal of the different protective coverings.
- The Contractor will make the required repairs to any damage after refitting the supports.
- The removal of paint and cleaning of the stains on the floor.

6.0 SURFACE PREPARATION STANDARDS

Following latest edition of standards shall be followed for surface preparations:

1. Swedish Standard Institution- SIS-05 5900-1967/ISO 8501-1
2. Steel Structures Painting Council, U.S.A. (Surface Preparation Specifications (SSPC-SP)
3. British Standards Institution (Surface Finish of Blast-cleaned for Painting) BS-4232.
4. National Association of Corrosion Engineers. U.S.A. (NACE).
5. IS-1477-1971 (Part-1) - Code of Practice for Painting of Ferrous metals in Buildings. (Part 1, Pre-treatment)
 - a) The contractor shall arrange, at his own cost to keep a set of latest edition of above standards and codes at site.
 - b) The paint manufacturer's instruction shall be followed as far as practicable at all times. Particular attention shall be paid to the following:

- Proper storage to avoid exposure as well as extremes of temperature.
 - Surface preparation prior to painting.
 - Mixing and thinning.
 - Application of paints and the recommended limit on time intervals between coats.
- c) Any painting work (including surface preparation) on piping or equipment shall be commenced only after the system tests have been completed and clearance for taking up painting work is given by the OWNER, who may, however, at his discretion authorize in writing, the taking up of surface preparation or painting work in any specific location, even prior to completion of system test.

7.0 PREPARATION OF THE SURFACES

7.1 General Specifications

The cases that occur in practice on building sites, with regard to painted surfaces, can be broken down as follows:

- Material of which the oxide content disappears by natural oxidation.
- Material that has already been covered with a layer of paint in the workshop.
- Material that is covered with old paint layers that show different degrees of weathering.

Good preparation of surface is the best guarantee for good anti-corrosion protection.

Paintwork may never begin until the surface to be treated is dry and is independent of the base coat and cleared of dirt, dust, rust, scale, grease, salt attack, cement powder, cement mud-scale, sand, oil, etc.

Based on the environmental conditions of coastal and saline nature, the Painting specification for station pipes defines the complete requirements like:

- Surface preparation standards like NACE etc.
- Sand blasting process
- Color Codes for piping
- Paint materials types and their DFT measurement.
- Selection and application of paints on external surfaces.

The pipeline passes through the coastal and marine environment, the **Table-4** of this specification to be followed for the painting works.

The method of preparation of the surface will be implemented in accordance with the preparation methods described below:

- Bright blast-cleaning
- Mechanical or Power tool cleaning
- Manual or hand tool cleaning

The Contractor should have the required material at his disposal to clean the surfaces to be coated thoroughly in accordance with the preparation methods regardless of the form or the condition of such surfaces. The cleaning devices that might be damaged during the surface preparation shall be screened off by the Contractor.

7.2 Air blast cleaning with abrasive

Before beginning cleaning by blasting, the person carrying out the work will take the following measures:

- Clear the steel surface of oil and/or grease;
- Ensure that each flange collar (section where the sealing is applied) is properly screened off against the blasting and the subsequent works;
- Check that no blasting grains can act into the pipes during this process. Any openings not sealed off must be screened off;
- Where there are valves, regulators and other devices, the manufacturer's identification plate will be dismantled so that all surfaces can be treated. The plate will then be put back again.
- Screen off all non-metal structures such as rubber where there is a filter;
- With valves, operators and other devices, care should be taken to ensure that no metal filings or paint get into the apparatus;
- The OWNER reserves the right to carry out part or all of these works himself.

To prevent rust forming quickly as the result of humidity on the blasted surface, cleaning by blasting may only be carried out when the temperature of the steel surface is at least 3°C higher than the dew-point of the ambient air.

Blasting may not be carried out if the relative degree of humidity exceeds 80%. The choice of the type of blasting medium used depends on local circumstances such as the possible presence of gas and the material to be blasted.

The abrasive to be used must conform to the local law i.e. it may contain no carbon and less than 1% free silicon dioxide. The Sa 3 will always be requested and must at least reach Sa 2½ during the initial stage of the paintwork. For blasting followed by metallization, the surface preparation degree to be achieved is always Sa 3. The degree of cleanliness to be obtained will be inspected in accordance with the Swedish standard SVENSK STANDARD ISO 8501-1-1988 SIS 05.5900.

- Sa 3: surface blasted down to the bare metal; when the surface is inspected with a magnifying glass, scale, rust and foreign bodies must be completely removed and it should be possible to raise a metallic -shine on the treated surface.
- Sa 2 1/2: blasted very carefully. Scale, rust and foreign bodies must be removed in such a way that anything left behind will only be visible as nuances (shading) or strips.

The blast-cleaning will be carried out by means of compressed air free of water and oil.

After the blasting and before painting, the surface should be completely cleaned of blasting material and so forth with a soft brush, a dry cloth or dry compressed air.

7.3 Mechanical or Power tool cleaning

If sandblasting is not permitted or if the metal structures are not easily accessible for blasting or blasting for one reason or other is technically unfeasible, mechanical de rusting can be used instead. With mechanical cleaning by means of chipping, rotating steel brushes and sanding discs, a degree of cleanliness St. 3 should be reached.

St 3: removal of the old paint layers of which the adhesion leaves something to be desired and/or of which the paint layer no longer fulfills the requirements.

If parts are present that are so corroded that St 3 is difficult to achieve, this should be notified to the OWNER representative prior to the start of the works.

N.B:

St. 3: means removal of every old paint layer. Retouching means local polishing with St. 3 or Sa 3 followed by application of the desired painting system.

After mechanical cleaning, the surface should be made dust-free with a cloth or a soft brush, washed with an organic solvent and thoroughly dried off with a dry cloth (e.g. with 1.1.1. Trichloroethane such as Solvethane, Chloroethene).

7.4 Manual or Hand tool cleaning

Manual derusting with the aid of scrapers, steel brushes, sandpaper etc. shall only be permitted in exceptional cases for local repairs. Any deviation there from must be requested from the OWNER/ OWNER 's Representative.

With manual derusting, a surface preparation degree St 3 must be obtained. The length of the handles of the equipment used may not exceed 50 cm.

7.5 Preparation of a surface covered with a layer of paint in the workshop.

This layer is in general applied by the manufacturer, for example, on valves, regulators etc. Layers of this kind will be checked for their proper adhesion in accordance with ASTM D 3359, method A (Standard Test Method for measuring adhesion by tape test). The adhesion should be at least.

If the paint layer shows less adhesion or is incompatible with the rest of the system it should be completely removed. If the paint layer is not removed, the Contractor accepts it in the state in which the coating is found and the guarantee remains in force. The adhesion does not have to be examined if system 63 has already been applied in the workshop on behalf of the OWNER.

The Contractor, who must provide for the protection on the construction site, must therefore obtain the information regarding the treatment of the surface and the quality of the paint that was used and must, moreover, examine the adhesion of the layer on the construction site, the percentage of damage and weathering as well as the value of the preparation of the surface in the workshop together with the thickness thereof that must be supplemented if necessary.

- a) Galvanized surface

Galvanized surfaces, both old and new will be carefully roughened up. Every foreign body (concrete splatters, chalk marks, grease and oil stains, etc.) will be removed. Thereafter, rub the surfaces with abundant water and, if necessary, with cleaning products.

To this end, nylon brushes will be used for every kind of dirt as well as for removing zinc salt residue. Thereafter, the surfaces will be treated in accordance with system 21. Where the zinc layer is lacking, it will be derusted manually to a degree of cleanliness St 3, after which a primer coat will be applied in accordance with system 22.

b) Metallized surfaces treated with an impregnation layer

- Degrease with the desired degreasing product:
- Clean under high pressure or with a product prescribed by the paint supplier.

If the paint layer adheres well and is applied on a clean base, the painting system described may be continued. If the percentage of damage and weathering does not exceed 5 % m. retouching may be considered. These partial repairs will be carried out.

If on the other hand, the percentage of damage does exceed 5 %/m or if the layer applied in the workshop comes loose the Contractor must draw the attention of the OWNER to this and carry out the complete application system.

7.6 Preparation of surfaces covered with earlier paint layers that show different degrees of weathering.

If the surfaces do not show deep weathering limited to the spread of rust by small pitted areas or non-penetrative rust in spots, it will very often be sufficient to clean the surfaces with abrasives or with an abrasive disc, then to rub them down with steel wool, remove the dust and wash off. If thick rust appears, in spots, scale rust and active rust canker, this should be removed with needle hammers or stripped away directly by blasting, removing the dust and washing off.

7.7 Preparation of concrete or cement plaster surfaces

Remove unsound paint layers and loose components with scrapers, blades or rotating steel brushes. Thoroughly clean the entire surface with water containing ammonia. Thoroughly remove moss, algae and fungal growths. Where these growths have been removed, treat the area with a fungicide in accordance with the instructions for use.

Once the entire area is completely dry, brush off the dead residue of moss, algae and fungus with a hard brush. In the case of reinforcement steel that has been laid bare, remove as rust, dust and grease as possible and treat with a primer coat. When painting concrete surfaces, they must first be checked for cracks. Cracks larger than 0.3 mm must be repaired with an appropriate system in accordance with the type and extent of the repairs (e.g. injection with epoxy mortar). Repair damage such as cracks and bursts to concrete parts with a two-component mortar or preferably with micro-mortars. Finally check the alkalinity of the surface with the aid of litmus paper and neutralize it if necessary.

7.8 Use of solvents

It is sometimes necessary to use solvents when the surfaces to be painted are streaked with grease or oil. In this case a suitable organic solvent should be applied. The operation should be carried out with the aid of clean brushes or rags and clean solvent.

All the legal specifications in connection with solvents etc. must be adhered to. The OWNER/OWNER's Representative will be informed in advance of any toxicity or flammability. All measures must be taken to prevent any risk of fire and to nick out any possibility of poisoning (ventilation). The Contractor will provide drip collectors to keep the environment free of pollution.

7.9 Condition of the metal after stripping

The Contractor must call in a representative of the OWNER/OWNER's representative or of the Approved supervisory Body responsible for checking the condition of the metal during stripping and informing the OWNER/OWNER's representative immediately of any damage that he might have noticed.

- Deep corrosion of the plates - rivets - bolts
- Faulty welding
- Fittings that appear to be dangerous because of their age.

7.10 Removing coating from surface pipelines

The Contractor must have the equipment necessary for the removal of asphalt from the pipe without damaging the latter (scratching, impact, etc.). The Contractor undertakes to carry out the work in accordance with an approved procedure.

TABLE-1 (FOR CLAUSE 7.0)
SURFACE PREPARATION STANDARDS

SL. NO.	DESCRIPTION	VARIOUS INTERNATIONAL STANDARDS (EQUIVALENT)			REMARKS
		ISO 8501-1/ SIS-05 59 00	SSPC-SP, USA	NACE, USA	
1	<p>Manual or hand tool cleaning</p> <p>Removal of loose rust, loose mill scale and loose paint, chipping, scrapping, standing and wire brushing. Surface should have a faint metallic sheen</p>	ST.2	SSPC-SP-2	-	<p>This method is applied when the surface is exposed to normal atmospheric conditions when other methods cannot be adopted and also for spot cleaning during maintenance painting.</p>
2	<p>Mechanical or power tool cleaning</p> <p>Removal of loose rust loose mill scale and loose paint to degree specified by power tool chipping, de-scaling, sanding, wire brushing and grinding, after removal of dust, surface should have a pronounced metallic sheen.</p>	ST.3	SSPC-SP-3	-	
3	<p>Dry abrasive Blast cleaning</p> <p>There are four common grades of blast cleaning</p>				

3.1	<p align="center">White metal</p> <p>Blast cleaning to white metal cleanliness. Removal of all visible rust. Mill scale, paint & foreign matter 100% cleanliness with desired surface profile.</p>	SA 3	SSPC-SP-5	NACE#1	<p>Where extremely clean surface can be expected for prolong life of paint system.</p>
3.2	<p align="center">Near white metal</p> <p>Blast cleaning to near white metal cleanliness, until at least 95% of each element of surface area is free of all visible residues with desired surface profile.</p>	SA 2½	SSPC-SP-10	NACE#2	<p>The minimum requirement for chemically resistant paint systems such as epoxy, vinyl, polyurethane based and inorganic zinc silicate paints, also for conventional paint systems used under fairly corrosive conditions to obtain desired life of paint system.</p>
3.3	<p align="center">Commercial Blast</p> <p>Blast cleaning until at least two-third of each element of surface area is free of all visible residues with desired surface profile.</p>	SA 2	SSPC-SP-6	NO.3	<p>For steel required to be painted with conventional paints for exposure to mildly corrosive atmosphere for longer life of the paint systems.</p>
3.4	<p align="center">Brush-off Blast</p> <p>Blast cleaning to white metal cleanliness, removal of all visible rust, mill scale, paint & foreign matter. Surface profile is not so important.</p>	SA 1	SSPC-SP-7	NO.4	

8.0 METALLISATION

8.1 Applying the metallization

Metallization must be carried out in accordance with ISO 2063,

Metallization is carried out as rapidly as possible after blasting in order to limit corrosion of the pipes (max. 3 hours later). With metallization, a surface preparation degree Sa 3 is compulsory. The roughness of the blasted surfaces should be from 25 to 50µ R_{Max}.

- The metallizing is always carried out on dry parts in good weather conditions (maximum relative humidity 80 %);
- For metallization, a wire composed of 85 % zinc and 15 % aluminum with a minimum guaranteed degree of purity of 99.5 % is used (subject to other specifications). The application thereof is always carried out in accordance with the conditions of the manufacturer and may at all times be submitted to the OWNER's representative.
- The sealant should be applied maximum 3 hours after metallization.
- The sealant must be thinned and applied as per the present specifications. A visual inspection whereby the sealant completely covers the metallization will suffice here.
- When evaluating the metallization, a negative deviation from the minimum coating thickness, to 80 μ for 20% of the measurements will be permitted.

9.0 COATING PROCEDURE AND APPLICATION

9.1 Conditions for carrying out paintwork

Painting may not be carried out in unsuitable conditions.

All preparatory work and painting may only be carried out in dry weather and at a minimum temperature of 10°C, except for special cases requested by the OWNER's Representative.

Unless otherwise stipulated in the specifications of the paint supplier, application of the paint is forbidden if it is forecast that the temperature will fall to below 0°C before the paint is dry. The temperature of the surface to be painted must be at least 3°C higher than the dew point of the ambient air. Application of the paint is also not permitted if there is a danger that the coat of paint will not be dry before dew or condensation sets in.

The work must be stopped:

- If the temperature of the surface to be painted is higher than that described by the supplier.
- In rain, snow, mist or fog or when the relative humidity is higher than 80 %.

Coats that have not yet dried and have been exposed to frost, mist, snow or rain and might thereby be damaged must be removed after drying and the surfaces must be repainted at the expense of the Contractor.

Working in direct sunlight or in hot weather must be avoided,

The first coat of paint must be applied maximum 3 hours after the preparation of the surface of the relative humidity of the air is between 50% and 80%. This time span may be increased to 6 hours if the relative humidity is less than 50%. In all cases, the preparation of the surface must exhibit degree Sa 3 and at the very least the appearance of degree Sa 2 ½ at the time of painting.

The coats of paint may only be applied on carefully cleaned surfaces that must be dry and free of grease and dust.

9.2 Special conditions

Painting may be carried out when the Contractor can be sure that the instructions of the paint supplier have been scrupulously followed with regard to the parameters in the following (non-exhaustive) list:

- Ambient temperature.
- Surface temperature.
- Relative humidity.
- Dew point.
- Drying times.

The Contractor must in this respect be able to produce the instructions for the paint on the site. The OWNER/CONSULTANT will guarantee 100% supervision in this regard during the execution of the work.

In addition, the paintwork may only be carried out to a minimum ambient temperature of 5°C and/or to a maximum relative degree of humidity of 85 %. Application of the paint is also not permitted if there is a danger that the coat of paint will not be dry before dew or condensation sets in.

10.0 PAINT MATERIAL

Manufacturers shall furnish the characteristics of all paints indicating the suitability for the required service conditions. Primer and finish coats shall be of class-I quality and shall conform to the following:

a) Primer (P-1)

Red oxide Zinc Chromate Primer

Type and Composition	Single pack, Modified phenolic alkyd medium pigmented with red oxide and zinc chromate.
Volume solids	30 - 35% (min)
DFT	25 microns/coat (min)
Covering capacity	12 - 13 M ² /Lit/coat

b) Primer (P-2)

High build chlorinated rubber zinc phosphate primer

Type and Composition	Single pack, Air Drying Chlorinated rubber medium Plasticized with unsaponifiable plasticiser pigmented with zinc phosphate
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	Volume solids	35 - 40% (min)
	DFT	30 - 40 microns/coat (min)
	Covering capacity	7 - 8 M ² /Lit/Coat
c)	Primer (P-3)	
	High build zinc phosphate primer	
	Type and Composition	Single Pack, Synthetic medium, pigmented with zinc phosphate.
	Volume solids	40 - 45% (min)
	DFT	35 - 50 microns/coat (min)
	Covering capacity	10 - 12 M ² /Lit/coat
	Heat resistance Upto 80 °C (dry)	
d)	Primer (P-4)	
	Etch Primer / Wash Primer	
	Type and Composition	Two pack Poly vinyl butyral resin medium cured with phosphoric acid solution pigmented with zinc tetroxy chromate.
	Volume solids	7 - 8% (min)
	DFT	8 - 10 microns/coat (min)
	Covering capacity	7 - 8 M ² /lit/coat
e)	Primer (P-5)	
	Epoxy Zinc Chromate Primer	
	Type and Composition	Two packs, Polyamide cured epoxy resin medium pigmented with zinc chromate.
	Volume solids	40 % (min)
	DFT	35 microns/coat (min)
	Covering capacity	11 - 12 M ² /lit/Coat
f)	Primer (P-6)	
	Epoxy Zinc Phosphate Primer	
	Type and Composition	Two packs, Polyamide cured Epoxy resin medium pigmented with zinc phosphate.
	Volume solids	40% (min)

	DFT	35 - 50 microns/coat (min)
	Covering capacity	11 - 12 M ² /lit/coat
g)	Primer (P-7)	
	Epoxy high build M10 Paint (Intermediate Coat)	
	Type and composition	two pack Poly Polyamide cured epoxy resin medium pigmented with micaceous iron oxide. Volume solids 7- 8%
	Volume Solids	50% (min)
	DFT	100 microns/coat (min)
	Covering capacity	5.0 M ² /lit/coat
h)	Primer (P-8)	
	Epoxy Red Oxide zinc phosphate primer	
	Type and Composition	two pack. Polyamine cured epoxy resin pigmented with Red oxide and Zinc phosphate.
	Volume solids	42% (min)
	DFT	30 microns/coat (min)
	Covering capacity	13 - 14 M ² /lit/coat
i)	Primer (P-9)	
	Epoxy based tie coat (suitable for conventional alkyd based coating prior to application of acrylic polyurethane epoxy finishing coat)	
	Type and Composition	Two packs, Polyamide cured epoxy resin medium suitably pigmented.
	Volume solids	50 - 60% (min)
	DFT	50 microns/coat (min)
	Covering capacity	10 - 12 M ² /Lit/Coat
j)	Finish Coats (F-1)	
	Synthetic Enamel	
	Type and Composition	Single pack, Alkyd medium pigmented with superior quality water and weather resistant pigments
	Volume solids	30 - 40% (min)
	DFT	20 - 25 microns/coat
	Covering capacity	16 - 18 M ² /lit/Coat
k)	Finish coat (F-2)	

Acrylic Polyurethane paint

Type and Composition	Two pack, Acrylic resin and iso-cyanate hardener suitably pigmented.
Volume Solids	40% (min)
DFT	30 - 40 microns / coat
Covering Capacity	10 - 12 M ² /lit/ coat

l) Finish Coat (F-3)

Chlorinated Rubber Paint

Type and Composition	Single pack, Plasticised chlorinated rubber medium with chemical & weather resistant pigments.
Volume solids	40% (min)
DFT	30 - 40 microns/coat (min)
Covering capacity	8 - 10 M ² /lit /coat

m) Finish Coat (F-4)

High build chlorinated rubber M10 paint.

Type and Composition	Single pack Chlorinated rubber based high build pigmented with micaceous iron oxide.
Volume solids	40 - 50% (min)
DFT	65 - 75 microns/coat
Covering capacity	6.0 - 7.0 M ² /lit/coat

n) Finish coat (F-5)

Chemical Resistant Phenolic based Enamel

Type and Composition	Single pack phenolic medium suitably pigmented.
Volume solids	35 - 40% (min)
DFT	25 microns/ coat
Covering capacity	15.0 M ² /lit/coat

o) Finish Coat (F-6)

Epoxy High Building Coating

Type and Composition	Two pack. Polyamide-amine cured epoxy resin medium suitably pigmented.
Volume solids	60 - 65% (min)

	DFT	100 microns/coat (min)
	Covering capacity	6.0 - 6.5 M ² /lit/coat
p)	Finish Coat (F-7)	
	High build Coal Tar Epoxy	
	Type and Composition	Two pack, Polyamine cured epoxy resin blended with Coal Tar.
	Volume solids	65% (min)
	DFT	100 - 125 microns/coat
	Covering capacity	6.0 - 6.5 M ² /lit/coat
q)	Finish Coat (F-8)	
	Self-priming epoxy high build coating (complete rust control coating)	
	Type and Composition	Two packs. Polyamide-amine cured epoxy resin suitably pigmented. Capable of adhering to manually prepared surface and old coatings.
	Volume solids	65 - 80% (min)
	DFT	125 - 150 microns/coat
	Covering capacity	4 - 5 M ² /lit/coat
r)	Finish Coat (F-9)	
	Inorganic Zinc Silicate coating	
	Type and Composition	Two packs, self-cured solvent based inorganic zinc silicate coating.
	Volume solids	60% (min)
	DFT	65 - 75 microns/coat
	Covering capacity	8 - 9 M ² /lit/coat
s)	Finish coat (F-10)	
	High build Black	
	Type and Composition	Single pack. Reinforced bituminous composition phenol based resin.
	Volume solids	55 - 60% (min)
	DFT	100 microns/coat (min)
	Covering capacity	5.5 - 6.0 M ² /lit/coat

- t) Finish Coat (F-11)
Heat Resistant Aluminium Paint Suitable up to 250°C.
- | | |
|----------------------|---|
| Type and Composition | Dual container (paste & medium). Heat resistant spec varnish medium combined with aluminium flakes. |
| Volume solids | 20 - 25% (min) |
| DFT | 20 microns/coat (min) |
| Covering capacity | 10 - 12 M ² /lit/coat |
- u) Finish Coat (F-12)
Heat Resistant Silicon Paint suitable up to 400° C.
- | | |
|----------------------|---|
| Type and Composition | Single pack Silicone resin based with aluminium flakes. |
| Volume solids | 20 - 25% (min) |
| DFT | 20 microns/coat (min) |
| Covering capacity | 10 - 12 M ² /lit/coat |
- v) Finish Coat (F-13)
Synthetic Rubber Based Aluminium Paint Suitable up to 1508C.
- | | |
|----------------------|--|
| Type and Composition | Single Pack, Synthetic medium rubber medium combined with leafing Aluminium, |
| DFT | 25 microns/coat (min) |
| Covering capacity | 9.5 M ² /lit/coat |

Notes:

- 1 Covering capacity and DFT depends on method of application Covering capacity specified above is theoretical. Allowing the losses during application, min specified DFT should be maintained.
2. All paints shall be applied in accordance with manufacturer's instructions for surface preparation, intervals, curing and application. The surface preparation quality and workmanship should be ensured.
3. Selected chlorinated rubber paint should have resistance to corrosive atmosphere and suitable for marine environment,
- 4 All primers and finish coats should be cold cured and air-drying unless otherwise specified.
5. Technical data sheets for all paints shall be supplied at the time of submission of quotations.

6. In case of use of epoxy tie coat, manufacturer should demonstrate satisfactory test for inter coat adhesion. In case of limited availability of epoxy tie coat (P-9) alternate system may be used taking into the service requirement of the system.
7. In case of F-6, F-9, F-1 1 & F-1 2 Finish Coats, No Primer are required.

11.0 MANUFACTURERS

The paints shall conform to the specifications given above and Class-I quality in their products range of any of the-following manufacturer or other approved vendors:

- i) Asian Paints (India) Ltd.
- ii) Bombay Paints
- iii) Berger Paints India Ltd.
- iv) Akzo Nobel
- v) Jenson & Nicholson
- vi) Shalimar Paints

STORAGE

All paints and painting material shall be stored only in rooms to be provided by contractor and approved by OWNER/ OWNER 's Representative for the purpose. All necessary precautions shall be taken to prevent fire. The storage building shall preferably be separate from adjacent, building.

A signboard bearing the words given below shall be clearly displayed outside:
PAINT STORAGE No NAKED LIGHT highly -inflammable

12.0 COLOR CODE FOR PIPING:

- i) For identification of pipelines, the color code as per Table -1 shall be used.
- ii) The color code scheme is intended for identification of the individual group of the pipeline. The system of color coding consists of a ground color and color bands superimposed on it.
- iii) Colors (Ground) as given in Table-2 shall be applied throughout the entire length of un insulated pipes, on the metal cladding & on surfaces. Ground color coating of minimum 2m length or of adequate length not to be mistaken as color band shall be applied at places requiring color bands. Color bands shall be applied as per approved procedure.
- iv) Line coating shall meet DIN 30670 standard for external coating and API 5L RP – 2 for internal coating.
- v) The thickness for the epoxy should be 180 microns, adhesive 200 microns and balance should be PE .
- vi) The minimum coating thickness on weld seam shall be 3.2 mm and minimum coating thickness on body should be 3.2.
- vii) Minimum thickness for liquid epoxy for internal coating should be 100 ± 20 microns.
Max design temperature for coating should be considered +80 °C.

COLOR CODE:

- A) Ball Valve (Above Ground) : Off White
- B) Globe Valve (Above Ground) : Oxford Blue-RAL 5005, IS-519941005

- C) Check Valve(Above Ground) : Oxford Blue-RAL 5005, IS-519941005
- D) Launcher / Receiver : Yellow Golden
- E) Jib Crane / Trolley : Yellow Golden
- F) All underground valves shall have epoxy base coating after surface finish of SA 2:5
- G) Valves and above ground pipes need to be properly blasted to achieve surface finish of Sa 2:5 before the application of paints.

Table 12.1 Colour Coding Scheme for Pipes and Equipment

Sl. No.	Description	Ground Color	First Color Band	Second Color Band
1	COMPRESSED AIR			
a)	Plant Air	Sky Blue	Silver Grey	-
b)	Instrument Air	Sea Green	Black	-
2	GASES			
a)	Charge Gas	Canary Yellow	Signal Red	Smoke Grey
b)	Regeneration Gas	Canary Yellow	White	Dark Violet
c)	Residue Gas	Canary Yellow	White	French Blue
d)	LPG	Canary Yellow	Brilliant Green	White
e)	Acetylene	Canary Yellow	Dark violet	-
	Flare Lines	Heat resistant aluminium		
f)	Fire water and Foam & Extinguisher	Post office red		
3	ALL EQUIPMENT			
a)	Vessels. Columns, exchangers, etc. containing non- hazardous fluids.	Light Grey		
b)	Base Frame/Structure	Black		
b)	All equipment containing hazardous fluids	Canary Yellow		

c)	Pipe carrying hazardous fluids	Bar is to be replaced by Hazardous Marking as per IS:2379 Clause 7.1C		
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IDENTIFICATION SIGN

- i) Colors of arrows shall be black or white and in contrast to the color on which they are superimposed.
- ii) Product names shall be marked at pump inlet, outlet and battery limit in a suitable size as approved by OWNER.
- iii) Size of arrow shall be either of the following:
 - a) Color Bands

Minimum width of color band shall be as per approved procedure.
 - b) Whenever it is required by the OWNER to indicate that a pipeline carries a hazardous material, a hazard marking of diagonal stripes of black and golden, yellow as per IS:2379 shall be painted on the ground color.

IDENTIFICATION OF EQUIPMENT

All equipment shall be stenciled in black or white on each vessels, column, equipment, and painting as per approved procedure.

INSPECTION AND TESTING

1. All painting materials including primers and thinners brought to site by contractor for application shall be procured directly from manufactures as per specifications and shall be accompanied by manufacturer's test certificates Paint formulations without certificates are not acceptable.
2. The painting work shall be subject to inspection by OWNER/ OWNER's Representative at all times. In particular, following stage wise inspection will be performed and contractor shall offer the work for inspection and approval at every stage before proceeding with the next stage.

In addition to above. record should include type of shop primer already applied on equipment e.g. Red oxide zinc chromate or zinc chromate or Red lead primer etc.

Any defect noticed during the various stages of inspection shall be rectified by the contractor to the entire satisfaction of OWNER/ OWNER's Representative before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work. Contractor shall be responsible for

making good any defects found during final inspection/guarantee period/defect liability period as defined in general condition of contract. Dry film thickness (DFT) shall be checked and recorded after application of each coat and extra coat of paint should be applied to make-up the DFT specified without any extra cost to OWNER.

PRIMER APPLICATION

- i. The contractor shall provide standard thickness measurement instrument with appropriate range(s) for measuring.

Dry film thickness of each coat, surface profile gauge for checking of surface profile in case of sand blasting. Holiday detectors and pinhole detector and protector whenever required for checking in case of immerse conditions.

- ii. At the discretion of OWNER/ OWNER's Representative, contractor has to provide the paint manufacturers expert technical service at site as and when required. For this service, there should not be any extra cost to the OWNER.
- iii. Final Inspection shall include measurement of paint dry film thickness, check of finish and workmanship. The thickness should be measured at as many points/ locations as decided by OWNER/ OWNER's Representative and shall be within +10% of the dry film thickness.
- iv. The contractor shall produce test reports from manufacturer regarding the quality of the particular batch of paint supplied. The OWNER shall have the right to test wet samples of paint at random for quality of same. Batch test reports of the manufacturer's for each batch of paints supplied shall be made available by the contractor.

18.0 PAINT SYSTEMS

The paint system should vary, with type of environment envisaged in and around the plants. The types of environment as given below are considered for selection of paint system. The paint system is also given for specific requirements.

- a) Normal Industrial Environment, Table 18.2.
- b) Corrosive industrial Environment, Table 18.3
- c) Coastal & Marine Environment, Table 18.4

Notes 1. Primers and finish coats for any particular paint systems shall be from same manufacturer in order to ensure compatibility.

TABLE 18.1: LIST OF PRIMERS & FINISH PAINTS

PRIMERS	
P-1	Red oxide Zinc chromate Primer
P-2	Chlorinated rubber zinc Phosphate Primer
P-3	High build Zinc phosphate Primer
P-4	Etch Primer/Wash Primer
P-5	Epoxy Zinc Chromate Primer

P-6	Two component Epoxy Zinc Phosphate Primer cured with polyamine hardener
P-8	Epoxy red oxide zinc phosphate primer
<u>FINISH COATS / PAINTS</u>	
F-1	Synthetic Enamel
F-2	Two component Acrylic – Polyurethane finish paint
F-3	Chlorinated Rubber finish paint
F-5	Chemical resistant phenolic based enamel
F-6	High Build Epoxy finish coating cured with polyamide hardener
F-7	High build Coal Tar Epoxy coating cured with polyamine hardener
F-8	Self priming surface Tolerant High Build epoxy coating. cured with polyamine hardener
F-9	Two component Inorganic Zinc Silicate coating
F-10	High build Reinforced bituminous composition phenol based resin.
F-11	Heat resistant synthetic medium based Aluminium paint suitable for 250 deg C
F-12	Two component Heat resistant Silicone Aluminium paint. suitable for 400 deg C
F-13	Synthetic based aluminium Paint suitable for 150 deg C

Table – 18.2: Painting System for Normal Industrial Environment for Piping and Equipment (Above Ground)

Sl. No.	Temp. Range	Surface Preparation	Primer	Finish Coat	Total DFT	Remarks
1	-10 to 20	SSPC-SP-3	One coat P-2 50 microns / coat (min)	One coat F-4 65 microns/ coat (min) Two coats F-3, 30 Microns/coat (min)	175	Primer and Finish coat can be applied at ambient temp.
2	21 to 60	SSPC-SP-6	Two coats P-1, 25 microns/ coat (min.)	Two coats of F-1, 20 microns/coat (min)	90	-
3	61 to 80	SSPC-SP-6	Two coats P-3, 50 microns/ coat (min)	Two coats of F-13, 25 microns/coat (min)	150	-
4	81 to 250	SSPC-SP-6	-	Three coats of F-11, 20 microns/ coat (min)	60	Paint application at ambient temp. curing at elevated temp. during start-up.
5	251 to 400	SSPC-SP-10	-	Three coats of F-12, 20 microns/ coat (min)	60	-do-

Table – 18.3: Painting System for Corrosive Industrial Environment for Piping and Equipment (Above Ground)

Sl. No.	Temp. Range	Surface preparation	Primer	Finish Coat	Total DFT	Remarks
1	-14 to 80	SSPC-SP-10	Two coats P-6, 35 microns / coat (min.)	One coats F- 6, 100 microns coat (min.) and one coats F- 2 40 microns coat (min.)	210	Paint application at ambient temp.

2	81 to 250	SSPC-SP-10	-	Three coats F-11, 20 Microns / coat (min.)	60	Paint application at ambient temp. and curing at 250°C for 4 hours
3	81 to 400	SSPC-SP-10	-	Three coats F-12, 20 Microns / coat (min.)	60	Paint application at ambient temp. and curing at 250°C for 4 hours

Table – 18.4 : Painting System for Coastal and Marine Environment for Piping and Equipment (Above Ground)

Sl. No.	Temp. Range	Surface Preparation	Primer	Finish Coat	Total DFT	Remarks
1	-14 to 80	SSPC-SP-10	Two coats P-6. 35 Microns. coat (Min.)	Two coats F-6, 100 microns /coat (min.) and one coats F-2 40 Microns /coat (min.)	310	Primer and Finish coat application at Ambient temp.
2	81 to 400	SSPC-SP-10	-	- Three coats F- 12, 20 Microns / coat (min.)	60	Paint application. at ambient temp, and curing at 250°C for 4 hours
3	401 to 550	SSPC-SP- 10	-	Three coats F-12, 20 Microns / coat (min.)	60	Paint application. at ambient temp, and curing at 250°C for 4 hours

Table – 18.5 : Painting System for External Side of Underground Tanks in all areas.

Sl. No.	Temp. Range	Surface Preparation	Primer	Finish Coat	Total DFT	Remarks
External side of un-insulated underground storage tanks:						

1	-40 to 80	SSPC-SP-10	1 coat of F-9 @ 65-75 μ DFT/ coat	3 coats of F-7 @ 100 μ DFT/coat (3x100=300)	365-375	
---	-----------	------------	--	---	---------	--

18.2 Precautions to be taken

Neither the environment of the site nor the marking labels of devices may be covered with paint nor must they be kept free of paint splashes. To this end, it is advisable to use removable masking tape.

Paint splashes, leaks, etc. on any adjacent installations such as measuring apparatus, valves, pipes. Sources of light, insulation, heat insulators, walls, concrete, etc, must immediately be wiped up and the damage repaired before the paint is dry.

Otherwise, the OWNER will be obliged to have the cleaning carried out at the expense of the Contractor. The paint recipient will only be opened at the time of use (unless otherwise specified by the manufacturer).

The product will be mixed in the recipient with the aid of suitable tools and thus homogenized.

18.3 Method of application

Normally, three methods of application will be used on the construction site for the paint products. i.e. with a brush, with a roller or with a spray gun.

- The brush method makes it possible to obtain good penetration of the paint over irregularities in the metal.
- Only this method will be used for application of the base coats, for retouching and for protrusions, welded areas, riveted joints or bolted joints:
- The roller method may be used on large flat surfaces for the intermediate and topcoats.
- The spray gun method must be used in accordance with the instructions of the manufacturer and carried out by qualified personnel.

The Contractor must guarantee that all safety measures have been taken for such work. The spray gun method may only be used on site for places that are difficult to reach with the brush. In this case, a request must be made to the OWNER/ OWNER's Representative for a deviation.

All paintwork will be carried out with good brushes or rollers that are suitable for the type of paint being used and for the form of the material to be painted and fitted with short handles. The maximum length of the brush and roller handles will be 50 cm; longer handles may only be used for places that are absolutely inaccessible. The maximum width of a brush will be 13 cm.

18.4 Application of the coating

Application of the paint will be carried out in accordance with best practice in order to obtain a homogeneous and continuous layer. The OWNER or the Approved Supervisory body demands that

painting of a layer will only be started after acceptance by them of the surface preparation or of the previous layer of paint.

The layers of paint must have a uniform thickness. They must be spread in such a way that all concave parts are dried out and that the surface is completely covered and has a glossy appearance without leaving brush marks and without exhibiting bubbles, foam, wrinkles, drips, craters, skins or gums that arise from weathered paint,

Each layer must have the color stipulated in the tables of the present specifications, which clearly differs from the previous layer, taking account of the Color of the top layer, all of which for the purpose of being able to identify the number of coats and their order of sequence. If the color of the coats is not mentioned in the tables the color difference in consecutive coats must, if possible, be at least 100 RAL. The color of the top layer is given in the table.

The coating power should be such that the underlying layer is not visible. Only 1 layer per day may be applied, unless otherwise specified by the OWNER or the Approved Supervisory Body.

The drying times prescribed by the paint manufacturer must be strictly observed in relation to the environmental conditions before proceeding with the application of the next layer.

The dry coating thickness indicated in the description of the paint systems are minimum thickness. In this connection, the Contractor is obliged to contact the paint manufacturer and conform to his guidelines. The Contractor must respect the thickness specified by the supplier.

18.5 Transporting treated items

In the case of works being carried out in a workshop, the metal structures will be surrounded by ventilated contraction film that prevents damage during transportation. This film may only be applied after complete polymerization of the paint.

19.0 GROUND-LEVEL TRANSITION POINT

19.1 Polyester protection system

The Contractor will provide system 02 over the entire length of the pipes above ground and below ground and up to a height of 20 cm and a depth of 40 cm. perpendicular to the ground level mark. In each case, he must ensure that the jointing below the asphalt is in good condition and assures' faultless adhesion. He will apply the following products over the entire surface area, prepared in accordance with is Sa 3:

- 1) The primer of system 01.
- 2) Reinforced polyester \pm 20 cm above the ground level marker and \pm 5 cm on the asphalt cleaned beforehand (application of reinforced polyester is carried out in accordance with the work method prescribed by the manufacturer). Moreover, in the case of PE, in contrast to asphalt, he will apply a polygon primer to PE immediately before applying the reinforced polyester.
- 3) He will then apply the other coats of system 01a to the surface section and thus cover the reinforced polyester with about 5 cm.

- 4) For new constructions, the polygon primer will be applied to PE and then subsequently processed as described under point 2.

20.0 USE OF SCAFFOLDING

Mounting, maintenance and dismantling of scaffolding for carrying out adaptation and/or paintwork to surface gas pipes or gas transport installations in use;

- The Contractor will specify the cost of scaffolding in the price list.
- The supplementary rental price for delays attributable to the Contractor will be charged to him:
- In his price quotation the Contractor should present the OWNER with diagrams of the scaffolding that he intends to install for carrying out the works of the OWNER.

21.0 QUALITY CONTROLS AND GUARANTEE

- 21.1 The Contractor is responsible for checking the weather conditions to ascertain whether the paintwork can be carried out within the technical specifications.

The Contractor should have the required calibrated monitoring apparatus for this purpose on site (with calibration certificates). The personnel who will have to use this apparatus should have the training for this purpose.

The OWNER or his representative and possibly the approved supervisory body indicated by the OWNER will maintain supervision during the works and inspect the works with random checks. A daily report will be drawn up in relation to the department that maintains supervision of these works.

The supplementary inspection and the supervision by the OWNER or the approved supervisory body do not diminish in any way the liability of the Contractor. The proper execution of the work and the materials used may be checked at any time.

- 21.2 Reference Surfaces

At the start of the works. The OWNER or the approved supervisory body will indicate a few surfaces that the Contractor will prepare and cover in accordance with the recognized method of operation under the inspection and to the satisfaction of all parties; the OWNER or his representative, the approved supervisory body, the contractor and possibly the paint manufacturer. These reference surfaces will serve as a point of comparison for the good adhesion of the paint on the installations as a whole. The parties will together work out a system for the identification of these surfaces in order to be able to monitor the conditions of the coatings over time. If the paintwork on a section of the installations is in a worse condition than the reference surfaces, the Contractor may be obliged to treat these parts again.

- 21.3 Measures to be taken in the event of a dispute

If on delivery of the works no agreement can be reached between the Contractor and the OWNER regarding the conformity of the works to the requirements of these specifications, an Approved Supervisory Body will be Called in. The Approved Supervisory Body will then carry out inspections' on site whereby the following assessment criteria will be used:

- The Swedish standards ISO 8501-1 1988 SS 05.5900 concerning the degree of cleanliness of the areas derusted by blasting, by machine or by hand.
- The wet film thickness of the paint will be measured in accordance with ISO 2808 or ASTM DI 212;
- The dry layer thickness of the film will be measured electronically, will complete statistical information. in accordance will, ISO 2808 or ASTM D 1186.
- The thickness of each layer will be measured in accordance with ISO 2808. ASTM 4138 or DIN 50986.
-
- Adhesion tests will be carried out in accordance with ISO 2409. ASTM 3359 or DIN 53151.
- Traction tests will he carried out in conformity with ISO 4624 or ASTM D 4541.
- The rugosity will be measured electronically in accordance with DIN 4768;
- The non-porosity will be measured with a test tension depending on the type of coating, the layer thickness and after consultation with the Paint manufacturer.
- Any defects in the paint film may be inspected visually by means of a magnifying glass or microscope. If necessary a photographic report may be drawn up in accordance with ASTM Standard D 4121-82.

The final judgment of the Approved Supervisory Body is irrevocable and binding for the Contractor and the OWNER. In the event of non-conformity of the works with the criteria of these specifications, all costs arising from the inspection by the Approved Supervisory Body shall be borne by the Contractor.

21.4 Guarantee

a) General Principles

The Contractor declares that he is aware of:

- The maximum operating temperature of the surfaces to be covered.
- The maximum permitted degree of humidity of the bearing surface.
- The properties of the environment to which the surfaces to be covered are: subject.

b) Summary of the Guarantee.

The contractor fully guarantees the following without reservation:

- The observance of all stipulations of the specifications for paintwork regarding, among other things:

- The preparation of the surfaces.
- The thickness of each layer.
- The total thickness of the covering.

- The uniformity of the materials used.

- The repair of all defects before delivery of the works.

The Contractor will carry out the requested repair work as promptly as possible.



**INSPECTION AND TEST PLAN FOR
BALL VALVE**

**DOCUMENT NO.
P-ITP-004**
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**INSPECTION AND TEST PLAN
FOR
BALL VALVE**

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INSPECTION AND TEST PLAN FOR BALL VALVE

DOCUMENT NO.
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ABBREVIATIONS:

CE	Carbon Equivalent	NPSH	Net Positive Suction Head
DFT	Dry Film Thickness	PO	Purchase Order
DPT	Dye Penetrant Testing	PESO	Petroleum Explosive Safety Organization
DHT	De-hydrogen Heat Treatment	PQR	Procedure Qualification Record
ERTL	Electronics Regional Test Laboratory	PR	Purchase Requisition
FCRI	Fluid Control Research Institute	PMI	Positive Material Identification
HT	Heat Treatment	RT	Radiography Testing
HIC	Hydrogen Induced Cracking	SSCC	Sulphide Stress Corrosion Cracking
ITP	Inspection and Test Plan	TC	Test Certificate
IP	Ingress Protection	TPI or TPIA	Third Party Inspection Agency
IHT	Intermediate Heat Treatment	UT	Ultrasonic Testing
IC	Inspection Certificate	VDR	Vendor Data Requirement
IGC	Inter Granular Corrosion	WPS	Welding Procedure Specification
MRT	Mechanical Run Test	WPQ	Welders Performance Qualification
NDT	Non-Destructive Testing	MPT / MT	Magnetic Particle Testing



INSPECTION AND TEST PLAN FOR BALL VALVE

**DOCUMENT NO.
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1.0 SCOPE

This Inspection and Test Plan covers the minimum testing requirements of Ball Valves.

2.0 REFERENCES

PO/ PR/ Standards referred there in/ Job specifications/ Approved documents.

3.0 INSPECTION AND TEST REQUIREMENTS:

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS / METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUB SUPPLIER	SUPPLIER	TPIA
1.0	PROCEDURES							
1.1	Hydrostatic Test, Heat Treatment, NDT and Other Procedures	Documented Procedures	100%	-	Procedure Documents	-	H	R
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	-	WPS ,PQR & WPQ	-	H	W- New R- Existing
1.3	Pre-Qualification Tests	Fire safe, Cryogenic & Other Test as applicable	As per PR/Purchase Specification	-	Acceptance Report	-	H	H (If new)
2.0	RAW MATERIAL							
2.1	Casting & Forging: Body & Bonnet / Connector	Visual & Dimension	100%	Material & Technical Specification	Inspection Report	H	H	-
		Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R



INSPECTION AND TEST PLAN FOR BALL VALVE

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		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
		Impact Test (@ - 29°C): for CS Impact Test (@ - 45°C): for LTCS	All Heats	Material & Technical Specification/ ASME B 16.34	Test Report	H	R	R
		Non-Destructive Examination (NDT): Radiography (100% Critical Area & BW Ends)	100%	Material & Technical Specification/ ASME B 16.34	RT Report	H	R	R
		Non-Destructive Examination (NDT): Magnetic Particle Examination (100% exterior & accessible interior)	100%	ASME B 16.34	MPI Report	H	R	R
2.2	Forging & Casting: Ball, Seat Ring, Spindle/Stem (Trim Material)	Visual & Dimension	100%	Material & Technical Specification	Inspection Report	H	H	-
		Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
		Impact Test (@ - 29°C): for CS	All Heats	Material & Technical Specification / ASME B 16.34	Test Report	H	R	R



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		Impact Test (@ -45°C): for LTCS						
		Non-Destructive Examination (NDT): Radiography (100% Critical Area & BW Ends)	100%	Material & Technical Specification /ASME B 16.34	RT Report	H	R	R
		Non-Destructive Examination (NDT): Magnetic Particle Examination (100% exterior & accessible interior)	100%	Material & Technical Specification /ASME B 16.34	MPI Report	H	R	R
		ENP (For Ball): Visual, Thickness & Hardness	100%	25 microns (min) & 50 HRC (min)	Vendor Test Certificate	H	R	R
3.0	INCOMING / BOF ITEMS							
3.1	Stem	Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
3.2	Fasteners	Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R



INSPECTION AND TEST PLAN FOR BALL VALVE

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		Impact Test (@ - 29°C): for CS Impact Test (@ - 45°C): for LTCS	All Heats	Material & Technical Specification /ASME B 16.34	Test Report	H	R	R
3.3	Gaskets, Gear units, Gland, Packings, etc.	Physical / Chemical Properties	100%	Material & Technical Specification	Test Certificates & Lab Report	H	R	R
4.0	MACHINED COMPONENTS							
4.1	Body, Connector, Ball & Seat Ring	Surface examination & Dimension Inspection: Visual & Measurement	100%	Manufacturer's Drawing	Inspection Reports	100%	R	R
5.0	IN-PROCESS							
5.1	Body & Connector joint welding	Non-Destructive Examination (NDT): Magnetic Particle Examination (MPI)	100%	ASME Sec VIII - Appendix V & VI	MPI Report	100%	R	R
5.2	Valve & Pup Piece Bevel Ends joint welding	Non-Destructive Examination (NDT): Radiography (100% on weld joint)	100%	ASME B16.34	RT Report	100%	R	R
6.0	FINAL INSPECTION							
6.1	Finished Valve Assembly: Pressure Test & Final Inspection	Shell Test: Hydrostatic	100%	Testing Procedure as per Code	Test Record	-	H	RW
6.2		Seat Test: Hydrostatic				-	H	RW



INSPECTION AND TEST PLAN FOR BALL VALVE

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6.3		Seat Test: Pneumatic				-	H	RW
6.4		Functional Test - Actuated Valve @ Atm. Pressure & Max. Diff. Pressure: Operation- Open / Close				-	H	RW
6.5		Double Block & Bleed: Hydrostatic				-	H	RW
6.6		Final Inspection: Visual, Dimension, TC Verification, Special Requirements & Marking as per sale order	100%	Approved GA Drawing (if applicable)	Test Report	-	H	RW
6.7		Anti-Static Test	100%	API 6D & Technical Specification	Test Record	-	H	RW
6.8		Fire Safe Test	100%	API-6FA / ISO-10497	Fire safe type test report	-	H	RW
6.9	PMI Check	Chemical	Technical Specification	Technical Specification	Inspection Report	-	H	RW
6.10	Final Stamping	Stamping Of Accepted Valves	Stamping of Valves which are witnessed by PLECO/ TPIA	As per Tender Specification	Inspection Report	-	H	H
7.0	PAINTING & PACKING	Surface examination & DFT Inspection: Visual & Measurement	100%	As per Tender Specification	Painting Record	-	H	RW



INSPECTION AND TEST PLAN FOR BALL VALVE

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8.0	DOCUMENTATION & INSPECTION CERTIFICATE(IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	As per Tender Specification	Supplier TC & IC	-	H	H
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Legend

- H - Hold (Do not proceed without approval),
- P - Perform,
- RW - Random Witness [As specified or 10% (min.1 no. of each size and type of Bulk items)],
- R - Review,
- W - Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable):

1. Supplier Test Certificates to be reviewed by CLIENT / TPIA.
2. This document describes the generic test requirements. Any additional test or Inspection scope if specified/required in contract documents shall also be Applicable (unless otherwise agreed upon).
3. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in/ Job Specification /Approved Documents.
4. For orders placed on stockist, items shall be accepted based on manufacturer's TC with EN310204 type 3.2 certification from approved suppliers.



**INSPECTION AND TEST PLAN – FLANGES
SPECTACLE BLINDS & DRIP RINGS**

**DOCUMENT NO.
P-ITP-008**

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**INSPECTION AND TEST PLAN – FLANGES
SPECTACLE BLINDS & DRIP RINGS**

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INSPECTION AND TEST PLAN – FLANGES
SPECTACLE BLINDS & DRIP RINGS

ABBREVIATIONS:

CE	Carbon Equivalent	NDT	Non Destructive Testing
CIMFR	Central Institute of Mining & Fuel Research	NPSH	Net Positive Suction Head
DFT	Dry Film Thickness	PO	Purchase Order
DPT	Dye Penetrant Testing	PESO	Petroleum Explosive Safety Organization
DHT	De-hydrogen Heat Treatment	PQR	Procedure Qualification Record
ERTL	Electronics Regional Test Laboratory	MR	Material Requisition
FCRI	Fluid Control Research Institute	PMI	Positive Material Identification
HT	Heat Treatment	RT	Radiography Testing
HIC	Hydrogen Induced Cracking	SSCC	Sulphide Stress Corrosion Cracking
ITP	Inspection and Test Plan	TC	Test Certificate
IP	Ingress Protection	TPI or TPIA	Third Party Inspection Agency
IHT	Intermediate Heat Treatment	UT	Ultrasonic Testing
IC	Inspection Certificate	VDR	Vendor Data Requirement
IGC	Inter Granular Corrosion	WPS	Welding Procedure Specification
MPT/MT	Magnetic Particle Testing	WPQ	Welders Performance Qualification
MTC	Material Test Certificate		
MRT	Mechanical Run Test		



INSPECTION AND TEST PLAN – FLANGES SPECTACLE BLINDS & DRIP RINGS

DOCUMENT NO.
P-ITP-008

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1.0 SCOPE

This Inspection and Test Plan covers the minimum testing requirements of Flanges, Spectacle blinds & Drip Rings.

2.0 REFERENCES

PO / PR / Standards referred there in / Job specifications / Approved documents.

3.0 INSPECTION AND TEST REQUIREMENTS:

SL. NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	TPIA
1.0	Procedure						
1.1	Heat Treatment, NDT and Other Procedures	Documented Procedures	100%	Procedure Documents	-	H	R
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS,PQR & WPQ	-	H	W- New R- Existing
2.0	Material Inspection						
2.1	Raw Material Inspection	Chemical & Mechanical Properties	100%	Test Certificates	-	H	R

**INSPECTION AND TEST PLAN – FLANGES
SPECTACLE BLINDS & DRIP RINGS**

3.0	In Process Inspection						
3.1	Welding / Forging	Forging /Welding Parameters	100%	Inspection Reports	-	H	-
3.2	Heat Treatment	Stress Relieving, Normalising, Tempering, Solution Annealing, Stabilization Heat Treatment etc. as applicable	100%	HT chart	-	H	R
3.3	Identification of Test Samples	Product Chemical, Mechanical, Impact, IGC and Other test as applicable	100%	Test Reports	-	H	H(Note-1)
3.4	Product Analysis (As applicable)	Chemical Composition	As per PR/Purchase Specification	Test Reports	-	H	R
3.5	Destructive Testing	Mechanical, Impact, IGC and Other test as applicable	100%	Test Reports	-	H	H(Note-1)
3.6	NDT as applicable	Surface & Internal Imperfections	As per PR/Purchase Specification	NDT Reports	-	H	R
3.7	Galvanizing (If Applicable)	Integrity Of Galvanised Coating	100%	Inspection Report	-	H	-



INSPECTION AND TEST PLAN – FLANGES
SPECTACLE BLINDS & DRIP RINGS

4.0	Final Inspection						
4.1	Final Inspection	1. Visual 2. Dimensions 3. Hardness 4. Marking etc	100%	Inspection report	-	H	H(Note-1)
4.2	PMI Check	Chemical Check	As Per PLECO Spec.	Inspection report	-	H	RW
4.3	Final Stamping	Stamping of accepted Items	Stamping of Items which are witnessed by TPIA.	Inspection report	-	H	H(Note-1)
5.0	Painting						
5.1	Rust Preventive Coating & Colour Coding	Visual Inspection & Colour Coding as applicable	100%	Inspection report	-	H	-
6.0	Documentation & IC						



**INSPECTION AND TEST PLAN – FLANGES
SPECTACLE BLINDS & DRIP RINGS**

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6.1	Documentation & Inspection Certificate(IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Supplier TC & IC	-	H	H
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Legend:

H - Hold (Do not proceed without approval), P - Perform,

RW - Random Witness (As specified or 10% [min.1 no. of each size and type of Bulk item]) R - Review,

W - Witness (Give due notice, work may proceed after scheduled date).PR- PURCHASE REQUISITION

NOTES (As applicable):

1. For Non NACE & Non Hydrogen service Carbon Steel Flanges, Spectacle Blinds & Drip Rings up to size 24"-300ANSI Class Will be accepted on review of Supplier Test Certificates. Supplier Test Certificate to be reviewed by TPIA.
2. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be Applicable (unless otherwise agreed upon).
3. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in / Job Specification /Approved Documents.
4. For orders placed on stockist, items shall be accepted based on manufacturer's TC with EN 10204 type 3.2 certification from PLECO/ OWNER approved suppliers.



**INSPECTION AND TEST PLAN – FORGED, SEAMLESS
& WELDED FITTINGS**

**DOCUMENT NO.
P-ITP-011**

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**INSPECTION AND TEST PLAN –
FORGED, SEAMLESS & WELDED FITTINGS**

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INSPECTION AND TEST PLAN – FORGED, SEAMLESS & WELDED FITTINGS

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ABBREVIATIONS:

CE	Carbon Equivalent	NDT	Non Destructive Testing
CIMFR	Central Institute of Mining & Fuel Research	NPSH	Net Positive Suction Head
DFT	Dry Film Thickness	PO	Purchase Order
DPT	Dye Penetrant Testing	PESO	Petroleum Explosive Safety Organization
DHT	De-hydrogen Heat Treatment	PQR	Procedure Qualification Record
ERTL	Electronics Regional Test Laboratory	MR	Material Requisition
FCRI	Fluid Control Research Institute	PMI	Positive Material Identification
HT	Heat Treatment	RT	Radiography Testing
HIC	Hydrogen Induced Cracking	SSCC	Sulphide Stress Corrosion Cracking
ITP	Inspection and Test Plan	TC	Test Certificate
IP	Ingress Protection	TPI or TPIA	Third Party Inspection Agency
IHT	Intermediate Heat Treatment	UT	Ultrasonic Testing
IC	Inspection Certificate	VDR	Vendor Data Requirement
IGC	Inter Granular Corrosion	WPS	Welding Procedure Specification
MPT/MT	Magnetic Particle Testing	WPQ	Welders Performance Qualification
MTC	Material Test Certificate		
MRT	Mechanical Run Test		



INSPECTION AND TEST PLAN – FORGED, SEAMLESS & WELDED FITTINGS

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1.0 SCOPE

This Inspection and Test Plan covers the minimum testing requirements of Forged, Seamless & Welded Fittings.

2.0 REFERENCES

PO / PR / Standards referred there in / Job specifications / Approved documents.

3.0 INSPECTION AND TEST REQUIREMENTS:

SL N	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	TPIA
1.0	Procedure						
1.1	Heat Treatment / NDT	Documented Procedures	100%	Procedure Documents	-	H	R
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS,PQR &WPQ	-	H	W- New R- Existing (Qualified under reputed TPIA)



**INSPECTION AND TEST PLAN – FORGED, SEAMLESS
& WELDED FITTINGS**

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2.0	Material Inspection						
2.1	Raw Material Identification (Billets, Rounds, Pipes, Coil, Plates, etc.)(** Special services like NACE, H2,HIC, UOP, AXEN, etc)	Review of MTC's for Chemical, Mechanical Properties, size & steel Making process, etc.	100%	Mill test certificate, Supplier's Inspection Report	-	H	RW-For CS W-For AS, SS, LTCS & CS with special services **
3.0	In Process Inspection						
3.1	Forming & Welding	Forming & Welding Parameters	100%	Supplier's records	-	H	-
3.2	Heat Treatment	Stress Relieving, Normalising, Tempering, Solution Annealing, Stabilization Heat Treatment etc. as applicable	100%	HT chart / report	-	H	R
3.3	Ferrite Check Of SS Welds (If Applicable)	% Ferrite Check	100%	Inspection Report	-	H	R



**INSPECTION AND TEST PLAN – FORGED, SEAMLESS
& WELDED FITTINGS**

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3.4	Identification of Test Samples	Product Chemical, Mechanical, Impact, IGC and Other test as applicable	Lot as per specification	Test Reports	-	H	H
3.5	NDT-RT as applicable	Surface & Internal Imperfections	As per PR/Purchase Specification	RT Film & Reports	-	H	R (Film Review)
3.6	NDT-UT (as applicable)	Surface & Internal Imperfections	As per PR/Purchase Specification	UT Reports	-	H	R
3.7	NDT-DPT / MPT of bevel ends	Surface / sub surface defects	100%	Test Report	-	H	R
3.8	Identification of Test Samples	Product Chemical, Mechanical, Impact, IGC and Other test as applicable	100%	Test Reports	-	H	H
3.9	Product Analysis (As applicable)	Chemical Composition	As per PR/Purchase Specification	Test Reports	-	H	R
3.10	Destructive Testing	Mechanical, Impact, IGC and Other test as applicable	100%	Test Reports	-	H	H
3.11	Galvanizing (If Applicable)	Integrity Of Galvanised Coating	100%	Inspection Report	-	H	-
4.0	Final Inspection						



**INSPECTION AND TEST PLAN – FORGED, SEAMLESS
& WELDED FITTINGS**

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4.1	Visual and Dimensional	Size, Thickness / Schedule, Dimensions, Surface quality, Marking, etc.	100%	Inspection report	-	H	RW
4.2	Hardness testing on fittings (** Special services like NACE, H2,HIC, UOP,AXEN,etc)	Hardness value of base metal & Weld / HAZ as applicable	Random 10%	Test report	-	H	R-For CS SS & RW- For AS, LTCS & CS with special services **
4.3	PMI Check	Chemical Check	As Per PLECO Spec.	Inspection report	-	H	RW
4.4	Final Stamping	Stamping of accepted Items	Stamping of Fittings which are witnessed by PLECO/ TPIA	Inspection report	-	H	H
5.0	Painting						
5.1	Shot Blasting Rust Preventive Coating & Colour Coding	Visual & Colour Coding as applicable	100%	Inspection report	-	H	-



**INSPECTION AND TEST PLAN – FORGED, SEAMLESS
& WELDED FITTINGS**

**DOCUMENT NO.
P-ITP-011**

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6.0	Documentation & IC						
6.1	Documentation & Inspection Certificate(IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Supplier TC & IC	-	H	H

Legend:
 H - Hold (Do not proceed without approval), P
 - Perform,
 RW - Random Witness (As specified or 10% [min.1 no. of each size and type of Bulk item]), R - Review,
 W - Witness (Give due notice, work may proceed after scheduled date).



INSPECTION AND TEST PLAN – FORGED, SEAMLESS & WELDED FITTINGS

DOCUMENT NO.
P-ITP-011

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NOTES (As applicable):

1. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be Applicable (unless otherwise agreed upon).
2. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in /Job Specification /Approved Documents.
3. For orders placed on stockist, items shall be accepted based on manufacturer's TC with EN310204 type 3.2 certification from PLECO/ OWNER approved suppliers.
4. For welded fittings, it is recommended to use low hydrogen consumable for AS, SS 410 fittings & HIC resistant consumable for HIC service fittings.
5. PLECO/ TPIA reserves the right to check raw material consumption and traceability records.



**INSPECTION AND TEST PLAN FOR
SMALL SIZE & ASSORTED LENGTH PIPES**

DOCUMENT NO.
P-ITP-013
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**INSPECTION AND TEST PLAN
FOR
SMALL SIZE & ASSORTED LENGTH PIPES**

00	18.10.22	ISSUED AS INSPECTION AND TEST PLAN	PNS	SM	AD
Rev.	Date	Purpose	Prepared by	Reviewed by	Approved by



INSPECTION AND TEST PLAN FOR SMALL SIZE & ASSORTED LENGTH PIPES

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REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	19.10.2022					
		PNS	SM	AD	SK	



INSPECTION AND TEST PLAN FOR SMALL SIZE & ASSORTED LENGTH PIPES

DOCUMENT NO.

P-ITP-013

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ABBREVIATIONS:

CE	Carbon Equivalent	NDT	Non – Destructive Testing
DFT	Dry Film Thickness	NPSH	Net Positive suction Head
DPT	Dye Penetrant Testing	PO	Purchase Order
DHT	De-hydrogen Heat Treatment	PESO	Petroleum Explosive Safety Organization
ERTL	Electronics Regional Test Laboratory	PQR	Procedure Qualification Record
FCRI	Fluid Control Research Institute	MR	Material Requisition
HT	Heat Treatment	PMI	Positive Material Identification
HIC	Hydrogen and Test Plan	RT	Radiography Testing
ITP	Inspection and Test Plan	SSCC	Sulphide Stress Corrosion Cracking
IP	Ingress Protection	TC	Test Certificate
IHT	Intermediate Heat Treatment	TPI or TPIA	Third Party Inspection Agency
IC	Inspection Certificate	UT	Ultrasonic Testing
IGC	Inter Granular Corrosion	VDR	Vendor Data Requirement
MPT/ MT	Magnetic Particle Testing	WPS	Welding Procedure Specification
MTC	Material Test Certificate	WPQ	Welders Performance Qualification
MRT	Mechanical Run Test		



INSPECTION AND TEST PLAN FOR SMALL SIZE & ASSORTED LENGTH PIPES

DOCUMENT NO.

P-ITP-013

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1.0 SCOPE

This Inspection and Test Plan covers the minimum testing requirements of small sizes and Assorted length pipes.

2.0 REFERENCES

PO / MR / Standards referred there in / Job specifications / Approved documents.

3.0 INSPECTION AND TEST REQUIREMENTS:

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	PLECO/TPIA
1.0	Procedure						
1.1	Hydro Test, NDT, Heat treatment and Other Procedures	Documented Procedures	100%	Procedure Documents	-	H	R
1.2	WPS, PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	-	H	W-New R-Existing
2.0	Material Inspection						



INSPECTION AND TEST PLAN FOR SMALL SIZE & ASSORTED LENGTH PIPES

DOCUMENT NO.

P-ITP-013

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SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	PLECO/TPIA
2.1.	Raw Material Inspection	Chemical & Mechanical Properties	100%	Procedure Documents	-	H	R
3.0	In Process Inspection						
3.1	Welding	Welding Parameters as per WPS/ PQR	100%	Inspection Reports	-	H	-
3.2	Heat Treatment as applicable	Stress Relieving, Normalising, Tempering, Solution Annealing, Stabilization Heat Treatment etc. as applicable	100%	HT chart/ Record	-	H	R



INSPECTION AND TEST PLAN FOR SMALL SIZE & ASSORTED LENGTH PIPES

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SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	PLECO/TPIA
3.3	Ferrite Check of SS Pipes (If Applicable)	% Ferrite Check	Random on Weld	Inspection Report	-	H	R
3.4	NDT As Applicable	Surface & Internal Imperfections	MR/ Material Specification	RT Films/ Test Reports	-	H	R
3.5	Identifications of Test Samples	Product Chemical, Mechanical, Impact, IGC and other test as applicable	100%	Test Reports	-	H	H (Note-1)
3.6	Product Analysis	Chemical Composition	MR/ Material Specification	Test Reports	-	H	R



INSPECTION AND TEST PLAN FOR SMALL SIZE & ASSORTED LENGTH PIPES

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SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	PLECO/TPIA
3.7	Destructive Testing	Mechanical, Impact, IGC and other test as applicable.	MR/ Material Specification	Test Reports	-	H	H (Note-1)
3.8	Galvanizing (If Applicable)	Integrity of Galvanised Coating	100%	Inspection Reports	-	H	R
4.0	Final Inspection						
4.1	Hydrostatic Test	Leak check	100%	Test Report	-	H	RW (Note-1)
4.2	Visual and Dimensional Inspection (VDI)	Surface Condition, Straightness, End Finish, Bevel Angle, Root Face, Outer Dia., Thickness, Length, End Finish, Marking etc.	100%	Inspection Report	-	H	-
4.3	Weight checking as applicable	Weight	100%	Inspection Report	-	H	-



INSPECTION AND TEST PLAN FOR SMALL SIZE & ASSORTED LENGTH PIPES

DOCUMENT NO.

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SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	PLECO/TPIA
4.4	PMI Check	Chemical Check	As per spec.	Inspection Report	-	H	H (Note-1)
4.5	Final Stamping	Stamping of accepted Pipes	Stamping of Pipes which are witnessed by Owner/ TPIA	Inspection Report	-	H	H (Note-1)
5.0	Painting						
5.1	Rust Preventive Coating & Colour Coding	Visual & Colour Coding as applicable	100%	Inspection Report	-	H	-
6.0	Documentation & IC						
6.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Manufacturer TC & IC	-	H	H



INSPECTION AND TEST PLAN FOR SMALL SIZE & ASSORTED LENGTH PIPES

DOCUMENT NO.

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Legend: H - Hold (Do not proceed without approval), P - Perform, RW - Random Witness (As specified or 10% [min.1 no. of each size and type of Bulk item]), R - Review, W - Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable):

1. For Non -NACE & Non -Hydrogen service Carbon Steel Pipes up to size 12" will be accepted on review of Supplier Test Certificates. Supplier Test Certificate to be reviewed by Owner/TPIA.
2. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable. (Unless otherwise agreed upon)
3. Acceptance Norms for all the activities shall be as per PO/MR/STANDARDS referred there in /Job Specification /Approved Documents.
4. For orders placed on stockiest, items shall be accepted based on manufacturer's TC with EN310204 type 3.2 certification from PLECO / OWNER approved suppliers.



**INSPECTION AND TEST PLAN FOR
CHECK, GATE & GLOBE VALVES**

DOCUMENT NO.
P-ITP-014
Page 1 of 10

**INSPECTION AND TEST PLAN
FOR
CHECK, GATE & GLOBE VALVES**

0	10.03.22	ISSUED AS INSPECTION AND TEST PLAN	PNS	MD	AD
Rev.	Date	Purpose	Prepared by	Reviewed by	Approved by



INSPECTION AND TEST PLAN FOR CHECK, GATE & GLOBE VALVES

DOCUMENT NO.

P-ITP-014

Page 2 of 10

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
0	09.03.2022					
		PNS	MD	AD	SK	



INSPECTION AND TEST PLAN FOR CHECK, GATE & GLOBE VALVES

DOCUMENT NO.

P-ITP-014

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ABBREVIATIONS:

FCRI	Fluid Control Research Institute	MPT/MT	Magnetic Particle Testing
HT	Heat Treatment	MTC	Material Test Certificate
CE	Carbon Equivalent	MRT	Mechanical Run Test
DFT	Dry Film Thickness	NDT	Non Destructive Testing
DPT	Dye Penetrant Testing	NPSH	Net Positive Suction Head
DHT	De-hydrogen Heat Treatment	PO	Purchase Order
ERTL	Electronics Regional Test Laboratory	PESO	Petroleum Explosive Safety Organization
IGC	Inter Granular Corrosion	PQR	Procedure Qualification Record
VDR	Vendor Data Requirement	PR	Purchase Requisition
WPQ	Welders Performance Qualification	PMI	Positive Material Identification
ITP	Inspection and Test Plan	RT	Radiography Testing
IP	Ingress Protection	WPS	Welding Procedure Specification



INSPECTION AND TEST PLAN FOR CHECK, GATE & GLOBE VALVES

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IHT	Intermediate Heat Treatment	TC	Test Certificate
IC	Inspection Certificate	TPI or TPIA	Third Party Inspection Agency
UT	Ultrasonic Testing		



INSPECTION AND TEST PLAN FOR CHECK, GATE & GLOBE VALVES

DOCUMENT NO.

P-ITP-014

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1.0 SCOPE:

This Inspection and Test Plan covers the minimum testing requirements of Valves

2.0 REFERENCE DOCUMENTS:

PO / PR / Standards referred there in / Job specifications / Approved documents.

3.0 INSPECTION AND TEST REQUIREMENTS:

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	PLECO/TPIA
1.0	Procedure						
1.1	Hydrostatic Test, Heat Treatment, NDT and Other Procedures	Documented Procedures	100%	Procedure Documents	-	H	R
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS ,PQR & WPQ	-	H	W- New R- Existing
1.3	Pre-Qualification Tests	Fire safe, Cryogenic & Other Test as applicable	As per PR/Purchase Specification	Acceptance Report	-	H	H (If new)



INSPECTION AND TEST PLAN FOR CHECK, GATE & GLOBE VALVES

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SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	PLECO/TPIA
2.0	Material Inspection						
2.1.	Castings & Forgings (Body, Bonnet, Disc, Stem, Body ring)	Chemical ,Mechanical , Heat Treatment, NDT,IGC & Other Properties as applicable	100%	Test Certificates	H	R	R
2.2	Castings & Forgings (Body, Bonnet, Disc, Stem, Body ring)	Visual & Dimension	100%	Inspection Report	H	H	-
2.3	Body and Bonnet Castings	Radiography Examination	As per PR / Purchase Specification	Films and report	H	R	R
2.4	Bars for Trim material	Chemical Analysis	Each Heat	Test Certificates& Lab Report	H	R	-
2.5	Gaskets, Gear units, Fasteners, Gland, Packings, etc.	Physical / Chemical Properties	100%	Test Certificates& Lab Report	H	R	-



INSPECTION AND TEST PLAN FOR CHECK, GATE & GLOBE VALVES

DOCUMENT NO.

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SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	PLECO/TPIA
2.6	Actuators as applicable	Performance , Statutory Certificates as applicable	100%	Test Certificates & Lab Report	H	H	R
3.0	In Process Inspection						
3.1	Welding	Welding Parameters as per WPS / PQR	100%	Inspection Reports	-	H	-
3.2	Machining of components	Visual / Dimension	100%	Inspection Reports	-	H	-
4.0	Final Inspection						
4.1	Hydrostatic / Pneumatic Test and Helium Leak test as applicable	Leak Check	As per PR / Purchase Specification	Test Report	-	H	RW (Note 1)



INSPECTION AND TEST PLAN FOR CHECK, GATE & GLOBE VALVES

DOCUMENT NO.

P-ITP-014

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SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	PLECO/TPIA
4.2	Visual / Dimension	Surface & Dimension Check	100%	Test Report	-	H	RW (Note 1)
4.3	Functional Test for Actuator Operated Valves	Satisfactory Performance	100%	Test Report	-	H	RW
4.4	PMI Check	Chemical	As per Spec.	Inspection Report	-	H	RW
4.5	Strip Check(As applicable)	Verify Components & Differential hardness if applicable	As per PR / Purchase Specification	Inspection Report	-	H	RW (Note 1)
4.6	Final Stamping	Stamping Of Accepted Valves	Stamping of Valves which are witnessed by PLECO/TPIA.	Inspection Report	-	H	H (Note -1)



INSPECTION AND TEST PLAN FOR CHECK, GATE & GLOBE VALVES

DOCUMENT NO.

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SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	PLECO/TPIA
5.0	Painting						
5.1	Painting and Colour coding as applicable	Visual / DFT Check	100%	Inspection Report	-	H	-
6.0	Documentation & IC						
6.1	Documentation & Inspection Certificate(IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Supplier TC & IC	-	H	H



INSPECTION AND TEST PLAN FOR CHECK, GATE & GLOBE VALVES

DOCUMENT NO.

P-ITP-014

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Legends:

H - Hold (Do not proceed without approval),

P - Perform,

RW - Random Witness [As specified or 10% (min.1 no. of each size and type of Bulk items)],

R - Review,

W - Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable):

1. For Non NACE & Non Hydrogen Service Carbon Steel Valves up to size 12" will be accepted on review of Supplier Test Certificates. Supplier Test Certificate to be reviewed by PLECO /TPIA.
2. This document describes the generic test requirements. Any additional test or Inspection scope if specified/required in contract documents shall also be Applicable (unless otherwise agreed upon).
3. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in /Job Specification /Approved Documents.
4. Final Certification Shall be EN 10204 Type 3.2



NGN LETEKUJAN TERMINAL UP TO NRL IGGL RT PIPELINE PROJECT

PIPING MATERIAL SPECIFICATION

DOCUMENT NO.: P158-PMS-P401

CB	08.08.2023	Issued for Client Approval	SS	SM	AD
CA	24.07.2023	Issued for Client Review	SS	SM	AD
IA	22.07.2023	Issued for Internal Review	SS	SM	AD
REV.	DATE	DESCRIPTION	ORG	REVIEW	APPROVED

ABBREVIATION

PMS	Piping Material Specification
IBR	Indian Boiler Regulations
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
AARH	Arithmetic Average Roughness Height
NDT	Non-Destructive Testing
BS	British Standards
CS	Carbon Steel
MS	Mild Steel
IS	Indian Standard Code
NFPA	National Fire Protection Association
OISD	Oil Industry Safety Directorate
PNRGB	Petroleum & Natural Gas Board
ERW	Electric Resistance Welding
BE	Bevel End
BW	Butt Welded
SW	Socket Weld
FF	Flat Face
PEB	Plain Bevel End
PE	Plain End
RF	Raised Face
SCRF	Screwed End Female
SCRM	Screwed End Male
M	Matching – Schedule / Thickness
BHN	Brinell Hardness Number
MP Test	Magnetic Particle Test

1.0 SCOPE

This specification covers minimum requirements for the material specification for pipe, fittings, flanges, line blinds, bolts, gaskets, and valves that shall be used for natural gas pipeline and associated facilities in accordance with ASME B31.8, OISD-226 and PNGRB guideline

This specification also defines, by piping class for each listed service, and defines the pressure/temperature limitations within which they may be used.

This specification shall be read in conjunction with various codes and standards as applicable.

2.0 CODES AND STANDARDS

2.1 Pipeline and pipeline terminal facilities envisaged as part of this project shall be designed and engineered primarily in accordance with the provisions of the latest edition of the following codes:

- i. ASME B 31.8 - Gas transmissions and Distribution Piping System
- ii. ASME B 31.3 - Chemical Plant and Petroleum Refinery Piping
- iii. OISD Standard 226 - Natural Gas Transmission Pipelines.
- iv. PNGRB - Petroleum & Natural Gas Regulatory Board

2.2 All codes, standards and specifications referred herein shall be the latest edition of such documents.

2.3 For sake of brevity the initials of the society to which the codes are referred may be omitted in the specifications, for example, B16.5 is a code referring to ASME A106 is a code referring to ASTM.

2.4 In addition to this PMS, various piping and pipeline materials shall also be applicable.

3.0 MATERIAL SPECIFICATIONS

Individual piping class has been generally designed to cover a set of service operating within pressure-temperature consideration as per ASME B16.5/ B16.34 or part of it. Deviations of material from class specifications may occur due to specific design conditions and/or availability. These deviations are permissible if they equal or better the individual class requirements and shall be subjected to approval on case-to-case basis.

4.0 CLASS DESIGNATION CODE

The piping class designation shall generally consist of three digits made up of a letter, number & letter e.g., P1C, P1L, P3C, P3L, P1F & P1U as follows:

First alphabet shall represent Pleco as well as Pipe, second place numeral is for class, 1/3 for 150# & 300# respectively and last alphabet shall represent the material; CS, LTCS, Fire Water, Portable water.

5.0 PIPELINE

Line pipe material grade and wall thickness details are indicated in PMS.

6.0 PIPES

- 6.1 Carbon steel pipe shall be made by open hearth, electric furnace or basic oxygen process only. The steel used shall be fully killed and made with fine grain structure. The grade and wall thickness of various sizes of pipes shall be as per piping material specification for the applicable class.
- 6.2 Pipe dimensions shall be in accordance with ASME B 36.10 for carbon steel ASTM standard pipes & API 5L for carbon steel API 5L grade pipes.
- 6.3 All pipe threads shall conform to American Standard taper as per ASME B 1.20.1 NPT, unless otherwise specified.
- 6.4 For butt weld end, bevel shall be in accordance with API specification 5L or ASME B16.25 as applicable.

7.0 FITTINGS

- 7.1 Fully killed carbon steel shall be used in the manufacture of fittings. The fitting shall have carbon equivalent not exceeding 0.45, based on check analysis.
- 7.2 Threaded joints, if used, shall conform to American Standard taper as per ASME B1.20.1 NPT.
- 7.3 Dimensions of socket welded/screwed fittings shall conform to ASME B 16.11. Swage shall be as per BS 3799.
- 7.4 Dimensions of steel butt welded fittings shall be as per ASME B 16.9.
- 7.5 Bore of socket welded fittings shall suit outside diameter (OD) of pipe and its thickness.
- 7.6 Butt welding ends shall conform to API specification 5L or ASME B 16.25 as applicable. In case of difference in thickness of matching ends, requirements of ASME B 31.4 shall apply.
- 7.7 Integrally reinforced forged branch fittings such as Sockolet, Weldolet etc. shall be as per MSS-SP-97. Fittings not covered in ASME B16.9 and MSS-SP-97 shall conform to manufacturer's standard.
- 7.8 Fittings thickness tolerances shall match pipe thickness tolerance.

8.0 BENDS

- 8.1 Unless otherwise specified for process piping, elbow of radius $R = 1.5 D$ shall only be used.
- 8.2 In order to accommodate changes in vertical and horizontal alignment in pig gable section of pipeline, Elastic bends/ Cold field bends/ Hot formed long radius bends shall be used.
- 8.3 $D =$ Specified Outside Diameter
- 8.4 Long Radius Bend shall be used only when indicated in AFC drawing.
- 8.5 Miters shall not be used.

9.0 FLANGES

- 9.1 Pressure Temperature rating of flanges shall conform to B16.5/ MSS-SP44/ B16.47 Series A, as applicable.

- 9.2 Dimensions of flanges shall be in accordance with B16.5/ MSS-SP44/ B16.47 Series A, as applicable.
- 9.3 Neck of weld neck (WN) flanges shall suit pipe bore and thickness.
- 9.4 Bore of socket welded (SW) flanges shall suit pipe O.D. and its thickness.
- 9.5 Threads for screwed flanges, if used, shall conform to American Standard taper as per ASME B 1.20.1 NPT.
- 9.6 Sizes for blind flanges shall be indicated by nominal pipe size.
- 9.7 Unless specified otherwise in Piping Material Specification the flange face finish shall be as per ASME B16.5.
- 9.8 Butt welding ends of WN flanges shall conform to ASME B 16.25.
- 9.9 Spectacle blind/spacer & blinds shall be in accordance with ASME B 16.48/ manufacturer's standard.

10.0 GASKETS

- 10.1 Spiral wound metallic gasket with Graphite filled winding with SS304 inner ring and CS outer ring and shall conform to ASME B 16.20/ API 601.
- 10.2 Spiral wound gasket shall be self-aligning type.

11.0 BOLTING & THREADS

- 11.1 Nuts for stud bolts shall be American Standard Hexagon Heavy Series and double chamfered.
- 11.2 Dimension and tolerances for stud bolts and nuts shall be as per ASME B 18.2.1 and 18.2.2 with full threading to ASME B 1.1 Class 2A thread for bolts and Class 2B for nuts. Diameter and length of stud bolts shall be as per ASME B 16.5/ASME B16.47 with full threading.
- 11.3 Threads for nuts shall be as per ASME B 1.1 as follows,
 - Nuts for stud bolts dia ¼" to 1" : UNC-2B
 - Nuts for stud bolts dia 1½" to 3¼" : 8UN-2B
- 11.4 Threads for stud bolts shall be as per ASME B 1.1, as follows:
 - Stud bolts dia ¼" to 1" : UNC-2A
 - Stud bolts dia 1½" to 3¼" : 8UN-2A
- 11.5 Threads for threaded pipe, fitting, flanges and valve shall be in accordance with 2B
- 11.6 1.20.1 taper threads, unless specified otherwise.
- 11.7 Heads of jack screws shall be heavy hexagonal type. Jack screw end shall be rounded. Stud bolts shall be fully threaded with two hexagonal nuts.

12.0 THREAD SEALANT

- 12.1 Threaded joints shall be made with 1" wide PTFE jointing tape.

13.0 VALVES

- 13.1 Valve ends shall be as per valve data sheets for various piping class.

- 13.2 Sectionalizing valves, Block valves and other isolation valves installed on the main pipeline shall be ball valves with butt welding ends. All inline isolation valves on the mainline (pipeline) shall be full bore valves to allow smooth passage of cleaning as well as intelligent pigs.
- 13.3 All buried valves shall be provided with stem extension, sealant, vent/drain and shall have butt welded ends as per relevant specification/ data sheet.
- 13.4 Flange dimensions and face finish of flanged end valves shall conform to clause 9.0 of this specification.
- 13.5 Butt welding ends of Butt-Welded valves shall conform to ASME B 16.25.
- 13.6 Face to face and end to end dimensions shall conform to applicable standards.
- 13.7 Valves shall conform to following standards unless specified otherwise in piping material specification for various piping class.

Flanged/Socket Welded end valves (1½" and below)

Design STD. for Process lines

Gate Valves	:	API 602
Globe Valves	:	BS EN ISO 15761
Check Valves	:	BS EN ISO 15761
Ball Valves	:	BS EN ISO 17292
Plug Valves	:	BS 5353

Flanged/Butt Welded end valves (2" and above)

Design STD. for Process Lines

Gate Valves	:	API 6D
Globe Valves	:	BS 1873
Check Valves	:	API 6D
Ball Valves	:	API 6D
Plug Valves	:	API 6D

- 13.8 All manual operated valves shall be provided with wrench / hand wheel or gear operator as specified here in below.

13.8.1 Gate Valves

For ANSI class 150 and 300	-	Hand wheel operated for size ≤ 12" NB Gear operated for size ≥ 14" NB.
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13.8.2 Globe Valves

For ANSI class 150, 300	-	Hand Wheel operated for all size
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13.8.3 Ball valves & Plug Valves

For all ANSI class	-	Wrench operated for size ≤ 4" NB.Gear operated for size ≥ 6" NB.
--------------------	---	---

13.8.4 Actuated Valves

Actuated valves shall be as per P & IDs. The actuator shall have provision for remote operation as per P & IDs. All Actuated valves shall have additional provision of hand wheel operation.

14.0 QUICK OPENING END CLOSURE

Quick opening end closure to be installed on scraper traps shall be designed in accordance with Section VIII of ASME Boiler and Pressure Vessel Code and equipped with safety locking devices in compliance with Section VIII, division 1, UG-35.2 of ASME Boiler and Pressure Vessel Code.

15.0 HYDROTESTING VENTS AND DRAINS

In terminal piping, high point vents and low point drains required for the purpose of hydro testing shall be of size 0.75". These vents & drains shall consist of gate valves with blind flange assembly.

16.0 PIPELINE SPECIALTY ITEMS

Pipeline specialty items viz. scraper traps, flow tees, insulating joints, LR bends etc. shall be as per data sheets and specification.

For Mainline Items, corrosion allowance shall be as per data sheet

17.0 INSULATING GASKET, SLEEVE AND WASHER

The insulating gasket shall consist of a PTFE (Teflon) spring-energized face seal, or an elastomeric O-ring, seated in an isolating laminate, which shall be permanently bonded to a high strength metal gasket core. Due to this unique pressure activated sealing mechanism, the gasket requires far less bolt stress to seal than any other gasket. The gasket inner diameter shall be exactly matched to the flange bore to eliminate turbulent flow and flange face erosion/ corrosion. The seal elements shall be replaceable in the reusable gasket retainer. The core of gasket shall be made of annealed 316 stainless steel or other metals including duplex and Inconel etc.

Insulating gasket shall include the following applications,

- Flange isolation in conjunction with cathodic protection.
- Isolation between dissimilar metals to prevent galvanic corrosion.
- Mating mismatched ring-joint to raised –face flanges.
- Eliminate fluid trap corrosion between ring-joint (RTJ) flanges where high concentrations of Co₂, H₂S and other aggressive hydrocarbon media are present.
- Eliminate turbulence and flow induced erosion between ring-joint (RTJ) flanges.
- Protect against coating impingement on coated flange faces.
- To seal between flanges subjected to vibration/ cavitation.

17.1 Insulating Gasket, sleeves and washers' material properties:

Compressive strength	:	65000 PSI
Average Dielectric strength	:	15 KV
Electrical resistance	:	> 1 Mega Ohm (When tested with 500- 1000 V DC megger)
Max. Operating temp.	:	302°F (150°C)
Min. Operating temp.	:	(minus) -200°F
Water absorption	:	5%
Flexural strength	:	70000 PSI
Tensile strength	:	50000 PSI
Bond strength	:	2600 lb
Shear strength	:	22000 lb.

17.2 Seal Material

The sealing elements shall intend to provide an impervious barrier through which no contained media or other substance can penetrate. The composite retainer backing material behind the seal remains uncontaminated and thus permanently holds the seal in place in a static, fully encapsulated manner.

Viton as a seal material shall consist following properties,

- General purpose oilfield elastomer.
- Excellent resistance to aliphatic hydrocarbons, glycols and H₂S.
- Good resistance to aromatic hydrocarbons.

Isolating Sleeve

Mylar as a seal material shall consist following properties,

- Spiral wound Mylar is a general-purpose material recommended for bolting application with flange temperatures below 250°F.
- Material shall be fair resistance to crushing, cracking, breaking and thread pinch.

Isolating washer: 1/8" (0.125) Thick washer

Steel Washer: ZPS standard – Zinc plated steel washers.

Butt weld (BW) ends of the insulating assembly shall be protected by metallic or high impact plastic bevel protectors.

The dimensions of insulating components (gaskets, sleeves and washers) shall be as indicated in Data Sheet. The insulating gasket and washers shall have adequate compressive strength to permit proper tightening of flange bolts for leak proof joint.

The insulating material shall be suitable for pressure and temperature indicated in Data Sheet under connecting pipeline details and shall be resistant to the fluid to be handled through the pipeline.

I.D. and O.D. of insulating washers shall be designed to fit over insulating sleeves and within spot faces on flanges.

After the hydrostatic test, insulating flange assembly shall be tested with air at 5 kg/cm² for 10 minutes. The tightness shall be checked by immersion or with a frothing agent. No leakage shall be accepted.

Insulating gasket, sleeve and washer after the field hydrostatic test shall be tested for dielectric integrity at 5000 V A.C., 50 Hz for one minute and the leakage current before and after shall be equal. Testing time, voltage and leakage shall be recorded and certified. The test shall be carried out in dry conditions.

18.0 CHARPY V-NOTCH TEST

All piping material like valves, fittings, flanges bolting etc. shall be Charpy impact tested. Charpy V-notch impact tests are required for the base metal weld metal and heat-affected zone (HAZ)

Sr. No.	Piping Class	Rating	C. A.	Spl. Reqt.	Basic Material	Service	Remarks
1	P1C	150	1.5	NON-IBR	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE/ /NONFLAMMABLE, NON- LETHAL - HYDROCARBONS	Page 10 of 14
2	P1L	150	1.5	LOW TEMPER ATURE SERVICE	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE/ NON-FLAMMABLE, NON- LETHAL - HYDROCARBONS	Page 15 of 20
3	P3C	300	1.5	NON-IBR	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE / NON-FLAMMABLE, NON- LETHAL- HYDROCARBONS	Page 21 of 25
4	P3L	300	1.5	LOW TEMPER ATURE SERVICE	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE / NON-FLAMMABLE, NON- LETHAL- HYDROCARBONS	Page 26 of 29
5	P1F	150	1.5	NON-IBR	CARBON STEEL	FIRE WATER (ABOVE GROUND / UNDER GROUND)	Page 30 of 34

PIPE CLASS	:	P1C
RATING	:	150
BASE MATERIAL	:	Carbon Steel
CORROSION ALLOWANCE	:	1.5 MM
SPECIAL REQUIREMENT	:	Non-IBR

TEMPERATURE (Deg. C) AND PRESSURE (Kg/Sq. cm g) RATINGS

TEMP	-29	38	93	149	204	260	316	343	371
PRESS	20.03	20.03	18.28	16.17	14.06	11.95	9.84	8.78	7.73

SERVICE

Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

NOTES

1. All vents and drains shall be provided with gate valve with blind flange assembly unless otherwise indicated in P&ID.
2. NDT of welds shall be as follows:

Radiography	:	All butt welds 100%
MPI	:	Socket welds 100%
3. Piping design as per ASME B 31.8, OISD 226 & PNGRB Guidelines
4. Charpy V notch test and hardness test shall be conducted for pipes, fittings and flanges at (-) 29°C.
5. All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
6. For valves, refer valve data sheets.

ITEM	SIZE	DESCRIPTION
Maintenance joints	ALL	Flanged, to be kept minimum
Pipe joints	1.5" & BELOW	SW coupling
	2.0" & ABOVE	Butt welded
Drains	ON LINES <= 1.5"	Refer std. P-STD-419
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. P-STD-418
Vents	ON LINES <= 1.5"	Refer std. P-STD-419
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. P-STD-418
Temp. Connection	1.5"	Flanged, installation as per std. P-STD-414 & 415, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std. P-STD-411, 412 & 413

Item	Lower Size (Inch)	Upper Size (Inch)	Sch./Thk.	Dmn. STD	Material (Charpy)	Description
Pipe Group						
PIPE	00.500	00.750	S160	B-36.10	ASTM A 106 GR. B	PE, SEAMLESS
PIPE	01.000	01.500	XS	B-36.10	ASTM A 106 GR. B	PE, SEAMLESS
PIPE	02.000	02.000	XS	B-36.10	ASTM A 106 GR. B (Charpy)	BE, SEAMLESS
PIPE	03.000	20.000	STD	B-36.10	ASTM A 106 GR. B (Charpy)	BE, SEAMLESS
NIPPLE	00.500	01.500	M	B-36.10	ASTM A 106 GR. B	PBE, SEAMLESS
Flange Group						
FLNG.SW	00.500	01.500	M	B-16.5	ASTM A 105	150, RF/125AARH
FLNG.WN	2.000	20.000	M	B-16.5	ASTM A 105 (Charpy)	150, RF/125AARH
FLNG.BLIND	00.500	01.500		B-16.5	ASTM A 105	150, RF/125AARH
FLNG.BLIND	2.000	20.000		B-16.5	ASTM A 105 (Charpy)	150, RF/125AARH
FLNG.FIG.8	00.500	08.000		ASME B16.48	ASTM A 105 (Charpy)	150, FF/125AARH
SPCR&BLND	10.000	20.000		ASME B16.48	ASTM A 105 (Charpy)	150, FF/125AARH
Fitting Group						
ELBOW.90	00.500	01.500		B-16.11	ASTM A 105	SW, 6000
ELBOW.90	02.000	20.000	M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW, 1.5D
ELBOW.45	00.500	01.500		B-16.11	ASTM A 105	SW, 6000
ELBOW.45	02.000	20.000	M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW, 1.5D
T. EQUAL	00.500	01.500		B-16.11	ASTM A 105	SW, 6000
T. EQUAL	02.000	20.000	M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW
T.RED	00.500	01.500		B-16.11	ASTM A 105	SW, 6000
T.RED	02.000	20.000	M, M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW

Item	Lower Size (Inch)	Upper Size (Inch)	Sch./Thk.	Dmn. STD	Material (Charpy)	Description
REDUC. CONC	02.000	20.000	M, M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW
REDUC. ECC	02.000	20.000	M, M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW
SWAGE. CONC	00.500	03.000	M, M	BS-3799	ASTM A 105 (Charpy)	PBE
SWAGE. ECC	00.500	03.000	M, M	BS-3799	ASTM A 105 (Charpy)	PBE
CAP	00.500	00.750		B-16.11	ASTM A 105	SCRF, 6000
CAP	01.000	01.500		B-16.11	ASTM A 105	SCRF, 3000
CAP	02.000	20.000	M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW
PLUG	00.500	00.750		B-16.11	ASTM A 105	SCRM, 6000
O' let						
WELDOLET	02.000	06.000	M, S160	MSS-SP97	ASTM A 105 (Charpy)	BW
SOCKOLET	00.500	00.750		MSS-SP97	ASTM A 105	SCRF, 6000
SOCKOLET	01.000	01.500		MSS-SP97	ASTM A 105	SW, 3000
Valves						
VLV.GLOBE	00.250	01.500		BS EN ISO 15761	BODY-ASTM A 105, TRIM-STELLITED, STEM-13%CR STEEL	SW, 800, 3000, B-16.11
VLV.GLOBE	02.000	18.000		BS-1873	BODY-ASTM A 216 GR.WCB, TRIM- 13% CR. STEEL	FLGD, 150, B-16.5, RF/125AARH
VLV.GLOBE	02.000	08.000		BS-1873	BODY-ASTM A 216 GR.WCB, TRIM- 13% CR. STEEL	BW, 150, B-16.25
VLV.CHECK	00.250	01.500		BS EN ISO 15761	BODY-ASTM A 105, TRIM-STELLITED	SW, 800, 3000, B-16.11
VLV.CHECK	02.000	20.000		API-6D	BODY-ASTM A 216 GR.WCB, TRIM- 13% CR. STEEL	FLGD, 150, B-16.5, RF/125AARH



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Item	Lower Size (Inch)	Upper Size (Inch)	Sch./Thk.	Dmn. STD	Material (Charpy)	Description
VLV.BALL	00.500	01.500		BS EN ISO 17292	BODY-ASTM A 105, TRIM-13% CR. STEEL, SEAT-RPTFE	SW, 150, B-16.5, RF/125AARH
VLV.BALL	02.000	20.000		API-6D	BODY-ASTM A216 GR.WCB, TRIM/BA LLSEAT-(AISI 4140 + 0.003"ENP)/AISI 410	FLGD, 150, B-16.5, RF/125AARH
VLV.BALL	02.000	20.000		API-6D	BODY-ASTM A 216 GR.WCB, TRIM- BALL, SEAT-(AISI 4140 + 0.003"ENP) / AISI 410	BW, 150, B-16.25
VLV.PLUG	00.500	01.500		BS-5353	BODY-ASTM A 105, PLUG - A105 +0.003" ENP	SW, 800, 3000, B-16.11,
Bolt Group						
BOLT.STUD	00.500	48.000		B-18.2	BOLT: A193 GR. B7, NUT: A194 GR.2H	
Gasket Group						
GASKET	00.500	20.000		B-16.20-ANSI B16.5	SP.WND METTALIC WITH GRAPHITE FILLER	SPIRAL, 150

PIPE CLASS	:	P1L
RATING	:	150
BASE MATERIAL	:	Carbon Steel
CORROSION ALLOWANCE	:	1.5 MM
SPECIAL REQUIREMENT	:	Low Temperature Service

TEMPERATURE (Deg. C) AND PRESSURE (Kg/Sq. cm g) RATINGS

TEMP	-45	38	93
PRESS	18.63	18.63	17.57

SERVICE

Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

NOTES

1. All vents and drains shall be provided with gate valve with blind flange assembly unless otherwise indicated in P&ID.
2. NDT of welds shall be as follows:

Radiography	:	All butt welds 100%
MPI	:	Socket welds 100%
3. Piping design as per ASME B 31.8 OISD 226 & PNGRB Guidelines
4. Charpy V notch test and hardness test shall be conducted for pipes, fittings and flanges at (-) 45°C.
5. All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
6. For valves, refer valve data sheets.

ITEM	SIZE	DESCRIPTION
Maintenance joints	ALL	Flanged, to be kept minimum
Pipe joints	1.5" & BELOW	SW coupling
	2.0" & ABOVE	Butt welded
Drains	ON LINES <= 1.5"	Refer std. P-STD-419
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. P-STD-418
Vents	ON LINES <= 1.5"	Refer std. P-STD-419
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. P-STD-418
Temp. Connection	1.5"	Flanged, installation as per std. P-STD-414 & 415, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std. P-STD-411, 412 & 413

Item	Lower Size (Inch)	Upper Size (Inch)	Sch./Thk.	Dmn. STD	Material (Charpy)	Description
Pipe Group						
PIPE	00.500	00.750	S160	B-36.10	ASTM A 333 GR.6	PE, SEAMLESS
PIPE	01.000	01.500	XS	B-36.10	ASTM A 333 GR.6	PE, SEAMLESS
PIPE	02.000	02.000	XS	B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
PIPE	03.000	06.000	STD	B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
NIPPLE	00.500	01.500	M	B-36.10	ASTM A 333 GR.6	PBE, SEAMLESS
Flange Group						
FLNG.WN	00.500	06.00	M	B-16.5	ASTM A 350 GR.LF2	150, RF/125AARH
FLNG.BLIND	00.500	06.00		B-16.5	ASTM A 350 GR.LF2	150, RF/125AARH
FLNG.FIG.8	00.500	06.00		ASME B16.48	ASTM A 350 GR.LF2	150, FF/ 125AARH
Fitting Group						
ELBOW.90	00.500	00.750		B-16.11	ASTM A 350 GR.LF2	SW, 6000
ELBOW.90	01.000	01.500		B-16.11	ASTM A 350 GR.LF2	SW, 3000
ELBOW.90	02.000	8.000	M	B-16.9	ASTM A 420 GR.WPL6	BW, 1.5D
ELBOW.45	00.500	00.750		B-16.11	ASTM A 350 GR.LF2	SW, 6000
ELBOW.45	01.000	01.500		B-16.11	ASTM A 350 GR.LF2	SW, 3000
ELBOW.45	02.000	6.000	M	B-16.9	ASTM A 420 GR.WPL6	BW, 1.5D
T. EQUAL	00.500	00.750		B-16.11	ASTM A 350 GR.LF2	SW, 6000
T. EQUAL	01.000	01.500		B-16.11	ASTM A 350 GR.LF2	SW, 3000

Item	Lower Size (Inch)	Upper Size (Inch)	Sch./ Thk.	Dmn. STD	Material (Charpy)	Description
T. EQUAL	02.000	6.000	M	B-16.9	ASTM A 420 GR.WPL6	BW
T.RED	00.500	00.750		B-16.11	ASTM A 350 GR.LF2	SW, 6000
T.RED	01.000	01.500		B-16.11	ASTM A 350 GR.LF2	SW, 3000
T.RED	02.000	6.000	M, M	B-16.9	ASTM A 420 GR.WPL6	BW
REDUC. CONC	02.000	6.000	M, M	B-16.9	ASTM A 420 GR.WPL6	BW
REDUC. ECC	02.000	6.000	M, M	B-16.9	ASTM A 420 GR.WPL6	BW
SWAGE. CONC	00.500	03.000	M, M	BS-3799	ASTM A 350 GR.LF2	PBE
SWAGE.ECC	00.500	03.000	M, M	BS-3799	ASTM A 350 GR.LF2	PBE
CAP	00.500	01.500		B-16.11	ASTM A 350 GR.LF2	SCRIF, 3000
CAP	02.000	6.000	M	B-16.9	ASTM A 420 GR.WPL6	BW
PLUG	00.500	01.500		B-16.11	ASTM A 350 GR.LF2	SCRM, 3000
COUPLING FULL	00.500	00.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
COUPLING FULL	01.000	01.500		B-16.11	ASTM A 350 GR.LF2	SW, 3000
COUPLING HALF	00.500	00.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
COUPLING HALF	01.000	01.500		B-16.11	ASTM A 350 GR.LF2	SW, 3000
O' let						
WELDOLET	02.000	06.000	M, XXS	MSS-SP97	ASTM A 350 GR.LF2	BW
SOCKOLET	00.500	00.750		MSS-SP97	ASTM A 350 GR.LF2	SW, 6000

SOCKOLET	01.000	01.500		MSS-SP97	ASTM A 350 GR.LF2	SW, 3000
Valves						
VLV.GLOBE	00.500	01.500		BS EN 1SO 15761	BODY-ASTM A 350 GR.LF2, TRIM STELLITED, STEM SS304	SW, 800, 3000, B-16.11
VLV.GLOBE	02.000	8.000		BS-1873	BODY-ASTM A 350 GR.LF2, TRIM STELLITED, STEM SS304	FLGD, 150, B-16.5, RF/125AARH
VLV.CHECK	00.500	01.500		BS EN 1SO 15761	BODY-ASTM A 350 GR.LF2, TRIM STELLITED	SW, 800, 3000, B-16.11
VLV.CHECK	02.000	6.000		API-6D	BODY-ASTM A352 GR.LCB, TRIM STELLITED	FLGD, 150, B-16.5, RF/125AARH
VLV.BALL	00.500	01.500		BS EN 1SO 17292	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1, TRIM-BODY SEAT-RPTFE	SW, 800, 3000, B-16.11
VLV.BALL	02.000	6.000		API-6D	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1, TRIM-BODY SEAT-RPTFE	FLGD, 150, B-16.5, RF/125AARH
VLV.BALL	02.000	6.000		API-6D	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1, TRIM-BODY SEAT-RPTFE	BW, 150, B-16.25
Bolt Group						
BOLT.STUD	00.500	6.000		B-18.2	BOLT: A320 GR. L7, NUT: A194 GR.4	
Gasket Group						



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GASKET	00.500	6.000		B-16.20- ANSI B16.5	SP.WND SS316+GRAFOIL	SPIRAL, 150
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PIPE CLASS	:	P3C
RATING	:	300
BASE MATERIAL	:	Carbon Steel
CORROSION ALLOWANCE	:	1.5 MM
SPECIAL REQUIREMENT	:	Non-IBR

TEMPERATURE (Deg. C) AND PRESSURE (Kg/Sq. cm g) RATINGS

TEMP	-29	38	93	149	204	260	316	343
PRESS	52.02	52.02	47.45	46.05	44.64	42.18	38.66	37.61

SERVICE

Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

NOTES

- All vents and drains shall be provided with gate valve with blind flange assembly unless otherwise indicated in P&ID
- NDT of welds shall be as follows:

Radiography	:	All butt welds 100%
MPI	:	Socket welds 100%
- Piping design as per ASME B 31.8, OISD 226 & PNGRB Guidelines
- Charpy V notch test and hardness test shall be conducted for pipes, fittings and flanges at (-) 29°C.
- Corrosion allowance of 1.5 mm has been considered for terminal piping.
- All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
- For valves, refer valve data sheets as enclosed.
- Design factor 0.5.
- Ball Valve to be used in main pipeline shall have butt welded ends.

ITEM	SIZE	DESCRIPTION
Maintenance Joints	All	Flanged, to be kept minimum
Pipe joints	1.5" & below	SW coupling
	2.0" & above	Butt welded
Drains	on lines <= 1.5"	Refer std. P-STD-419
	on lines >= 2.0"	As per P&ID or 0.75". Refer std. P-STD-418
Vents	on lines <= 1.5"	Refer std. P-STD-419
	on lines >= 2.0"	As per P&ID or 0.75". Refer std. P-STD-418
Temp. Connection	1.5"	Flanged, installation as per std. P-STD-414 & 415, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std. P-STD-411, 412 & 413



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Item	Lower Size (Inch)	Upper Size (Inch)	Sch./ Thk.	Dmn. STD	Material (Charpy)	Description
PIPE GROUP						
PIPE	00.500	00.750	S160	B-36.10	ASTM A 106 GR. B	PE, SEAMLESS
PIPE	01.000	01.500	XS	B-36.10	ASTM A 106 GR. B	PE, SEAMLESS
PIPE	02.000	02.000	XS	B-36.10	ASTM A 106 GR. B (CHARPY)	BE, SEAMLESS
PIPE	03.000	03.000	STD	B-36.10	ASTM A 106 GR. B (CHARPY)	BE, SEAMLESS
PIPE	04.000	06.000	XS	B-36.10	ASTM A 106 GR. B (CHARPY)	BE, SEAMLESS
PIPE	08.000	10.000	STD	B-36.10	ASTM A 106 GR. B (CHARPY)	BE, SEAMLESS
NIPPLE	00.500	01.500	M	B-36.10	ASTM A 106 GR. B	PBE, SEAMLESS
FLANGE GROUP						
FLNG.SW	00.500	01.500	M	B-16.5	ASTM A 105	300, RF/125AARH
FLNG.WN	02.000	8.000	M	B-16.5	ASTM A 105 (CHARPY)	300, RF/125AARH
FLNG.BLIND	00.500	01.500		B-16.5	ASTM A 105	300, RF/125AARH
FLNG.BLIND	02.000	20.000		B-16.5	ASTM A 105 (CHARPY)	300, RF/125AARH
FLNG.FIG.8	00.500	01.500		ASME- B 16.48	ASTM A 105	300, FF/125AARH
FLNG.FIG.8	02.000	08.000		ASME- B 16.48	ASTM A 105 (CHARPY)	300, FF/125AARH
SPCR & BLND	10.000	20.000		ASME- B 16.48	ASTM A 105 (CHARPY)	300, FF/125AARH
FITTING GROUP						
ELBOW.90	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
ELBOW.90	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
ELBOW.90	02.000	8.000	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW, 1.5D
ELBOW.45	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
ELBOW.45	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
ELBOW.45	02.000	8.000	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW, 1.5D
T. EQUAL	00.500	00.750		B-16.11	ASTM A 105	SW, 6000

Item	Lower Size (Inch)	Upper Size (Inch)	Sch./ Thk.	Dmn. STD	Material (Charpy)	Description
T. EQUAL	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
T. EQUAL	02.000	8.000	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
T.RED	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
T.RED	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
T.RED	02.000	8.000	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
REDUC. CONC	02.000	8.000	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
REDUC. ECC	02.000	8.000	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
SWAGE. CONC	00.500	03.000	M, M	BS-3799	ASTM A 105 (CHARPY)	PBE
SWAGE .ECC	00.500	03.000	M, M	BS-3799	ASTM A 105 (CHARPY)	PBE
CAP	00.500	00.750		B-16.11	ASTM A 105	SCRF, 6000
CAP	01.000	01.500		B-16.11	ASTM A 105	SCRF, 3000
CAP	02.000	8.000	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
PLUG	00.500	00.750		B-16.11	ASTM A 105	SCRM, 6000
PLUG	01.000	01.500		B-16.11	ASTM A 105	SCRM, 3000
CPLNG. FULL	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
CPLNG. FULL	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
CPLNG.HALF	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
CPLNG.HALF	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
CPLNG.LH	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
CPLNG.LH	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
CPLNG.RED	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
CPLNG.RED	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
O'let						
SOCKOLET	00.500	00.750		MSS-SP97	ASTM A 105	SW, 6000

Item	Lower Size (Inch)	Upper Size (Inch)	Sch./ Thk.	Dmn. STD	Material (Charpy)	Description
SOCKOLET	01.000	01.500		MSS-SP97	ASTM A 105	SW, 3000
WELDOLET	02.000	08.000	M, XXS	MSS-SP97	ASTM A 105 (CHARPY)	BW
VALVE GROUP						
VLV.GATE	00.500	01.500		API-602	BODY-ASTM A 105, TRIM-STELLITED, STEM-13% CR. STEEL	SW, 600,3000, B-16.11
VLV.GLOBE	00.500	01.500		BS EN 1SO 15761	BODY-ASTM A 105, TRIM-STELLITED, STEM-13% CR STEEL	SW, 600, 3000, B-16.11
VLV.GLOBE	02.000	8.000		BS 1873	BODY-ASTM A 216 GR.WCB, TRIM-13% CR. STEEL	FLGD, 300, B-16.5, RF/125AARH
VLV.CHECK	00.500	01.500		BS EN 1SO 15761	BODY-ASTM A 105, TRIM- STELLITED	SW, 600, 3000 ,B-16.11
VLV.BALL	00.500	01.500		BS EN 1SO 17292	BODY-ASTM A 105, TRIM-BODY SEAT - RPTFE	SW, 600, B-16.5, RF/125AARH
VLV.BALL	02.000	8.000		API-6D	BODY-ASTM A 216 GR.WCC/A234 GR.WPC, TRIM: SEAT: AISI4140+0.003 "ENP/AISI410	FLGD, 300, B-16.5, RF/125AARH
VLV.BALL	02.000	8.000	M	API-6D	BODY-ASTM A 216 GR.WCC/A234 GR. WPC, TRIM: SEAT: AISI 4140+0.003"ENP/AISI 410	BW, 300, B-16.25
VLV.PLUG	00.500	01.500		BS-5353	BODY-ASTM A 105, PLUG-A105 +0.003" ENP	SW, 600, 3000, B-16.11
VLV.PLUG	02.000	8.000		API-6D	BODY- A 216GR. WCB, PLUG: A216 GR.WCB + 0.003" ENP	FLGD, 300, B-16.5, RF/125AARH
VLV.PLUG	02.000	02.000	M	API-6D	BODY-ASTM A 216 GR.WCB, PLUG: A216 GR.WCB + 0.003"ENP	BW, 300, B-16.25
BOLT GROUP						
BOLT.STUD	00.500	8.000		B-18.2	BOLT: A193 GR. B7,NUT: A194 GR.2H	
GASKET						



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Item	Lower Size (Inch)	Upper Size (Inch)	Sch./ Thk.	Dmn. STD	Material (Charpy)	Description
GASKET	00.500	8.000		B-16.20-ANSI B16.5	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 300

PIPE CLASS	:	P3L
RATING	:	300
BASE MATERIAL	:	Carbon Steel
CORROSION ALLOWANCE	:	1.5 MM
SPECIAL REQUIREMENT	:	Low Temperature Service

EMPERATURE (Deg. C) AND PRESSURE (Kg/Sq. cm g) RATINGS

TEMP	-45	38	93	120	149	204
PRESS	48.86	48.86	46.05	45.54	44.99	43.59

SERVICE

Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

NOTES

1. All vents and drains shall be provided with gate valve with blind flange assembly unless otherwise indicated in P&ID.
2. Piping design as per ASME B 31.8, OISD 226 & PNGRB Guidelines
3. Flanged end shall be as per ASME B 16.5 for valve up to 24" (excluding 22"), for 22" as per MSS-SP-44.
4. Impact testing is required at (-45) Deg C.
5. NDT of welds within terminal shall be as follows:

Radiography	:	All Butt welds 100%
MPI	:	Socket welds 100%

ITEM	SIZE	DESCRIPTION
Maintenance Joints	all	Flanged, to be kept minimum
Pipe joints	1.5" & below	SW coupling
	2.0" & above	Butt welded
Drains	on lines <= 1.5"	Refer std. P-STD-419
	on lines >= 2.0"	As per P&ID or 0.75". Refer std. P-STD-418
Vents	on lines <= 1.5"	Refer std. P-STD-419
	on lines >= 2.0"	As per P&ID or 0.75". Refer std. P-STD-418
Temp. conn	1.5"	Flanged, installation as per std. P-STD-414 & 415, except skin temperature measurement.
Press. conn	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std. P-STD-411, 412 & 413

Item	Lower Size (Inch)	Upper Size (Inch)	Sch./ Thk.	Dmn. STD	Material (Charpy)	Description
PIPE GROUP						
PIPE	00.500	00.750	S160	B-36.10	ASTM A 333 GR.6	PE, SEAMLESS
PIPE	01.000	01.500	XS	B-36.10	ASTM A 333 GR.6	PE, SEAMLESS
PIPE	02.000	02.000	XS	B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
PIPE	03.000	03.000	STD	B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
PIPE	04.000	04.000	XS	B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
PIPE	06.000	10.000	XS	B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
NIPPLE	00.500	00.750	M	B-36.10	ASTM A 333 GR.6	PBE, SEAMLESS
NIPPLE	01.000	01.500	M	B-36.10	ASTM A 333 GR.6	PBE, SEAMLESS
FLANGE GROUP						
FLNG.SW	00.500	01.500	M	B-16.5	ASTM A 350 GR.LF2	300, RF/125AARH
FLNG.WN	02.000	10.000	M	B-16.5	ASTM A 350 GR.LF2	300, RF/125AARH
FLNG.BLIND	00.500	10.000		B-16.5	ASTM A 350 GR.LF2	300, RF/125AARH
FLNG.FIG.8	00.500	08.000		ASME- B 16.48	ASTM A 350 GR.LF2	300, FF/125AARH
SPCR&BLND	10.000	10.000		ASME- B16.48	ASTM A 350 GR.LF2	300, FF/125AARH
FITTINGS						
ELBOW.90	00.500	00.750		B-16.11	ASTM A 350 GR.LF2	SW, 6000
ELBOW.90	01.000	01.500		B-16.11	ASTM A 350 GR.LF2	SW, 3000
ELBOW.90	02.000	10.000	M	B-16.9	ASTM A 420 GR.WPL6	BW, 1.5D
ELBOW.45	00.500	00.750		B-16.11	ASTM A 350 GR.LF2	SW, 6000
ELBOW.45	01.000	01.500		B-16.11	ASTM A 350 GR.LF2	SW, 3000
ELBOW.45	02.000	10.000	M	B-16.9	ASTM A 420 GR.WPL6	BW, 1.5D
T. EQUAL	00.500	00.750		B-16.11	ASTM A 350 GR.LF2	SW, 6000
T. EQUAL	01.000	01.500		B-16.11	ASTM A 350 GR.LF2	SW, 3000
T. EQUAL	02.000	10.000	M	B-16.9	ASTM A 420 GR.WPL6	BW
VALVE GROUP						

Item	Lower Size (Inch)	Upper Size (Inch)	Sch./ Thk.	Dmn. STD	Material (Charpy)	Description
VLV.GATE	00.500	01.500		API-602	BODY-ASTM A 350 GR.LF2, TRIM-STELLITED, STEM- SS 304	SW, 600, 3000, B-16.11
VLV.GLOBE	00.500	01.500		BS EN ISO 15761	BODY-ASTM A 350 GR.LF2, TRIM-STELLITED, STEM-SS304	SW, 600, 3000, B-16.11
VLV.CHECK	00.500	01.500		BS EN ISO 15761	BODY-ASTM A 350 GR.LF2, TRIM-STELLITED	SW, 600, 3000, B-16.11
VLV.PLUG	00.500	01.500		BS-5353	BODY-ASTM A 350 GR.LF2, PLUG: A350 GR.LF2 + 0.003" ENP	SW, 600, 3000, B-16.11
VLV.PLUG	02.000	10.000		API-6D	BODY-ASTM A 352 GR.LCB / A350 GR.LF2, STEM-SS 304/SS316	FLGD, 300, B-16.5, RF/125AARH
VLV.PLUG	02.000	10.000		API-6D	BODY-ASTM A 352 GR.LCB/ ASTM A350GR.LF2, TRIM-SS304/ SS316	BW, 300, B-16.25
BOLT & GASKET						
BOLT.STUD	00.500	10.000		B-18.2	BOLT: A320 GR. L7,NUT: A194 GR.4	
GASKET	00.500	10.000		B-16.20-ANSI B16.5	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 300

PIPE CLASS : **P1F**
RATING : 150
BASE MATERIAL : Carbon Steel
CORROSION ALLOWANCE : 1.5 MM
SPECIAL REQUIREMENT : NON-IBR

TEMPERATURE (Deg. C) AND PRESSURE (Kg/Sq. cm g) RATINGS

TEMP	0	38	50	65
PRESS	18.9	18.9	18.9	18.9

SERVICE

Fire Water (Above Ground/ Under Ground)

NOTES

1. All vents and drains for hydro test shall be provided with gate valve with blind flange assembly unless otherwise indicated in P&ID
2. Forgings are acceptable in Lieu of Plate material.
3. Sizes given in PMS are nominal bore for O.D. of IS 3589 pipes refer ANSI B36.10.
4. Butterfly Valves shall be lugged wafer type up to 24" and double flanged body for sizes beyond 24".
5. Pipe thicknesses are job specific based on the soil properties of job site and depth of top of pipe of 1.5m. No live load has been considered for calculation of pipe thickness. Live loads wherever expected shall be suitably taken care of.
6. NDT of welds shall be as follows:
 - Radiography : All Butt welds 10%
 - MPI : Socket welds 10%

ITEM	SIZE	DESCRIPTION
MAINTENANCE JOINTS	ALL	FLANGED, TO BE KEPT MINIMUM
PIPE JOINTS	1.5" & BELOW	SW COUPLING
	2.0" & ABOVE	BUTT WELDED
DRAINS	ON LINES <= 1.5"	Refer std. SD-PI-019
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. SD-PI-018
VENTS	ON LINES <= 1.5"	Refer std. SD-PI-019
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. SD-PI-018
TEMP.CONN	1.5"	Flanged, installation as per std. SD-PI-014 & 015, except skin temperature measurement.
PRESS.CONN	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std. SD-PI-011, 012 & 013



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BRANCH TABLE

										T	14	R A N C H P I P E										
										T	R		12									
										T	R		R	10								
										T	R		R	R	8							
										T	P		R	R	R	6						
										T	R		P	R	R	R	4					
										T	P		R	P	R	R	R	3				
										T	P		P	R	P	R	R	R	2			
										T	T		H	H	H	H	H	H	H	1.5		
										T	T		H	H	H	H	H	H	H	H	1	
										T	T		T	H	H	H	H	H	H	H	H	0.75
										T	T		T	T	H	H	H	H	H	H	H	H
0.05	0.75	1	1.5	2	3	4	6	8	10	12	14											
R U N P I P E																						

CODE DESCRIPTION

F	SADDLE FUSED JT	T	TEES
H	H. COUPLING	W	WELDOLETS
P	PIPE TO PIPE	I	INSTRUMENT TEE
R	REINFORCED	X	Refer Notes
S	SOCKOLETS	L	SWEEPOLET

Item Type	Lower Size (Inch)	Upper Size (Inch)	Sch/Thk	Dmn. STD	Material	Description
Pipe Group						
PIPE	00.500	01.500	HVY	IS-1239-I	IS-1239 (BLACK)	PE, C. WELDED
PIPE	02.000	06.000	HVY	IS-1239-I	IS-1239 (BLACK)	BE, C. WELDED
PIPE	08.000	12.000	6.0	IS-3589	IS-3589 GR.410	BE, WELDED
PIPE	14.000	14.000	8.0	IS-3589	IS-3589 GR.410	BE, WELDED
NIPPLE	00.500	01.500	HVY	STD	IS-1239 (BLACK)	PBE, C. WELDED
Flange Group						
FLNG.SW	00.500	01.500	M	B-16.5	ASTM A 105	150, RF/125AARH
FLNG.SO	02.000	14.000		B-16.5	ASTM A 105	150, RF/125AARH
FLNG.BLIND	00.500	14.000		B-16.5	ASTM A 105	150, RF/125AARH
FLNG.FIG.8	00.500	08.000		ASME- B16.48	ASTM A 105	150, FF/125AARH
SPCR&BLND	10.000	14.000		ASME- B16.48	ASTM A 105	150, FF/125AARH
Fitting Group						
ELBOW.90	00.500	01.500		B-16.11	ASTM A 105	SW, 3000
ELBOW.90	02.000	06.000	STD	B-16.9	ASTM A 234GR.WPB	BW, 1.5D
ELBOW.90	08.000	14.000	M	B-16.9	ASTM A 234GR.WPB-W	BW, 1.5D
ELBOW.45	00.500	01.500		B-16.11	ASTM A 105	SW, 3000
ELBOW.45	02.000	06.000	STD	B-16.9	ASTM A 234GR.WPB	BW, 1.5D
ELBOW.45	08.000	14.000	M	B-16.9	ASTM A 234GR.WPB-W	BW, 1.5D
T. EQUAL	00.500	01.500		B-16.11	ASTM A 105	SW, 3000
T. EQUAL	02.000	06.000	STD	B-16.9	ASTM A 234GR.WPB	BW
T. EQUAL	08.000	14.000	M	B-16.9	ASTM A 234 GR.WPB-W	BW
T.RED	00.500	01.500		B-16.11	ASTM A 105	SW, 3000
T.RED	02.000	06.000	STD, STD	B-16.9	ASTM A 234GR.WPB	BW
T.RED	08.000	14.000	M, M	B-16.9	ASTM A 234 GR.WPB-W	BW
Fitting Group						
REDUC.CONC	02.000	06.000	STD, STD	B-16.9	ASTM A 234 GR.WPB	BW
REDUC.CONC	08.000	14.000	M, M	B-16.9	ASTM A 234 GR.WPB-W	BW
REDUC.ECC	02.000	06.000	STD, STD	B-16.9	ASTM A 234GR.WPB	BW
REDUC.ECC	08.000	14.000	M, M	B-16.9	ASTM A 234 GR.WPB-W	BW
SWAGE. CONC	00.500	03.000	M, M	BS-3799	ASTM A 105	PBE

ItemType	Lower Size (Inch)	Upper Size (Inch)	Sch/Thk	Dmn. STD	Material	Description
SWAGE. ECC	00.500	03.000	M, M	BS-3799	ASTM A 105	PBE
CAP	00.500	01.500		B-16.11	ASTM A 105	SCRFB, 3000
CAP	02.000	06.000	STD	B-16.9	ASTM A 234 GR.WPB	BW
CAP	08.000	14.000	M	B-16.9	ASTM A 234 GR.WPB	BW
CPLNG.FULL	00.500	01.500		B-16.11	ASTM A 105	SW, 3000
CPLNG.HALF	00.500	01.500		B-16.11	ASTM A 105	SW, 3000
CPLNG.LH	00.500	01.500		B-16.11	ASTM A 105	SW, 3000
CPLNG.RED	00.500	01.500		B-16.11	ASTM A 105	SW, 3000
SOCKOLET	00.500	01.500		MSS-SP97	ASTM A 105	SW, 3000
UNION	00.500	01.500		BS-3799	ASTM A 105	SW, 3000
Valves Group						
VLV.GATE	00.500	01.500		API-602	BODY-ASTM A 105, TRIM-STELLITED, STEM- 13%CR. STEEL	SW, 800, 3000, B-16.11.
VLV.GATE	02.000	24.000		API-600	BODY-ASTM A 216 GR.WCB, TRIM- 13% CR. STEEL	FLGD, 150, B-16.5, RF/125AARH.
VLV.GLOBE	00.500	01.500		BS-5352	BODY-ASTM A105, TRIM-STELLITED, STEM-	SW, 800, 3000, B-16.11.
VLV.GLOBE	02.000	16.000		BS-1873	BODY-ASTM A 216 GR.WCB, TRIM- 13% CR. STEEL	FLGD, 150, B-16.5, RF/125AARH.
VLV.CHECK	00.500	01.500		BS-5352	BODY-ASTM A 105, TRIM- STELLITED	SW, 800, 3000, B-16.11.
VLV.CHECK	02.000	24.000		BS 1868	BODY-ASTM A 216 GR.WCB, TRIM- 13% CR. STEEL	FLGD, 150, B-16.5, RF/125AARH.
Valves Group						
VLV.BTRFLY	03.000	24.000		BS-5155	BODY-ASTM A 216 GR.WCB, TRIM- 13% CR. STEEL	WAFL, 150, B-16.5, WAF/125AARH.
Bolt Group						
BOLT.STUD	00.500	14.000		B-18.2	BOLT: A193 GR. B7, NUT: A194 GR.2H	
Gasket Group						
GASKET	00.500	14.000		B-16.21-ANSI B16.5	IS-2712-GR. W/3	RING, 150, 2 MM
Trap/Strainer Group						



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ItemType	Lower Size (Inch)	Upper Size (Inch)	Sch/Thk	Dmn. STD	Material	Description
STRNR.PERM	00.500	01.500		MNF'STD	B: A105; INT:SS304	SW, Y-TYPE, 800
STRNR.PERM	02.000	06.000	M	PLECO'STD	B: A234GR.WPB; INT:SS304	BW, T-TYPE
STRNR.PERM	08.000	14.000	M	PLECO'STD	B: A234GR.WPBW; INT:SS304	BW, T-TYPE

	LIST OF RECOMMENDED THIRD PARTY INSPECTION AGENCY (TPIA)			
	CONSULTANT:	Pipeline Engineering Consultants Private Limited (PLECO)		
SL. NO	NAME OF TPI	ADDRESS	PHONE NO	FAX NO
1	Tata Projects Ltd.	22,Sarvodaya Society,Nizampura,Baroda-390002	0265-2392863	0265-2785952
2	Bax counsel Inspection Bureau Pvt. Ltd.	303, Madhava,Bandra Kurla Complex, Bandra(E),Mumbai-400051	022-26591526,022-26590236	022-26591526
3	Germanischer Lloyd	4th Floor, Dakshna Building, Sec-11, Plot NO.2, CBD Belapur, Navi Mumbai 400 614	022-4078 1000	022-4024 2935
4	ABS Industrial Verification Ltd., Mumbai	404,Mayuresh Chambers,Sector-11,CBD Belapur(E),Navi Mumbai-400614	022-27578780 /1 /2	022-27578784 / 5
5	Certification Engineers International Ltd.	EIL Bhavan,5th floor,1,Bhikaji Camma Place, New Delhi-110066	011-26167539,26102121	011-26101419
6	Dalal Mott MacDonald	501, Sakar -II, Ellisbridge,Ahemedabad-380006	079-26575550	079-6575558
7	International Certification Systems	E-7,Chand Society, Juhu Road, Juhu, Mumbai-4000049	022-26245747	022-226248167
8	SGS	SGS India Pvt. Ltd.,SGS House,4B,A.S.Marg,Vikhroli(W),Mumbai-400083	022-25798421 to 28	022-25798431 to 33
9	Intertek Moody	9th Floor, Kanchenjunga Building, 18-Barakhamba Road, New Delhi-110001	011-4713 3900	011-4713 3999
10	TUV SUD South Asia	C-153/1, Okhla Industrial Ara, Phase-1, New Delhi-110020	011-3088 9611/9797	011-3088 9598
11	TUV Rheinland (India) Pvt. Ltd.	F-51, Kailash Complex GF, Veer Savarkar Marg, Vikhroli Park Site, Vikhroli(W), Mumbai-400079	022-4215 5435	022-4215 5434
12	Vincott International India Assessment Service Pvt. Ltd.	C-301, Mangalya Premises Cooperative Soc. Ltd, Off. Marol Maroshi Road, Andheri(E), Mumbai-400959	022-4247 4100	022-4247 4101
13	Meenar Global Consultants	Mr. Nitin Taneja (Project Manager)	M: +91-9711212783 T: +91-129-4072836	Web : www.meenaar.in Email : nitin.taneja@meenaar.in
14	VCS Quality Services Pvt. Ltd.	505, 5th floor, 360 Degree Business Park, Next to R-Mall, L.B.S. Marg, Mulund West, Mumbai 400080	Tel: 91 22 21649720	091 22 21646392
15	Edlipse Engg. Global Pvt. Ltd.	Office No. - 24 , Upper ground floor, Parsvnath Bibhab Plaza, Alpha-1, Commercial Belt, Greater Noida UP . Mobile - +91 9910502293 Landline - +91 120 4922792	Mobile - +91 9910502293 Landline - +91 120 4922792	www.edlipse.com



LIST OF APPROVED PARTIES FOR BOUGHT OUT ITEMS

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LIST OF SUPPLIERS OF MAJOR BOUGHT - OUT ITEMS

1. (MECHANICAL & FIRE FIGHTING EQUIPMENT)

i) Pipe Carbon Steel to Indian Standards

1. A.S.T. Pipes Pvt. Ltd. (AST Group)
2. Advance Steel Tube Ltd.
3. Apl Apollo Tubes Ltd. (Er. Bihar Tubes Ltd.
4. Asian Mills Pvt. Ltd.
5. Asrani Tubes Limited
6. Dadu Pipes (P) Ltd.
7. Essar Steel Limited (Er Hazira Pipes Mill)
8. Gaurang Products Pvt Ltd. (Ast Group)
9. Goodluck Steel Tubes Ltd.
10. Hi-Tech Pipes Limited
11. Indus Tube Limited
12. Jindal Industries Ltd
13. Jindal Pipes Ltd.
14. Jindal Saw Ltd (Kosi Works)
15. Jotindra Steel & Tube Ltd
16. Lalit Pipes and Pipes Ltd.
17. Maharashtra Seamless Ltd.
18. Man Industries (India) Ltd. – Pithampur
19. Man Industries (India) Ltd. Anjar
20. Mukat Tanks & Vessels Ltd.
21. Nezone Tubes Limited
22. North Eastern Tubes Limited
23. Pratibha Industries Limited
24. Pratibha Pipes & Structural Ltd.



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25. Psl Ltd (Chennai)
26. Psl Ltd (V1, V2 & Nc)
27. Rama Steel Tubes Ltd.
28. Ratnamani Metals and Tubes Ltd.
29. Ravindra Tubes Limited
30. Samshi Pipe Industries Limited
31. Surya Roshni Ltd.
32. Swastik Pipes Ltd.
33. Utkarsh Tubes & Pipes Ltd. (Formerly Bmw)
34. Welspun Corp. Limited (Dahej)
35. Zenith Birla (India) Limited

ii) **Pipe & Tubulars To A.P.I. Standards**

1. Arcelormittal Tubular Products Roman Sa, Romania
2. Bhel (Trichy), India
3. Dalmine Spa (Enquiry To Tenaris),Uae
4. Eewkorea Co. Ltd (Germany), Korea
5. Eew Korea Co. Ltd. (Korea), Korea
6. Eisenbau Kramer Gmbh, Germany
7. Hyundai Rb Co. Ltd. South Korea
8. Ilva Lamiere E Tubi Srl (Enq to Ilva Spa, Italy)
9. Inox Tech. Spa, Italy
10. Ismt Ltd. Ahmedngr, India
11. Ismt Ltd. Baramati, India
12. Jindal Pipes Ltd., India
13. Jindal Saw Ltd. (Kosi Works), India
14. Jindal Saw Ltd. (Nashik Works), India
15. Lalit Pipes and Pipes Ltd. India



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16. Maharashtra Seamless Ltd., India
17. Man Industries (I) Ltd. (Pithampur), India
18. Mukat Tanks & Vessels Ltd., India
19. Pratibha Industries Limited, India
20. Ratnamani Metals and Tubes Ltd., India
21. Siderca S.A.I.C (Enquiry Totenaris), Uae
22. Sumitomo Metal Ind. Ltd., India
23. Surya Roshni Ltd., India
24. Swastik Pipes Ltd, India
25. Tata Steel Uk Limited (Formerly C702)
26. Tubos De Acero De Mexico Sa (Enq. Tenaris), Uae
27. Tubos Reunidos Sa Spain
28. Umran Steel Pipe Inc (Turkey), Turkey
29. Valcovny Trub Chomutov, Czech Republic
30. Vallourec and Mannesmann Tubes, France
31. Welspun Corp Limited (Dahej), India

iii) Pipe/Tube CS (Seamless) To ASTM Stds

1. Arcelormittal Tubular Products Roman Sa, Romania
2. Bhel (Trichy), India
3. Changshu Seamless Steel Tube Co. Ltd., China
4. Dalmine Spa (Enquiry to Tenaris, Uae)
5. Heavy Metals & Tubes Limited (Mehsana), India
6. Ismt Ltd. Ahmedngr, India
7. Ismt Ltd. Baramati India
8. Jfe Steel Corporation, Uae
9. Jindal Sdaw Ltd (Nashik Works) India
10. Klt Automotive and Tubular Products Ltd., India



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11. Mahalaxmi Seamless Limited, India
12. Maharashtra Seamless Ltd, India
13. Products Tubulares S.A.U, Spain
14. Ratnadeep Metal Tubes Ltd., India
15. Staineest Tubes Pvt Ltd., India
16. Sumitomo Metal Ind. Ltd., India
17. Tubos Reunidos Sa Spain
18. Valcovny Trub Chomutov, Czech Republic
19. Vallourec Andmannesmann Tubes France
20. Yangzhou Chengde Steel Pipe Co. Ltd Dubai (UAE)

iv) Pipe Carbon Steel (Welded) To ASTM Stds

1. Eew Korea Co. Ltd. (Germany), Korea
2. Eew Korea Co. Ltd. (Korea), Korea
3. Eisenbau Kramer Gmbh, Germany
4. Hyundai Rb Co. Ltd., South Korea
5. Inox Tech. Spa, Italy
6. Jindal Saw Ltd (Kosi Works), India
7. Lalit Pipes And Pipes Ltd., India
8. Man Industries (I) Ltd.(Pithampur), India
9. Man Industries (India) Ltd. Anjar, India
10. Mukat Tanks & Vessels Ltd., India
11. Ratnamani Metals And Tubes Ltd., India
12. Sumitomo Metal India Ltd., India
13. Tata Steel Uk Limited

v) Valve

a) Globe Valves

- 1) M/s BDK (New Delhi)



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- 2) M/s Datre Corpn (Calcutta)
- 3) M/s KSB Pumps (New Delhi)
- 4) M/s L&T (New Delhi)
- 5) M/s Neco Schuber & Salzer Ltd. (New Delhi)
- 6) M/s Niton Valve (Mumbai)
- 7) M/s Ornate Valves (Mumbai)
- 8) M/s Panchavati Valves (Mumbai)
- 9) AV Valves Ltd.
- 10) BHEL (Trichy), India
- 11) Econo Valves Pvt Ltd, India
- 12) Fouress Engg (I) Ltd (Aurangabad)
- 13) Guru Industrial Valves Pvt Ltd
- 14) Leader Valves Ltd, India
- 15) NSSL Ltd. (Neco Schubert & Salzerltd)
- 16) Oswal Industries Ltd, India
- 17) Petrochemical Engineering Enterprises, India
- 18) Sakhi Engineers Pvt Ltd
- 19) Shalimar Valves Pvt Ltd
- 20) Steel Strong Valves India Pvt Ltd, India
- 21) Petro Valves Pvt. Limited, Ahmedabad

b) Check Valves

1. M/s Advance Valves Pvt. Ltd., Noida
2. M/s Aksons & Mechanical Enterprises, Mumbai
3. M/s Larsen & Toubro Limited (M/s Audco India Limited, Chennai)
4. M/s AV valves Ltd., Agra
5. M/s BDK engineering India Ltd., Hubli
6. M/s BHEL, OFE&OE Group, New Delhi



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7. M/s Datre Coroportion Limited, Calcutta
8. M/s Leader Valves Ltd., Jalandhar
9. M/s Neco schubert & Salzer Ltd., New Delhi
10. M/s Niton Valves Industries (P) Ltd., Mumbai
11. M/s Precision Engg.Co., Mumbai
12. Econo Valves Pvt Ltd, India
13. Fouress Engg (I) Ltd (Aurangabad)
14. KSB Pumps Ltd (Coimbatore), India
15. NSSL Ltd. (Neco Schubert & SalzerLtd)
16. Oswal Industries Ltd, India
17. Panchvati Valves & Flanges Pvt Ltd, India
18. Petrochemical Engineering Enterprises, India
19. Sakhi Engineers Pvt Ltd
20. Shalimar Valves Pvt Ltd
21. Steel Strong Valves India Pvt Ltd, India

c) Plug Valves

1. M/s Breda Energia Sesto Industria Spa, Italy
2. M/s Fisher Sanmar Ltd., Chennai
3. M/s Larsen & Toubro Ltd., New Delhi
4. M/s Nordstrom Valves, USA
5. M/s Serck Audco Valves, UK
6. M/s Sumitomo Corporation India Pvt. Ltd., New Delhi
7. M/s Z Corporation, Korea
8. M/s Hawa Valves (India) Pvt. Ltd., Mumbai
9. M/s Steel Strong Valves India Pvt. Ltd., Navi Mumbai
10. M/s Econo Valves
11. M/s Flow-Serve PTE (Mfr. SERCK), India



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d) **Ball Valves**

1. M/s Hawa Valves (India) Pvt. Ltd, Navi Mumbai
2. M/s Larsen & Toubro, Delhi
3. M/s Microfinish Valves Pvt. Ltd., Noida
4. M/s Oswal Industries Ltd., Gandhi nagar
5. M/s Virgo Engineers Ltd., Delhi
6. M/s Boteli Valve Group Co. Ltd., China
7. M/s Cameron (Malaysia) SDN BHD, Malaysia
8. M/s Dafram S.P.A., Italy
9. M/s Fangyuan Valve Group Co. Ltd., China
10. M/s Franz Schuck GmbH, Germany
11. O.M.S. Saleri (Italy)
12. Pibi Viesse S.P.A (Italy)
13. Nuovo Pignone (Italy)
14. Perar S.P.A (Italy)
15. Pietro Fiorentini (Italy)
16. Cooper Cameron Valv Italy SRL-FRM, Itly
17. Petrol Valves SRL
18. Tormene Gas Technology S.P.A (VALVITALIA)

vi) **Flow Tee**

1. M/s Coprosider SPA, Italy
2. M/s GEA Energy System India Limited, Chennai
3. M/s Multitex Filtration
4. M/s Pipeline Engineering, UK
5. M/s Scomark Engg. Limited (U.K.)
6. M/s Skeltonhall Limited, Engaland(U.K.)
7. M/s Technospecial SPA, Italy



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8. M/s Tectubi SPA, Italy
9. M/s RMA Germany
10. M/s Pipefit Engineers Pvt. Ltd.
11. M/s PSN Energy Systems (up to 24"NB, 600#)

vii) Split Tee

1. M/s T D Williamson India Private Limited, India
2. M/s Furmanite International Ltd., USA
3. M/s Huwelco Inc., South Houston
4. M/s Plant-Tech Power Technical Services Pvt. Ltd., India
5. M/s VKVC, India
6. Teemans, UK

viii) Flanges

1. M/s Aditya Forge Ltd., Vadodara
2. M/s Amforge Industries Ltd., Mumbai
3. M/s CD Engineering Co., Ghaziabad
4. M/s Echjay Forgings Pvt. Ltd. (Bombay), Mumbai
5. M/s Echjay Industries Ltd., Rajkot
6. M/s Forge & Forge Pvt. Ltd., Rajkot
7. M/s Golden Iron & Steel Works, New Delhi
8. M/s JK Forgings, New Delhi
9. M/s Metal Forgings Pvt. Ltd., Mumbai
10. M/s Perfect Marketings Pvt. Ltd., New Delhi
11. M/s Sky Forge, Faridabad
12. M/s S&G, Faridabad
13. Chaudhry Hammer Works Ltd, India
14. JAV Forgings (P) Ltd, India
15. Kunj Forgings Pvt Ltd, India



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16. MS Fittings
17. R.N. Gupta & Co. Ltd, India
18. R.P. Engineering Pvt Ltd, India
19. Sanghvi Forgings & Engineering Ltd
20. Shri Ganesh Forgings Ltd., India
21. Uma Shankar Khandelwal & Co., India
22. Sawan Engineers, Baroda
23. Stewarts & Lloyds of India Ltd., Kolkata
24. Engineering Services Enterprises
25. Pipefit Engineers Pvt. Ltd.

ix) **Fittings**

1. M/s Commercial Supplying Agency, Mumbai
2. M/s Dee Development Engineers Ltd.
3. M/s Eby Industries, Mumbai
4. M/s Flash Forge Pvt. Ltd., Vishakhapatnam
5. M/s Gujarat Infra Pipes Pvt. Ltd., Vadodara
6. M/s M.S. Fittings Mfg. Co. Pvt. Ltd., Kolkata
7. M/s Stewarts & Lloyds of India Ltd., Kolkata
8. M/s Teekay Tubes Pvt. Ltd., Mumbai
9. M/s Pipe Fit, Baroda
10. M/s Sky Forge, Faridabad
11. M/s S&G, Faridabad
12. M/s Sawan Engineers, Baroda
13. Eby Fasteners, India
14. Leader Valves Ltd, India
15. R.N. Gupta & Co. Ltd, India
16. Exten Engg Pvt Ltd



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17. Sivananda Pipe & Fittings Ltd
18. Sawan Engg - Vadodara
19. P.K. Tubes –rajasthan
20. CSA fittings
21. Dee Development Engineers Limited (Palwal)
22. Fittech Industries Pvt Ltd (Thane)
23. Gujrat Infrapipes Pvt Ltd ,Vadodara
24. K.S Pipe Fittings (P) Ltd, Palwal
25. Teekay Tubes Pvt Ltd (New Mumbai)
26. Petro Chem Industries,Vadodara
27. Topaz Piping Industires ,Vadodara
28. Tube Bend ,Calcutta
29. Tube Turn India Pvt Ltd , Navi Mumbai
30. Sidharth & Gautam Engineers

x) Gaskets

1. IGP Engineers (P) Ltd., Madras
2. Madras Industrial Products, Madras
3. Dikson & Company, Bombay
4. Banco Products (P) Ltd., Vadodara
5. Goodrich Gaskets Pvt Ltd
6. Starflex Sealing India Pvt Ltd, India
7. Teekay Meta Flex Pvt Ltd
8. UNIKLINGER Ltd
9. HEM Engg. Corp.
10. Unique Industrial Packing Pvt. Ltd.

xi) Fasteners

1. Nireka Engg. Co. (P) Ltd., Calcutta



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2. Precision Taps & Dies, Bombay
3. AEP Company, Vithal Udyoug Nagar
4. Fix Fit Fasteners, Calcutta
5. Precision Engg. Industries, Baroda
6. Echjay Forgings Pvt. Ltd., Bombay
7. Capital Industries, Bombay
8. Boltmaster India Pvt Ltd, India
9. Deepak Fasteners Limited, India
10. Fasteners & Allied Products Pvt Ltd, India
11. Hardwin Fasteners Pvt Ltd, India
12. J.J. Industries, India
13. Multi Fasteners Pvt Ltd, India
14. Nexo Industries, India
15. Pacific Forging & Fasteners Pvt Ltd, India
16. Pioneer Nuts & Bolts Pvt Ltd, India
17. Precision Auto Engineers, India
18. President Engineering Works, India
19. Sandeep Engineering Works, India
20. Syndicate Engineering Industries, India

xii) Welding Electrodes

1. For Mainline – Lincon make
2. For Terminal – For root pass - Lincon Make
3. For other passes – Lincon, D&H or equivalent make

xiii) Fire Fighting Equipment's

a) Fire Extinguishers

1. Avon Services (Production & Agencies) Pvt. Ltd., Bombay
2. Kooverji Devshi & Co., Bombay



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3. Zenith Fire Services, Bombay
4. Safex Fire Services, Bombay
5. Reliable (Fire Protection) India Ltd., Bombay
6. Brijbasi Hi-Tech Udyog Ltd.
7. Bharat Engg Works, India
8. Gunnebo India Ltd
9. Nitin Fire Protection Industries Ltd, India
10. Supremex Equipments, India
11. Vimal Fire Controls Pvt Ltd., India

b) Fire Hydrants, Monitors, Deluge Valve, Nozzles

1. Zenith
2. Minimax
3. Newage
4. HD Fire
5. Vijay Fire
6. Asco Strumech Pvt Ltd, India
7. Brij Basi Hi
8. tech Udyog
9. Gunnebo India Ltd
10. Nitin Fire Protection Pvt Ltd
11. Shah Bhogilal Jethamal & Brothers
12. Venus Pumps & Engineering Works

c) RRL Hose

1. Jayshree
2. Newage

d) Hoses

1. Ashit Sales Corporation, Bombay



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2. Royal India Corporation, Bombay
3. Gayatri Industrial Corporation
4. Simplex Rubber Products Ltd., Ahmedabad
5. Zaverchand Marketing Pvt. Ltd., Baroda
6. Presidency Rubber Mill, Calcutta
7. The Cosmopolite, Calcutta
8. Simplex Rubber Products, Thane

e) Hose Delivery

1. Chhatarya Rubber & Chemical Industries,
2. Nitin Fire Protection Industries Ltd, India

f) Fire Hose Accessories

1. Asco Strumech Pvt Ltd
2. Brij Basi Hi-tech Udyog
3. Gunnebo India Ltd
4. Shah Bhogilal Jethamal & Brothers
5. Vimal Fire Controls Pvt Ltd., India

g) Heat Shrinkable Sleeves

1. Seal for Life - Covalence
2. Canusa

h) Cold Applied Tapes

1. Denso GmBH
2. Polyken (Berry Plastics Corporation)

i) PUR Coating

1. Powercrete (Berry Plastics Corporation)

j) Casing End Closure

1. Raci, Italy
2. Raychem RPG Limited



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k) Casing Insulators

1. Raci, Italy
2. Raychem RPG Limited

l) Rockshield

1. Raychem RPG Limited

m) Warning Tape /Mesh

1. Sparco Multiplast Pvt. Ltd., Ahmedabad
2. M/s Raychem RPG Limited
3. Singhal Industries Private Limited

n) High Build Epoxy Coating

1. Berry Plastics – Powercrete
2. Specialty Polymer Canada
3. Denso Protal, Canada

o) Casing Insulators

1. Raci, Italy
2. Raychem RPG Limited
3. Veekay Vikram

xiv) DRY GAS FILTER & FILTER SEPERATOR

1. Grand Prix Fab (Pvt.) Ltd.(New Delhi)
2. Perry Equipment, USA
3. Faudi Filter, Germany
4. Forain S.r.l., Italy
5. ABB, Faridabad
6. Burgess Manning, USA
7. Multitex Filtration Engineers India
8. Triveni Plenty Engg. Ltd. (New Delhi)
9. Siirtec International Contractor S.P.A (Italy)



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10. Flashpoint, Pune india
11. Filtration Engineers (I) Pvt Ltd, India
12. Gujarat Otofilt, India
13. Tormene Gas Technology
14. Ultrafilter (India) Pvt Ltd, India
15. Ravi Techno Systems Pvt Ltd, India
16. Siirtec Nigi S.P.A
17. Filtan Filter Anlagenbau GmbH
18. Fairley Arlon BV
19. PECO Facet
20. EPE Epenstenner GMBH
21. Filtrex srl
22. Petromar Engineered Soln
23. Plenty Filter
24. Eurofilttec
25. PTI Technologies Inc

xv) QUICK OPENING END CLOSURE (QOEC)

1. Forain S.R.L.
2. GD Engineering
3. Pipeline Engineering, UK
4. Siirtec Nigi S.P.A
5. TD Williamson
6. Peerless
7. Grinelli
8. Huber Yale
9. Tube Turn (U.S.A.)
10. Pipeline Technologies, France



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11. M/s Grand Prix Engineering Pvt. Ltd.
12. M/s VKVC LLP
13. M/s Multitex Filtration Engineers Ltd

xvi) FILTER ELEMENT

1. Peco – Facet
2. Velcon
3. Pall – Filterite
4. Burgress Manning

xvii) NDT Agency

1. NDT Services, Ahmedabad
2. GEECY Industrial Services Pvt. Ltd., Mumbai
3. Corrosion Control Services, Mumbai
4. Perfect Metal Testing & Inspection Agency, Calcutta
5. Inter Ocean Shipping Co., New Delhi
6. RTD, Mumbai
7. Sievert, Mumbai
8. X-Tech, Vizag

xviii) Long Radius Bends

1. M/s BHEL, Trichy, Tamilnadu
2. M/s Jindal SAW Limited, (Koshi Works), U.P.
3. M/s PSL Limited, Gandhidham, Gujarat
4. M/s Welspun, Gujarat
5. M/s Fabricon, Belgium
6. M/s Sawan
7. M/s Gujarat Infra
8. M/s P K Tubes
9. M/s DEE Development

10. Pipefit Engineers Pvt. Ltd.

xix) PIG LAUNCHERS/ RECEIVERS/ PIG SIGNALERS

1. Bassi Luigi Fittings B.V., Holland
2. BRAUN STAHL PIPE TEC, GERMANY
3. FORAIN, ITALY
4. Fluidel SRL, ITALY
5. RMA Maschinen- und, GERMANY
6. Siiritec Nigi, Italy
7. SCHUCK ARMATUREN, GERMANY
8. T.D. Williamson Inc., USA
9. Tectubi SPA, Italy
10. Taylor Forge Engineering System INC, USA
11. Tormene Americana S.A. (Argentina)
12. Tormene Gas Technology S.p.A., Italy
13. PIPELINE ENGINEERING, UNITED KINGDOM
14. Krohne, Oil & Gas BV, Drive Houston,
15. Multitex Filtration Engrs. Ltd, New Delhi
16. BGR ENERGY SYSTEMS LIMITED New Delhi
17. Glapwell Contracting Services Ltd. UK
18. FULGOSI GIOVANNI S.n.c di Corrado & C, ITALY
19. VEEKAY VIKRAM & CO, GUJRAT
20. GBM S.R.L, ITALY
21. Multitex Filtration Engineers Ltd., India
22. Cardew Ltd., Alexeander
23. Forain S.R.L.
24. GD Engineering, India



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25. Pipeline Engineering, UK

26. Siirtec Nigi SPA

LIST OF MATERIALS OF APPROVED BRAND AND/ OR MANUFACTURE

2. (CIVIL & STRUCTURE)

Unless otherwise specifically mentioned in the Schedule of Items, Contractor has to use materials as listed below of only these brand names/ Company's names, which are mentioned in the approved list for civil, water supply and sanitary items thereon.

a. CIVIL

S. NO.	ITEMS/ NAME OF PRODUCTS	MAKE/ BRANDS/ MANUFACTURES
1.	Reinforcement Steel	TATA,SAIL,RINL,IISCO,RATHI
2.	Cement	Ambuja, ACC, JK, Grasim, Ultratech, Birla, L&T, Cement Corporation of India, Maihar
3.	Structural Steel	TATA, SAIL, RINL, IISCO, ESSAR, ISPAT
4.	Pre- engineered building (PEB) firms	Kirby Building system India ltd, Interach Building Product limited, Tata blue scope steel, Lloyd Insulation India ltd, Everest Industries. Ltd. Modern Prefab System Pvt Ltd, Aster Building Solution Pvt.Ltd, Octamec Engineering Ltd, Jindal Mectec Pvt Ltd, Fedders Lloyd Corporation Ltd.
5.	Structural Steel Tubes	TATA, JINDAL , SURYA , SWASTIK
6.	(a) Zincalume colour coated steel sheet (COIL) (b) Profile of Sheet (as per tender specification)	(a) Tata Blue scope, Dongbu Steel, Union Steel, JSW STEEL Ltd., Kirby Building system India ltd, Interach Building Product limited, Tata blue scope steel, Lloyd Insulation India ltd, Everest Industries. Ltd., Modern Prefab System Pvt Ltd, Aster Building Solution Pvt. Ltd, Octamec Engineering Ltd, Jindal Mectec Pvt Ltd, Fedders Lloyd Corporation Ltd.
7.	Polycarbonate Sheet	Sabic Innovative Plastic , Everest
8.	Mineral wool for thermal insulation of ceilings (Under deck insulation)	Rock wool (india) Ltd. Minwool Rock Fibres Ltd., Lloyd Insulation,

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9.	Rolling shutters (ISI marked)	Swastic, Hercules, Shubdwar, M/s Bharat Rolling Shutters Industries Agra, Bengal Rolling Shutter Rama Rolling Shutter Works, Gandhi Entrance Automations Private Limited
10.	Wind driven air Ventilators	Apurva Enterprises (Mumbai), SVS Wind Driven Turbo Ventilator(Ahmadnagar), Real Green Engineers Pvt. Ltd., Bangalore, Sun Green Ventilation system Pvt. Ltd., Mylapore-Chennai, Citadel, Mumbai, Multi colour, Anchit Ispat Pvt Ltd. (Faridabad),
11.	Synthetic Enamel Paint (1st quality only)	ICI Paint (Dulux), Asian Paint (Apolite), Berger Paints (Luxol). Goodlass Nerolac Paints (Nerolac), Jenson & Nicholson Paints Ltd (Borolac), Shalimar, Garware & Goodlass.
12.	G.I SHEET	ESSAR, JSW, SAIL
13.	Sheeting Screw	Corroshield, Buildex.
14.	Chemical for Antitermite treatment	DE-NOCIL Bombay, Pest Control of India, Trishul.
15.	Factory made Panelled Door shutter	M/s Goel Brothers Raipur New Industrial Area, Raipur (CG) M/s Hindustan Housing Factory Ltd, New Delhi M/s Delhi Construction Eqpt Sadar Bazar, Delhi M/s Joinery Manufacturing Co., Calcutta M/s Goyal Industries, Faridabad M/s Surbhi Metal (India) Ltd., Jodhpur M/s Jain wood Industries Sonipat/ Rohini, Delhi (HO) M/s Poiner Timber Products, Chandigarh

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16.	Flush doors IS-2191, 2202	M/s Mysore Wood Products M/s Laxmi Doors, Faizabad Road, Chinhat, Lucknow M/s Merino flush doors M/s Poiner Timber Products, Chandigarh, M/s Goyal Industries Faridabad M/s National M/s Century Plyboards (i) Limited.
17.	Fly proof doors (Made out of solid block marine grade)	M/s Laxmi Doors, Faizabad Road, Chinhat, Lucknow, Northern doors Kanpur
18.	Natural Fibre Thermo Composite door/ window shutter & frames, roofing sheets etc.	Durosam
19.	PVC Panel Door (Solid Core)	Rajshri Plastiwood Limited, Sintex, Hindopan, Marino.
20.	Pressed steel door frames/ cupboard and window frames (manufacturers)	M/s SAIL, M/s TATA
21.	Pressed steel door frames/ cupboard and window frames (fabricators)	M/s Loyal safe works Mayapuri, New Delhi M/s Multiwyn Industrial Corpn., Calcutta M/s Metal Window Corpn., New Delhi M/s Chhabra Steel Udyog, 260 Sadar Bazar, Meerut Cantt. M/s Delite safe works, Rani Jhansi Road, New Delhi M/s Ishwar Industries, 175/A Bombay Bazar, Meerut Cantt. M/s Chandni Industries, J-142, Patel Nagar 1st, Ghaziabad.

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22.	Steel Windows, Ventilators (as per IS-1038 of 1983) & frames pressed steel door/ window	M/s Multiwyn Industrial Corpn., Calcutta M/s Metal Window Corp N/ Delhi Govind Enterprises, Delhi M/s Chhabra Steel Udyog 260, Sadar Bazar, Meerut Cantt., Agent steel MFG Pvt Ltd, Ahmedabad, Godrej, M/s Chandni Industries, J-142, Patel Nagar 1st, Ghaziabad.
23.	Al Section for Al Door/ Window/ Partitions	Hindalco, Indal, Ajit India, Jindal
24.	Aluminum Door/ Window/ Glazing Fabricated and Anodized	M/s Ahlcon M/s Alumilite Pvt Ltd, M/s Ajit India Pvt Ltd, M/s Ramniklal S Raste Agra, Argent Industries, M/s Aluminium Tech Industries, I-2249 DSIDC Narela, Delhi,
25.	Aluminium door and windows Fittings	M/s Elite Enterprises C/6 Shalimar Hardware 133, Jarg Mahal, Dhobitalao Mumbai 400002. M/s Mohan Metal Industries 178/2-A, Bhola Nath Nagar, Shahadara, Delhi 110032. M/s Mepro, Argent New Delhi, Classic, New Delhi. M/s Jindal, Argent New Delhi, M/s Golden Industries Pvt. Ltd. M/s ECIE (P) ltd.
26.	Automatic Glass Door	Ditec (Gandhi)
27.	Aluminium Grill	Alu Grill, Arihant Aluminium Corporation, Decogrille
28.	Door Closer	Everite, Golden, Gandhi
29.	Floor Spring	Prabhat, Everite
30.	Builders Hardware	M/s Golden Industries Pvt. Ltd., Everite, Solo, Hardwyn.

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31.	Plywood for general purpose (IS-303)	National Plywood Inds Pvt Ltd, S Fancy lane, 8th floor, Calcutta-700001, Merino Plywood, Archid Ply, Kitply, Swastik, Universal
32.	Pre laminated Particle board	Kitply, Bhutan board, Ecoboard, Novapan, Archid ply, Merinova, Merino
33.	Laminated Sheets	Formica, Merino Lam, Greenlam, National
34.	Modular Partitions	Godrej, Blowplast
35.	False Ceiling (Mineral Fibre Board)	Armstrong, Daiken, Luxalon, Llyods, Gypboard, Trac, Aerolite
36.	False Ceiling (POP/ Gypsum Board)	Gypboard, Anchor ceiling tiles, LA
37.	Aluminium False	Lloyds, Armstrong, Luxlon, Trac
38.	Flooring Tiles (Mosaic/ Terrazzo/ PCC) (1st quality only)	M/s Mehtab Tiles, NITCO, Royal Tiles, Gem Tiles, Hindustan Tiles, M/s National Tiles & Industries, Ultra Tiles
39.	Glazed Ceramic Tiles, Non-Skid (Floor/ Wall), (1st quality only)	Kajaria, Somany, NITCO. Murudeshwar Ceramic Ltd (Navin Diamond tile), Johnson (Marbonite), Marbitto, Somany, Orient, Asian
40.	Vitrified/ Designer Vitrified Tiles (1st quality only)	Asian, Marbonite (Johnson), Kerrogres (Kajaria), NITCO, Orient
41.	PVC Tiles/ Flooring (IS 3461) (1st quality only)	Marblex Tiles, Krishna Tiles, Polyfin, Armstrong, Wonder floor.
42.	False Flooring	Godrej or equivalent
43.	Glass Mosaic Tiles	Paladio, Coral, Accura, Bisazza, Italia, Mridul.
44.	Designer Paver Tiles/ Interlocking tiles ISI marked/ Grass-jointed Tiles (1st quality only)	Pavit, Ultra, Hindustan, Eurocon, Vyara, National Tiles, Gem, Unistone, Konkrete, Unatile
45.	Glass reinforced Paver block	Unistone or equivalent

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46.	Wall care Putty for Base preparation (1st quality only)	Birla Wall care putty, Berger, Jenson & Nicholson, JK White
47.	White Cement	Birla, JK
48.	Cement based Paints (1st quality only)	Super Snowcem, Duracem, Super Acrocem.
49.	Dry Distemper/ Oil bound Distemper (1st quality only)	Goodlass Nerolac Paint, Shalimar Paint, Jenson & Nicholson, Asian Paint, Berger. ICI Dulux
50.	Acrylic Washable Distemper (1st quality only)	Asian, Berger, ICI Dulux, Jenson & Nicholson, Nerolac, Shalimar, Garware & Goodlass.
51.	Plastic Emulsion Paint (1st quality only)	Asian, Berger, ICI, Nerolac, Jenson & Nicholson, Shalimar, Garware & Goodlass.
52.	Exterior Acrylic Emulsion (1st quality only)	ICI (Weathercoat), Excel (Nerolac), Apex (Asian), Berger, Jenson & Nicholson, Shalimar, Garware & Goodlass
53.	Polymer based Paint	STP, CICO
54.	Textured Paint / Wall Tile (1st quality only)	Unitile, Heritage, Spectrum, lokos, Acropaints, Asian
55.	Flexible board for Expansion joint	STP or equivalent
56.	Grout	Shrinkomp, Fosroc, Fairmate
57.	Integral water proofing compound	STP, Pidilite, Fosroc, CICO, Sika.
58.	Concrete Admixture	Pidilite, Fosroc, CICO, Sika.
59.	Water proofing for cementations surface IS-2645	Acrocrete & Acrocote, CICO, Fosroc, STP
60.	Bituminous Product	M/s Faridabad Spinning & Woolen Mills Pvt Ltd, 837, SP Mukherjee Marg Delhi, M/s STP Ltd (Formerly Shalimar Tar Products) M/s Bitufelt Pvt Ltd 123/377 Fazalm Ganj Kanpur-208012, Texas, Texas India Ltd, Multiplas, IWL Chennai

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61.	Hardeners	Ironite, Ferrok, Hardonate
62.	Construction	Choksey, CICO, Forsroc, Sika
63.	Non Metallic Surface	CICO, Fosroc, STP, Sika
64.	Corrugated, Semi Corrugated & AC Sheets (IS-459-1970,IS-2098)	M/s Everest Bldg Products Ltd., Jata Sankar Bosa Marg, Muland (west), Bombay 400080 M/s Ramco AC Sheets "SWASTIK", M/s Eternit Everest Ltd, UP Asbestos Ltd
65.	GI Sheet - ISI Marked	Multicolor, TATA, Bluescope, JSW, Colour Plus, Interarch, Lloyds, Jindal, Everest
66.	Sheet Glass/ Structural Glazing	Hindustan Pilkington Glass Works, Saint Gobain, Modi Float, Triveni Float Glass, ASI, Fresca, Emirates.
67.	Multiell/ Multiwall Polycarbonate Panel	M/s Coxwell Domes Engineering, Delhi M/s Lexan, M/s Gallina India Pvt. Ltd. M/s Vijaynath Interiors & exteriors products
68.	Stainless Steel	Jindal
69.	Punch Tape	Global Technocrat, S.G.Engineers, Delhi
70.	Punch Tape in Plastic Spool	Global Technocrat, S.G.Engineers, Delhi
71.	Stainless Steel Railing	Jindal
72.	FRP/ HDPE Garbage	Sintex, Swift, Nutech, Sheetal
73.	Thermoplastic Road	Shalimark (STP)
74.	Bollard	STP
75.	Cateye	TATA, STP
76.	Readymade Speed	STP
77.	Fountain	Ripples, Green Evolutions, Agritech Services, Premier
78.	Multi-Vent	Multicolor

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79.	Sanitary ware	Neycer Kermag (standard), Hindustan Sanitary Ware (Ist quality), Parryware (superfine), Cera (Ist quality), Classica (Ist/ standard)
80.	WC seat cover - ISI Marked	Parryware, Neycer Kermag (standard), Hindustan Sanitary Ware (Ist quality), Cera (Ist quality), Classica (Ist / standard)
81.	PVC Flushing Cistern IS: 774-1984 (ISI Certified)	Parryware, Hindustan Sanitary Wares, Cera.
82.	Faucets & Taps, Stop Valves & Pillar Taps, Surgical basin mixer, Shower rose etc.	Gem, Parko, Parryware, HSW, Jaquar, Orient
83.	Kitchen Stainless Steel	Diamond, Nirali, Neel Kanth, Jayna
84.	Looking Mirror	Saint Gobain, Modi Float, Triveni Float Glass, Crown, Atul, Ashai
85.	Readymade Bathroom Cabinets	Commander Gratings (I) Pvt Ltd, Gratolite Cabinet, A-4 Sector Viii, Noida-202701, Alpina, Cera.
86.	Float Valve	Leader, Bombay Metal & Alloy Co, Bombay superflow.
87.	SGSW Pipes (IS-651) ISI Marked	Perfect Agra, Devraj Ind Gaziabad, Buran, RK, Prince, Supreme pipe and Fittings.
88.	CI (Centrifugally Cast) Pipes for sewage disposal ISI marked.	NICCO, SRIF, A-1 Singhal Casting Co Agra, Jindal Saw, Kesoram, NECO.
89.	PVC rain water/ sewage pipes (IS-4985)	Reliance, Finolex, Supreme, Kisan, Prince, Hindustan Plastic & machine corporation, Polypack industries (P) Ltd.
90.	HDPE Water storage tanks (Rotational Moulded)	Sintex, Swift, Nutech, Sheetal
91.	Cast Iron Pipes and Fittings	Hindustan Engineering Products Company Calcutta, S.L.C., Standard approved manufacturers of any other brand of fittings having ISI marking, RIF, BIS.

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92.	RCC Pipes	Indian Hume Pipe Company, Delhi/ Prayagraj/ Chandigarh/ Lucknow; Hindustan Pressure Pipes, Kolhapur Dhere Concrete Products, Pune or any other approved manufacturer conforming B.I.S. Standard
93.	Brass Fittings	Leader Engineering Works, Jalandhar; L & K Mathura; Luster Sanitary, Jalandhar; Annapurna Metal Works, Calcutta; Neta Metal Works, Jalandhar; Honey Industrial Corporation, Bombay.
94.	C.P. Fittings	Ego Metal Works, Ballabgarh; Jaquar Industries, Delhi; Soma Plumbing Fixtures Limited, Calcutta; Gem Sanitary Appliances Pvt. Ltd., Delhi; Essco Sanitations, Delhi; Bilmet, Bombay.
95.	Stone Ware (Salt-Glazed) Pipes	Hind Ceramics Limited, Orissa; Ceramic Industries Limited, Sambalpur; Shrikamakshi Agencies, Madras; Binary Udyog Pvt. Limited, Howrah; Tirumati Moulds Limited, Nagpur; Kiran Potteries, Hyderabad; Perfect Sanitary Pipes, Bharatpur.
96.	Asbestos Cement Pipes and Fittings	Ganga Asbestos Limited, U.P.; Hyderabad Asbestos Cement Products Limited; J.K. Super Pipe Industries, Nanded; Konark Cement and Asbestos Limited, Orissa; Maharashtra Asbestos Limited, Bombay; Poddar Industrial Corporation, Patna; Sarbamangala Mfg. Company, Calcutta.
97.	HDPE pipes and fittings	ORI-PLAST, HASTI

b. STRUCTURE

S. NO.	ITEMS/ NAME OF PRODUCT	MAKES/BRANDS/MANUFACTURES
1	Structural Steel	SAIL / TATA / RINL / IISCO / ESSAR / ISPAT
2	Structural Steel	TATA / JINDAL / SURYA / SWASTIK



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3	Synthetic Enamel Paint (Ist Quality only)	ICI Paint (Deluxe), Asian Paint (Apolite), Shalimar Paint (Superlac), Goodlass, Nerolac Paint(Nerolac), Berger Paints.
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Any materials not fully specified in these specification and which may be offered for use in the works shall be subject to approval of Engineer, without which it shall not be used anywhere in the construction works.

LIST OF SUPPLIERS OF MAJOR BOUGHT-OUT ITEMS

3. (ELECTRICAL)

i) Air Conditioner

1. O General
2. Daikin
3. Hitachi

ii) Batteries (Lead Acid)

1. Amco Batteries Ltd.
2. Exide Industries Ltd.
3. HBLNIFE Power System Ltd.
4. Amara Raja Batteries Ltd.

iii) Batteries (Nickel Cadmium)

1. Amco Batteries Ltd.
2. HBLNIFE Power Systems Ltd.

iv) Batteries Charger/DC-DC Converter

1. Amara Raja Power System(P)Ltd.
2. BCH.
3. Chhabi Electricals Pvt. Ltd.
4. Caldyne Automatics Limited
5. Dubas
6. HBL Nife Power Systems Ltd.
7. Universal Industries Products
8. Universal Instrument Mfg Co Pvt Ltd

v) Cable – Fire Alarm & Communication Cables

1. Cords Cable Industries Ltd.
2. CMI
3. Delton cables Ltd.



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4. ELKAY Telelinks
5. KEI Industries Ltd.
6. Reliance Engineers Ltd.

vi) Cable – HT (XLPE)

1. Universal Cable Ltd.
2. KEI Industries Ltd.
3. Industrial Cables
4. NICCO Corporation Ltd.
5. Uniflex
6. Polycab.
7. Torrent cables Ltd.

vii) Cable – LT Power and Control

1. Cords Cable Industries Ltd.
2. Universal Cable Ltd.
3. KEI Industries Ltd.
4. Havells.
5. Delton
6. Elkay Telelinks
7. Evershine Electricals
8. Ecko
9. Ravin
10. Rallison.
11. Suyog
12. Netco
13. Uniflex
14. Paramount
15. Gloster



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16. Associated cables Pvt Ltd.

17. CMI

18. Gemscab

19. Industrial cables

20. NICCO

21. Polycab

22. Torrent

viii) Cable – Gland

1. Baliga

2. Comet

3. Flexpro

4. Flameproof

5. FCG

6. Electro Werke

7. Dowels

8. CCI

ix) Cable – Lugs

1. Dowels

2. Jainson

3. Ismal

x) Cable – Tray

1. Ercon Composites

2. Yamuna Power & Infrastructure Ltd.

xi) Cable Termination and Jointing Kit

1. CCI

2. Raychem

3. M-Seal



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xii) Ceiling/Exhaust/Pedestal Fans & Circulators

1. Bajaj Electricals Ltd.
2. Crompton Greaves Ltd.
3. Khaitan Electricals Ltd.
4. Havell's

xiii) Contractors – AC Power

1. Andrew Yule
2. ABB
3. BHEL
4. C&S
5. Havell's
6. L&T
7. Schneider
8. Siemens Ltd.
9. Telemecanique

xiv) Control Transformer

1. AE
2. Indushree
3. Intra Vidyut
4. Kalpa Elektrikals
5. Transpower Industries Ltd.
6. Siemens

xv) DG Set

1. Sterling and Wilson.
2. GD ankalesaria.
3. Deev Genset.



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4. Jackson Limited.
5. Sudhir Gensets.
6. Power Engineering (India) Pvt Ltd.
7. Prasha Technologies Limited.
8. Kumar Generator house.
9. Ashok Leyland Ltd.
10. Powerica Limited.
11. Supernova Engineers Limited.
12. Bhaskar Power Products (P) Ltd.
13. Caterpillar India (P) Ltd.
14. Cummins India Ltd.
15. Escorts Ltd.
16. Greaves Cotton Ltd.
17. Kirloskar Ltd.
18. Mahindra & Mahindra Ltd.
19. Honda.
20. Perkins.
21. Eicher.
22. Tata Motors.
23. Ashok Leyland.

xvi) Earthing Materials

1. Rukmani Electrical & Components Pvt Ltd.
2. Indiana Grating Pvt Ltd.
3. Jef Techno Solutions Pvt Ltd

xvii) Flame proof LDB's/ JB's/ Control Station/ switches

1. FCG
2. Sudhir

3. Prompt Engineering Works
4. Flame Proof equipments pvt. Ltd.
5. Baliga Lighting Equipments Pvt. Ltd.
6. Flexpro Electricals Pvt. Ltd.

xviii) High Mast

1. Bajaj Electricals Limited
2. Crompton Greaves Limited.
3. Philips India Limited
4. Surya Roshani

xix) High Voltage PCC/ MCC panels

1. BHEL
2. Control and Switchgear
3. Siemens
4. Tricolite Electrical Industries
5. Schneider
6. CGL
7. L&T

xx) Indicating Lamps

1. Alstom Ltd.
2. BCH
3. L&T Ltd.
4. Siemens Ltd.
5. Vaishno Electricals

xxi) Indicating Meters

1. ABB
2. AMCO
3. AE



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4. Alstom Ltd. (EE)
5. Conzerv/Schneider
6. Elecon Measurement Pvt. Ltd.
7. HPL Electric & Power Pvt. Ltd.
8. MECO Instruments Ltd.
9. Minilec
10. Rishabh Instruments Pvt. Ltd.
11. Trinity energy system
12. kaycee
13. Salzer

xxii) Lighting Fixtures

1. GE Lighting Pvt. Ltd.
2. Bajaj Electricals Ltd.
3. Crompton Greaves Ltd.
4. Philips India Ltd.

xxiii) Lighting Fixtures – Flameproof

1. Bajaj Electricals Ltd.
2. Baliga Lighting Equipment Pvt. Ltd.
3. Crompton Greaves Ltd.
4. CEAG Flameproof Controlgear Pvt. Ltd.
5. Flexpro Electricals Pvt. Ltd.
6. Philips India Ltd.
7. Sudhir Switchgears Pvt. Ltd.
8. FCG.

xxiv) Miniature Circuit Breakers (MCBs) and Lighting DB

1. ABB
2. Hagger



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3. Havell's India Ltd.
4. Indo Asian Fusegear Ltd.
5. Legrand
6. MDS Switchgear Ltd.
7. Schneider
8. Siemens Ltd.
9. HPL

xxv) Moulded Case Circuit Breaker (MCCBs)

1. ABB
2. Andrew yule
3. Larsen & Toubro
4. Schneider
5. Siemens
6. Control and Switchgear

xxvi) Protection Relays – Thermal

1. BCH
2. L&T Ltd.
3. Siemens Ltd.
4. Telemenchanique & Controls (India) Ltd.

xxvii) Low Voltage Power Control Center (PCC)/ MCC/ PDB/ MLDB/ LDB

1. ABB
2. BCH
3. C & S
4. Elecmech Switchgear & Instrumentation
5. KMG ATOZ
6. L&T
7. Pyrotech Electronics Pvt. Ltd.

8. Risha control Engineers Pvt. Ltd.
9. Siemens
10. Tricolite Electrical Industries
11. Unilec Engineers Ltd.
12. Vidyut Control India Pvt. Ltd.
13. Control and Schematic
14. Zenith Engineering

xxviii) Push Buttons

1. BCH
2. Alstom Ltd.
3. L&T
4. Siemens Ltd.
5. Telemenchanique & Controls (India) Ltd.
6. Vaishno Electricals

xxix) Switches-Control

1. BCH
2. Easum Reyrolle Relays & Devices Ltd.
3. Alstom
4. Kaycee Industries Ltd.
5. L&T
6. Siemens Ltd.

xxx) Switches – 5/15A Piano/ Plate, Switch Socket

1. Anchor Electronics & Electricals Pvt. Ltd.
2. Kingal Electricals Pvt. Ltd.
3. North-West Switchgear Ltd.

xxxi) Switch Socket Outlets (Industrial)

1. Alstom Ltd.

2. Best & Crompton Engineering Ltd.
3. BCH
4. Crompton Greaves Ltd.
5. Essen Engineering Company Pvt. Ltd.

xxxii) Solar Modules

1. Tata BP Solar (I) Ltd.
2. REIL, Jaipur.
3. CEIL, Sahibabad.
4. HBL Power

xxxiii) Solar Street Lighting

1. Tata BP Solar (I) Ltd.
2. REIL, Jaipur.
3. CEIL, Sahibabad.
4. HBL.

xxxiv) Terminals Blocks

1. Connectwell
2. Controls & Switchgear Co. Ltd.
3. Elmex Controls Pvt. Ltd.
4. Essen Engineering Co. Pvt. Ltd.

xxxv) Transformers

1. ABB
2. Andrew Yule
3. Areva
4. BHEL
5. Bharat Bijlee
6. Crompton Greaves
7. EMCO Ltd.



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8. Intra Vidyut
9. Indushree
10. Indcoil
11. Kirloskar
12. Skippers Electricals
13. Transformers & Rectifiers (I) Ltd.
14. Voltamp

xxxvi) UPS System and Inverter

1. DB Power
2. Aplab
3. Keltron
4. Hi-Rel
5. Dubas
6. Toshiba Corporation
7. Fuzi Electric Co Ltd

xxxvii) GI-Octogonal Pole

1. Bajaj
2. Transrail
3. Wipro

xxxviii) List of Recommended Manufacturers for Heater

1. Escorts Limited, Faridabad, Haryana
2. Spherehot/ Kanti Lal Chuni Lal & Sons Appliances Pvt Ltd. Surat
3. Kerone, Bhayander (E), Thane - 401105
4. Excel Heaters, Andheri (West), Mumbai - 400 053, India
5. Nirmal Industrial Controls Pvt. Ltd., Mulund(W), Mumbai - 400 080

NOTES: Item/ Vendor, which are not listed above, shall be subject to prior approval from Client/ Consultant.

LIST OF MATERIALS OF APPROVED BRAND AND/ OR MANUFACTURE

4. (INSTRUMENTATION)

i) OFC

Manufacture/ Procurement, Testing and supply of suitable OFC Joint closures including all necessary accessories of any of the following make:

1. Raychem
2. 3M
3. Siemens
4. Any other make from the approved vendor list of client with supporting paper.

ii) METERING SKID

1. M/s Chemtrols Industries Ltd., Mumbai
2. M/s Daniel Measurement Solutions Pvt Ltd, Vadodara.
3. M/s Elster-Instromet India Pvt Ltd, Vadodara
4. M/s INEL Gas Controls Pvt Ltd, Vadodara.
5. M/s Nirmal Industrial Controls Pvt. Ltd., Mumbai
6. M/s Oswal Industries Limited, Ahmedabad
7. M/s Autometer energytech ltd, NOIDA
8. M/s Rockwin Flowmeter india Pvt Ltd, Ghaziabad.
9. M/s Intromet international Ny Rajkmakeriaan 9, B-2910, Essen, Belgium
10. M/s Pietro Fiorentini Spa, 20124, Milino, Itally
11. M/s FMC Measurement Solutions, 6 Braidway, thetford, Norfolk, IP24 1 JA, England.
12. M/s Petrogas Gas system BV, Doesburgweg, 7, 203 PL Gouda, PO Box 20, 2800, AA Gouda, Netherland.
13. Tormene Gas Technology SpA, via campolongo, 97, 35020 – Due carrare (Padova), Itally
14. M/s ODS BV, Donk 6, 2291 Berendrecht, Netherland.
15. M/s RMG Regel + Messtechnik Gmbh Osterholzstr, 45, D-34123 Kassel, Germany.

iii) PRESSURE GAUGES

1. AN Instruments Pvt Ltd



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2. Badotherm Process Instruments B.V.
3. Baumer Bourdon Haenni S.A.S
4. British Rototherm Co Ltd
5. Budenberg Gauge Co Ltd
6. Dresser Inc
7. Forbes Marshall (Hyd) Pvt Ltd
8. General Instrument Consortium
9. H. Guru Instruments (South India) Pvt Ltd
10. Manometer (India) Pvt Ltd
11. Nagano Keiki Seisakusho Ltd
12. Hirlekar Precision, India
13. Waaree Instruments Ltd
14. Walchandnagar Industries Ltd (Tiwac Divn)
15. Wika Alexander Wiegand & Co GmbH
16. Wika Instruments India Pvt Ltd
17. Ashcroft India Pvt Ltd.

iv) **TEMPERATURE GAUGES**

1. AN Instruments Pvt Ltd.
2. Badotherm Process Instruments B.V.
3. Bourdon Haenni S.A.
4. Dresser Inc.
5. General Instruments Consortium
6. H. Guru Instruments (South India) Pvt Ltd
7. Nagano Keiki Seisakusho Ltd
8. Solartron ISA
9. Walchandnagar Industries Ltd (Tiwac Divn)
10. Wika Alexander Wiegand & Co GmbH

11. Wika Instruments India Pvt Ltd
12. Pyro Electric, Goa
13. Ashcroft India Pvt Ltd.

v) TEMPERATURE ELEMENTS, THERMO-WELLS

1. ABB Automation Ltd
2. Altop Industries Ltd
3. Bourdon Haenni S.A.
4. Detriv Instrumentation & Electronics Ltd
5. General Instruments Consortium
6. Japan Thermowell Co Ltd
7. Tecnomatic S.P.A
8. Tempsen Instrument India Ltd
9. Thermo Electric Co. Inc.
10. Thermo-Couple Products Co
11. Thermo-Electra B.V.
12. Wika Alexander Wiegand & Co GmbH
13. Altop Industries Ltd., Baroda
14. Nagman Sensors (Pvt.) Ltd.
15. Pyro Electric, Goa

vi) TURBINE METERS

1. Daniel (USA)
2. RMG (Germany)
3. Instromet International (Belgium)
4. Sensus Metering System Inc
5. Rockwin Flowmeter (India)
6. Vemmtec Messtechnik GmbH, (Germany)
7. ITRON GmbH (Germany)

vii) POSITIVE DISPLACEMENT FLOW METERS

1. Actaris
2. RMG (Germany)
3. Instromet International (Belgium)
4. Romet
5. Dresser
6. Itron GmbH (Germany)

viii) ORIFICES (METER RUN, FLOW CONDITIONER, ORIFICE PLATE AND ASSEMBLY)

1. Emerson
2. FMC, USA
3. Pietro Fiorentini S.P.A (Italy)
4. Canalta Controls, Canada

ix) ULTRASONIC FLOW METERS

1. Daniel (USA)
2. RMG (Germany)
3. Instromet International (Belgium)
4. Sick Maihak, Germany
5. FMC, Germany

x) MASS FLOW METERS

1. Daniel Measurement & Control Asia Pacific
2. Endress + Hauser Instruments International
3. FMC Measurements Solutions
4. Heinrichs Messtechnik GMBH
5. Rheonik MessGerate GMBH

xi) LEVEL GAUGES/ LEVEL INSTRUMENTS

1. Bliss Anand
2. Chemtrols



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3. V-Automat
4. Levcon
5. Nivo Controls
6. Sbeletro Mechanicals
7. TRAC

xii) FIELD INSTRUMENTS (P, DP, F, L, T)

1. ABB Ltd
2. Honeywell
3. Fuji Electric Instruments Co Ltd
4. Yokogawa
5. Invensys India Pvt.Ltd

xiii) FLOW COMPUTERS

1. Emerson
2. Instromet International (Belgium)
3. FMC Measurement Solutions (UK)
4. RMG (Germany)
5. OMNI Flow Computers Inc.
6. Thermo Fisher, USA

xiv) PRESSURE REGULATOR AND SLAM SHUT VALVE

1. Pietro Fiorentini S.P.A. (Italy)
2. Emerson
3. RMG-Regel Messtechnik (Germany)
4. Mokveld Valves BV (Netherlands)
5. Schlumberger (USA)
6. Gorter Controls B V (Netherlands)
7. Instromet International NV
8. Nirmal Industrial Controls Pvt Ltd. (up to 6" size only)



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9. ESME Valves Ltd
10. Kaye & Macdonald Inc.
11. Nuovo Pignone S.P.A (Italy) (GE Oil Co.)
12. Richards Industries (Formerly Treloar)
13. Samson AG Mess-und Regeltechnik
14. Tormene Gas Technology
15. Dresser Inc, USA (upto 8" size, 300# class only)

xv) PRESSURE SAFETY VALVES

1. Keystone Valves (India) Pvt. Ltd.
2. Larson & Toubro Ltd.
3. Lesser GmbH & Co KG
4. Mekaster Engg Ltd.
5. Tyco Sanmar Ltd. (New Delhi)
6. Anderson Greenwood Crosby
7. BHEL (Trichy)
8. Curtiss Wright Flow Control Corporation
9. Dresser Inc.
10. Fukui Seisakusho Co. Ltd
11. Nakakita Seisakusho Co Ltd
12. Nuovo Pignone S.P.A (Italy) (GE Oil co)
13. Parcol S.P.A
14. Safety Systems UK Ltd
15. Tai Milano S.P.A
16. Weir Valves & Controls France
17. Bliss Anand Pvt Ltd.

xvi) FLOW CONTROL VALVES

1. Fouress Engg. (New Delhi)



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2. Fisher Xomox (New Delhi)
3. MIL Control Ltd. (Noida)
4. KOSO India Pvt Ltd
5. Samson Control (Thane)
6. Dresser Valves India Pvt Ltd.
7. Fisher Controls
8. Valvitalia Italy
9. CCI Valve technology
10. Flowserve Pvt Ltd.
11. Metso Singapore Pvt Ltd.
12. Instrumentation Ltd Palghat
13. Dresser Inc. USA

xvii) MOV actuator:

1. Rotork- UK, USA & INDIA
2. Limitorque
3. Auma- India
4. Biffi- Italy

xviii) Pneumatic actuator (Solenoid Operated ON-OFF type)

1. Metso Automation
2. Tyco
3. Samson Controls
4. L&T
5. Emerson
6. Fisher
7. Masoneilan Process Control
8. Instrumentation Limited (IL)-Palghat
9. Micro Finish



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10. Rotex

xix) Solenoid Valves

1. Avcon

2. Festo

xx) Electro – Hydraulic Actuator

1. Avcon Rotork controls (Deutschland Gmbh)

2. Biffi Italia Srl

3. Ledeen (Italy)

4. Virgo Valves and Controls Ltd.-India

5. Limittorque

6. Reineke

7. Voith

8. Bettis

9. Rotork- UK, USA & INDIA

10. Rotex

11. Schuck Group

xxi) CONTROL PANEL & ACCESSORIES

1. Keltron Controls Ltd., Kerala

2. Elechmec Corporation Ltd., Mumbai

3. Industrial Controls & Appliances Pvt. Ltd.,

4. Alstom System Ltd., Noida

5. Emerson Process Management (I) Pvt. Ltd.

6. ABB Instruments Ltd., New Delhi

7. Larsen & Toubro Ltd.

8. Control & Automation, New Delhi

9. GE Fanuc Systems Pvt. Ltd., New Delhi

10. Rockwell Automation (I) Ltd., Ghaziabad

11. Honeywell Automation Ltd.
12. Rittal
13. Pyrotech Elcronics Pvt Ltd.
14. Positronics Pvt Ltd.
15. Electronics Corporation of India Ltd.

xxii) JUNCTION BOXES AND CABLES GLANDS

1. Ex-Protecta
2. Flameproof Control Gears
3. Baliga
4. Flexpro Electricals

xxiii) CONTROL AND SIGNAL CABLES

1. Associated Cables
2. Brook
3. Associated Flexibles & Wires (Pvt) Ltd
4. Universal Cables Ltd, India
5. Delton Cables Ltd, India
6. KEI Industries Ltd INDIA
7. CMI Limited
8. Cords Cable Industries Ltd, India
9. Elkay Telelinks (P) Ltd., India
10. Udey Pyrocables Pvt Ltd, India
11. Goyolene Fibres (I) Pvt Ltd, India
12. Netco Cable Industries Pvt Ltd, India
13. Nicco Corporation Ltd, India
14. Paramount Communications Ltd, India
15. Polycab Wires Pvt Ltd, India
16. Radiant Cables Pvt Ltd, India



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17. Reliance Engineers Ltd., India
18. Suyog Electricals Ltd, India
19. Thermo Cables Ltd

xxiv) INDICATORS & CONTROLLERS

1. Yokogawa
2. Eurotherm Chessel
3. Honeywell
4. Emerson

xxv) BARRIERS

1. MTL
2. STHAL
3. P&F
4. Phoenix

xxvi) GAS CHROMATOGRAPH

1. ABB
2. Emerson
3. Instromet International, NV
4. RMG Regal+Messtechnik GmbH
5. Yokogawa

xxvii) I/P CONVERTERS

1. ABB
2. Emerson
3. IMI Watson Smith Ltd.
4. Moore Controls Ltd
5. Shreyas Instruments Pvt Ltd, India
6. Thermo Brandt Instruments

xxviii) SS FITTINGS, INSTRUMENT VALVES & MANIFOLDS



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1. Aura Inc.
2. Hoke
3. Excelsior Engg Works, India
4. Parker
5. Swagelok Co.
6. Swastic Engineering Works, India
7. Comfit & Valves Pvt.Ltd
8. Arya Crafts & Engg.Pvt. Ltd

xxix) SS TUBES

1. Sandvik
2. Hoke
3. Parker
4. Swagelok Co.
5. Heavy metal & tubes LTD
6. Nuclear Fuel Complex. India
7. Ratnamani Metal & Tube Ltd
8. Jindal Saw

xxx) GAS DETECTION SYSTEM

1. Crowcon Detection Instruments Ltd
2. Detection Instruments (I) Pvt Ltd
3. Detector Electronics Corporation
4. Drager Safety AG & Co. KGAA
5. General Monitors Ireland Ltd
6. Mine Safety Appliances Company
7. MSA – Mines Safety Appliances(India) Ltd
8. Industrial Scientific Oldham France S.A.
9. Riken Keiki Co Ltd



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10. Simrad Optronics Icare
11. Honeywell Analytics
12. Net Safety Monitoring Inc.
13. Simtronics SAS

LIST OF RECOMMENDED MANUFACTURERS

5. (SHOP & FIELD PAINTING)

i) Indian Vendors

1. Asian Paints(I) Ltd.
2. Berger Paints Ltd.
3. Goodlass Nerlolac Paints Ltd.
4. Jenson And Nicholson Paint Ltd & chokuGu Jenson & Nicholson Ltd.
5. Shalimar Paints Ltd.
6. Sigma Coating, Mumabai
7. CDC Carboline Ltd.
8. Premier Products Ltd.
9. Coromandel Paints & Chemicals Ltd.
10. Anupam Enterprises
11. Grand Polycoats
12. Bombay Paints Ltd.
13. Vanaprabha Esters & Glycer, Mumbai
14. Sunil Paints and Varnishes Pvt. Ltd.
15. Courtaulds Coating & Sealants India (Pvt.) Ltd.
16. Mark-chem Incorporated, Mumbai (for phosphating chemicals only)
17. VCM Polyurethane Paint (for polyurethane Paint only)

ii) Foreign Vendors for Overseas Products

1. Sigma Coating, Singapore
2. Ameron, USA
3. Kansai Paint, Japan
4. Hempel Paint, USA
5. Valspar Corporation, USA
6. Courtaulds Coating, UK.

Notes:

1. Bidder can select equipment of two different makes, selected from this VENDOR LIST and mention the same in the checklist for technical evaluation attached with the tender. The offered bid must include filled datasheet indicating make, model, size, rating of offered instrument/ equipment duly supported by sizing calculation of offered equipment (wherever applicable).
2. Vendors who have already supplied above equipment in other terminals of same Client/ Owner, shall also be considered qualified for this tender provided the supplied equipment are commissioned and running successfully and they have not been put on holiday in list of Client/PLECO/ Other PSU
3. Equipment / Instruments of any make which is offered by one bidder and acceptable to Client/ Owner shall be accepted for other bidder also. After placement of order, on request of the successful bidder list of other qualified makes for a particular item (for which successful bidder wants to change the vendor) shall be provided.
4. Bidder shall take prior approval of the make / model no of the offered item and it shall be from the list given above. However additional vendors will be considered in exceptional cases, provided they have supplied for similar application to reputed gas transmission/distribution companies, in quantities at least half the numbers being supplied for this tender, and working satisfactorily for minimum 6 months. Documentary evidence substantiating above shall be submitted for taking approval.
5. For procuring bought out items from vendors other than those listed above, the same may be acceptable subject to the following: -
 - a) The vendor/ supplier of bought out item(s) is a manufacturer/ supplier of said item(s) for intended services and the sizes being offered is in their regular manufacturing supply range.
 - b) Should have supplied at least one single random length (i.e. 5.5 meters to 6.5 meters) for item assorted pipes / tubes and for other items, which are to be supplied in quantity on number-basis (other than assorted pipes / tubes) minimum 01 (One) number of same or higher in terms of size and rating as required for intended services. The bidder should enclose documentary evidences i.e. PO copies, Inspection Certificate etc. for the above, along with their bids.
6. For any other item(s) for which the vendor list is not provided, bidders can supply those item(s) from vendors/ suppliers who have earlier supplied same item(s) for the intended services in earlier projects and the item(s) offered is in their regular manufacturing/ supply range. The bidder is not required to enclose documentary evidences (PO copies, Inspection Certificate etc.) along with their



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offer, however in case of successful bidder, these documents shall require to be submitted by them within 30 days from date of Placement of Order for approval to CLIENT / PLECO.

7. The details of vendors indicated in this list are based on the information available with PLECO, Contractor shall verify capabilities of each vendor for producing the required quantity with. PMC 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.