



HPOIL GAS PRIVATE LIMITED

**ANNUAL RATE CONTRACT FOR SUPPLY
OF (PART-A)-DISTRICT REGULATING
STATION (DRS) -1500 SCMH,2500 SCMH &
5000 SCMH & (PART-B)- DE-COMPRESSION
UNIT (DCU) -100 SCMH,450 SCMH IN
GEOGRAPHICAL AREAS OF DIMAPUR,
NAGALAND FOR HPOIL**

TENDER DOCUMENT FOR PART-A – DISTRICT REGULATING STATION PART- B-DE-COMPRESSION UNIT (DCU)

TENDER No:HOGPL/VCS/2025-26/C&P-NL/PRC/DRS&DCU/024

VCS REFERENCE NO. VCS/HOGPL/PRC/2026/004

Technical Volume

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**PREPARED AND ISSUED BY VCS QUALITY
SERVICES PVT.LTD. NOIDA, INDIA**



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**SUPPLY FOR DISTRICT
REGULATING STATION (DRS)& DE-
COMPRESSION UNIT (DCU) OF
NAGALAND GA's (HPOIL**



SCOPE OF SUPPLY

HPOIL GAS PRIVATE LIMITED

**PART-A
DISTRICT REGULATING SKIDS (DRS)
1500 SCMH, 2500 SCMH & 5000 SCMH**

**PART-B
DE-COMPRESSION UNIT (DCU)
100 SCMH, 450 SCMH**

REV	DATE	DESCRIPTION	PREP	CHK	APPR



SUPPLY OF DISTRICT REGULATING SKIDS (DRS) -1500 SCMH,2500 SCMH & 5000 SCMH & DE COMPRESSION UNIT 100 SCMH & 450SCMH IN GEOGRAPHICAL AREAS DIMAPUR, NAGALAND FOR HPOIL

1. INTRODUCTION

Hindustan Petroleum Corporation Limited (HPCL) is a Central Public Sector with a Navratna Status, and a Forbes 2000 and Global Fortune 500 company incorporated in 1974 engaged in refining and marketing of petroleum products with its headquarter in Mumbai, Maharashtra.

Oil India Limited (OIL) is a premier Indian National Oil Company engaged in the business of exploration, development and production of crude oil and natural gas, transportation of crude oil and production of LPG founded in 1959 with its headquarters in Duliajan, Assam.

A JVC has been incorporated in the name of HPOIL GAS PRIVATE LIMITED, which has received the authorization from PNGRB vide letter PNGRB/CGD/BID/8/2018/GA/Ambala-Kurukshetra District dated 22/02/2018 to Lay, Build and Operate City Gas Distribution networks in Ambala & Kurukshetra and vide letter PNGRB/CGD/BID/8/2017/BEC/GA-Kolhapur dated 06/03/2018 to Lay, Build and Operate City Gas Distribution networks in Kolhapur District.

HPOIL GAS PRIVATE LIMITED (HOGPL) has engaged M/s VCS Quality Services Private Limited (herein after referred as "VCS" or "VCSQSPL") as a consultant, for CGD project for Geographical Area (GA) of Ambala and Kolhapur District.

2. DEFINITION

PROJECT	CITY GAS DISTRIBUTION PROJECT OF DIMAPUR, NAGALAND
OWNER / COMPANY	HPOIL GAS PRIVATE LIMITED (HOGPL)
CONSULTANT	VCS Quality Services Private Limited (VCSQSPL) the party to act for and on behalf of OWNER for the Engineering Services.
VENDOR / BIDDER	The party, who manufactures and supplies equipment and Provide services to the Owner or to Contractor



SCOPE OF SUPPLY

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SUPPLY OF DISTRICT REGULATING SKIDS (DRS) -1500 SCMH,2500 SCMH & 5000 SCMH & DE COMPRESSION UNIT 100 SCMH & 450SCMH IN GEOGRAPHICAL AREAS DIMAPUR, NAGALAND FOR HPOIL

3. SCOPE OF SUPPLY & SERVICES

This document covers supply of District Regulating Station to be used in City Gas Distribution Project in Dimapur Nagaland GA.

The scope of supply covers design, engineering, manufacture, integration, inspection, performance testing, supply, shipment, erection, installation, testing, commissioning and documentation of these items in accordance with the requirements of this Requisition.

DESCRIPTION	QUANTITY	REMARKS
PART-A DISTRICT REGULATING SKIDS-		
DRS Station - Flow Capacity - 1500 SCMH	2 Nos.	
DRS Station - Flow Capacity - 2500 SCMH	2 Nos.	
DRS Station - Flow Capacity - 5000 SCMH	1 Nos.	
PART-B DE-COMPRESSION SKIDS		
DE-COMPRESSION SKIDS (DCU) -100 SCMH	4 Nos.	
DE-COMPRESSION SKIDS (DCU) -450 SCMH	2 Nos.	

NOTE- Brief description of supply of District Regulating skids in PART-A and Decompression Skid in PART-B

	SCOPE OF SUPPLY	

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**PART-A-DISTRICT
REGULATING
STATION (DRS) -
1500 SCMH,2500
SCMH & 5000
SCMH**



**SUPPLY FOR DISTRICT
REGULATING STATION (DRS) OF
NAGALAND GA's (HPOIL**



**MATERIAL REQUISITION FOR
DISTRICT REGULATING STATION**

TOTAL SHEETS

13

DOCUMENT NO

C261162

00

IN

MR

3006

HPOIL GAS PRIVATE LIMITED

**MATERIAL REQUISITION FOR
DISTRICT REGULATING SKIDS (DRS) –
1500 SCMH, 2500 SCMH & 5000 SCMH**

PART-A

C1	05-05-2026	ISSUED FOR INTERNAL REVIEW	AB	SA	AB
REV	DATE	DESCRIPTION	PREP	CHK	APPR



SUPPLY OF DISTRICT REGULATING SKIDS (DRS) -1500 SCMH,2500 SCMH & 5000 SCMH IN GEOGRAPHICAL AREAS DIMAPUR, NAGALAND FOR HPOIL

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SUPPLY OF DISTRICT REGULATING SKIDS (DRS) -1500 SCMH,2500 SCMH & 5000 SCMH IN GEOGRAPHICAL AREAS DIMAPUR, NAGALAND FOR HPOIL

1. INTRODUCTION

M/s. HPOIL Gas Private Limited (HPOIL) is in the process of starting to setup City Gas Distribution (CGD) Network for the Geographical area of Nagaland state.

VCS Quality Services Pvt. Ltd. (VCS has been appointed as Project Management Consultant for providing consultancy services for this Project

2. DEFINITION

PROJECT	CITY GAS DISTRIBUTION PROJECT OF DIMAPUR, NAGALAND
OWNER / COMPANY	HPOIL GAS PRIVATE LIMITED (HOGPL)
CONSULTANT	VCS Quality Services Private Limited (VCSQSPL) the party to act for and on behalf of OWNER for the Engineering Services.
VENDOR / BIDDER	The party, who manufactures and supplies equipment and Provide services to the Owner or to Contractor

3. ORDER OF 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:

- Datasheets;
- Codes & Standards;
- Material Requisition;
- Technical Specification;
- Approved GA Drawings.

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.)

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		C261162-00-ME-MR-3006	C1
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SUPPLY OF DISTRICT REGULATING SKIDS (DRS) -1500 SCMH,2500 SCMH & 5000 SCMH IN GEOGRAPHICAL AREAS DIMAPUR, NAGALAND FOR HPOIL

4. SCOPE OF SUPPLY & SERVICES

This document covers supply of District Regulating Station to be used in City Gas Distribution Project in Dimapur Nagaland GA.

The scope of supply covers design, engineering, manufacture, integration, inspection, performance testing, supply, shipment, erection, installation, testing, commissioning and documentation of these items in accordance with the requirements of this Requisition.

DRS Station - Flow Capacity - 1500 SCMH ,2500 SCMH & 5000 SCMH			
S.NO	DESCRIPTION	QUANTITY	REMARKS
1	DISTRICT REGULATING SKIDS Design, Engineering, Manufacturing, inspection ,testing , Loading, Shipment, Unloading, handling at Site. Skids shall be consisting of (1W+1S) Filtration Unit,(1W+1S) pressure reduction (active-monitor configuration), Pressure gauges, Temperature Gauges, Differential Pressure Gauges, Pressure Safety Valves, Pressure Control Valves with integrated SDV, Creep Relief Valves, Restriction Orifice, RPD Type Flow Meter with Pressure & Temperature Transmitters, EVC with data logger, 2 Nos. NDR (Point Gas Detectors) with GSM based communication system, Solar Power System (i.e Solar Module, Battery and Mounting Pole & required arrangement) along with necessary Battery, Invertor & Battery Charger etc. as per P&ID (C261162-00-PC-PID-1300,C261162-00-PC-PID-1400 & C261162-00-PC-PID-1500) attached with the Tender along with associated accessories including instrument fittings, manifolds, impulse tubing with fittings, pipes, valves, NRVs, flanges, gaskets, all structure / base frame / supports / operating platforms, flame arrestors, cables and cabling from field instruments to FC, glands, ferrules, lugs, tags at both ends, supports, SS blind plugs. It includes supply of all applicable accessories required for commissioning for commissioning of the DRS at the respective GA's as per technical specification, Datasheet, P&ID, scope of work and MR attached with this tender. It also includes supply of commissioning spares. Details of quantity of DRS required as mentioned below :-		

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SUPPLY OF DISTRICT REGULATING SKIDS (DRS) -1500 SCMH,2500 SCMH & 5000 SCMH IN GEOGRAPHICAL AREAS DIMAPUR, NAGALAND FOR HPOIL

1.1	DRS Skid – 1500 SCMH Design Pressure: INLET 49 Barg / OUTLET 19 Barg Design Temperature: -29 Deg C to 65 Deg C Inlet Pressure: 45 to 15 Barg Outlet Pressure: 4 Barg Flow: 1500 SCMH Design Class: INLET 300# / OUTLET 150# Inlet Size: 2" x 300# Outlet Size: 3" x 150#	2 Nos.	
1.2	Proving assistance during Installation, Testing and Commissioning of 1500 SCMH DRS as per technical specification along with mounting stands and all applicable accessories required for commissioning for all the respective GA's as per technical specification, P&ID & scope of work attached with this tender.	2 Nos.	
2	DISTRICT REGULATING SKIDS Design, Engineering, Manufacturing, inspection ,testing , Loading, Shipment, Unloading, handling at Site. Skids shall be consisting of (1W+1S) Filtration Unit,(1W+1S) pressure reduction (active-monitor configuration), Pressure gauges, Temperature Gauges, Differential Pressure Gauges, Pressure Safety Valves, Pressure Control Valves with integrated SDV, Creep Relief Valves, Restriction Orifice, RPD Type Flow Meter with Pressure & Temperature Transmitters, EVC with data logger, 2 Nos. NDR (Point Gas Detectors) with GSM based communication system, Solar Power System (i.e Solar Module, Battery and Mounting Pole & required arrangement) along with necessary Battery, Invertor & Battery Charger etc. as per P&ID (C261162-00-PC-PID-1300,C261162-00-PC-PID-1400 & C261162-00-PC-PID-1500) attached with the Tender along with associated accessories including instrument fittings, manifolds, impulse tubing with fittings, pipes, valves, NRVs, flanges, gaskets, all structure / base frame / supports / operating platforms, flame arrestors, cables and cabling from field instruments to FC, glands, ferrules, lugs, tags at both ends, supports, SS blind plugs. It includes supply of all applicable accessories required for commissioning of the DRS at the respective GA's as per technical specification,		

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SUPPLY OF DISTRICT REGULATING SKIDS (DRS) -1500 SCMH,2500 SCMH & 5000 SCMH IN GEOGRAPHICAL AREAS DIMAPUR, NAGALAND FOR HPOIL

	Datasheet, P&ID, scope of work and MR attached with this tender. It also includes supply of commissioning spares. Details of quantity of DRS required as mentioned below :-		
2.1	DRS Skid - 2500 SCMH Design Pressure : INLET 49 Barg / OUTLET 19 Barg Design Temperature : -29 Deg C to 65 Deg C Inlet Pressure : 45 to 15 Barg Outlet Pressure : 4 Barg Flow : 2500 SCMH Design Class : INLET 300# / OUTLET 150# Inlet Size: 3" x 300# Outlet Size: 4" x 150#	2 Nos.	
2.2	Proving assistance during Installation, Testing and Commissioning of 2500 SCMH DRS as per technical specification along with mounting stands and all applicable accessories required for commissioning for all the respective GA's as per technical specification, P&ID & scope of work attached with this tender.	2 Nos.	

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SUPPLY OF DISTRICT REGULATING SKIDS (DRS) -1500 SCMH,2500 SCMH & 5000 SCMH IN GEOGRAPHICAL AREAS DIMAPUR, NAGALAND FOR HPOIL

3	DISTRICT REGULATING SKIDS Design, Engineering, Manufacturing, inspection ,testing , Loading, Shipment, Unloading, handling at Site. Skids shall be consisting of (1W+1S) Filtration Unit,(1W+1S) pressure reduction (active-monitor configuration), Pressure gauges, Temperature Gauges, Differential Pressure Gauges, Pressure Safety Valves, Pressure Control Valves with integrated SDV, Creep Relief Valves, Restriction Orifice, RPD Type Flow Meter with Pressure & Temperature Transmitters, EVC with data logger, 2 Nos. NDR (Point Gas Detectors) with GSM based communication system, Solar Power System (i.e Solar Module, Battery and Mounting Pole & required arrangement) along with necessary Battery, Invertor & Battery Charger etc. as per P&ID (C261162-00-PC-PID-1300,C261162-00-PC-PID-1400 & C261162-00-PC-PID-1500) attached with the Tender along with associated accessories including instrument fittings, manifolds, impulse tubing with fittings, pipes, valves, NRVs, flanges, gaskets, all structure / base frame / supports / operating platforms, flame arrestors, cables and cabling from field instruments to FC, glands, ferrules, lugs, tags at both ends, supports, SS blind plugs. It includes supply of all applicable accessories required for commissioning for commissioning of the DRS at the respective GA's as per technical specification, Datasheet, P&ID, scope of work and MR attached with this tender. It also includes supply of commissioning spares. Details of quantity of DRS required as mentioned below :-		
3.1	DRS Skid - 5000 SCMH Design Pressure: INLET 49 Barg / OUTLET 19 Barg Design Temperature: -29 Deg C to 65 Deg C Inlet Pressure: 45 to 15 Barg Outlet Pressure: 4 Barg Flow: 5000 SCMH Design Class: INLET 300# / OUTLET 150# Inlet Size: 3" x 300# Outlet Size: 6" x 150#	1 Nos.	

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SUPPLY OF DISTRICT REGULATING SKIDS (DRS) -1500 SCMH,2500 SCMH & 5000 SCMH IN GEOGRAPHICAL AREAS DIMAPUR, NAGALAND FOR HPOIL

3.2	Proving assistance during Installation, Testing and Commissioning of 5000 SCMH DRS as per technical specification along with mounting stands and all applicable accessories required for commissioning for all the respective GA's as per technical specification, P&ID & scope of work attached with this tender.	1 Nos.	

NOTES:

- Accessories for DRS shall be supplied as specified in the instrument datasheet attached with the material requisition.
- Bidder has to quote full quantity of quoted item mentioned above; partial quotation for the item shall be liable to rejection.
- Procurement, supply, inspection, Factory Acceptance Test and Site Acceptance Test shall be in the bidder scope;
- Erection, Installation, field calibration / testing, pre-commissioning & commissioning shall be in the bidder scope;
- Transportation, transit insurance, loading and unloading of material at HOGPL site / stores shall be in the bidder scope;
- Rectification of any damage (if any) occurred during transportation/ unloading / observed on receipt of material at site shall be in bidder scope.
- Mandatory Spares required for maintenance, commissioning and two-year operation if required need to be considered;
- Compliance of Checklist points during FAT, SAT, Site, stores (if any);
- Mandatory and commissioning spares need to be considered as per mandatory spares list provided in tender document;
- HOGPL LOGO should be embossed/ stamped/ punched at prominent places on the body of DRS.
- Bidder to submit Ex-works prices for mandatory spare required for operation and maintenance along with the priced bid. The submitted Ex-works prices for mandatory spare required for operation and maintenance is required for reference purpose and shall not be used for evaluation purpose.
- Signal and power redundancy to be provided;
- All documentations, calibration test reports, alarm set points as per process design, detail P&ID, earthing drawings to be provided along with the systems and instruments.

5. DOCUMENTS & DATA REQUIREMENTS

The table hereunder specifies the quantities & nature of the documents to be submitted by the bidder to Company.

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

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

The final & certified documents are listed under column C.

Any document even when preliminary shall be binding and therefore duly identified & signed by the bidder. It shall bear the company project reference, the MR number and identification number.

The documents are fully part of the supply which shall be complete only if and when the documents complying fully with the material requisition requirements received by the engineer

S.no.	Documents and Data	A	B		C	
		Number of copies	Number of copies	Required time period	Number of copies	Required time period
1.	Drawing/document/data submittal list/schedule	-	3	2 weeks	3	2 weeks
2.	P&ID in compliance with the tender document	1	3	2 weeks	3	2 weeks
3.	Fabrication, test and delivery schedule (per item)	-	3	2 weeks	3	2 weeks
4.	Progress report	-	3	2 weeks	3	2 weeks
5.	Catalogues / Datasheets/ Specification/ References of all Instruments	1	3	2 weeks	3	With final tech. file
6.	Outline drawing + unit weight (per skid)	-	3	2 weeks	3	With final tech. file
7.	Detail drawing + material specification	-	3	2 weeks	3	With final tech. file
8.	Code compliance certificate	-	3	2 weeks	3	With final tech. file

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SUPPLY OF DISTRICT REGULATING SKIDS (DRS) -1500 SCMH,2500 SCMH & 5000 SCMH IN GEOGRAPHICAL AREAS DIMAPUR, NAGALAND FOR HPOIL

9.	Welding procedure specification and records WPS/PQR	-	3	4 weeks	3	With final tech. file
10.	Inspection and test procedures	1	3	2 weeks	3	With final tech. file
11.	Test reports	-	3	3 weeks	3	With final tech. file
12.	NDE reports	-	3	1 week after test	3	With final tech. file
13.	Heat treatment reports	-	3	1 week after test	3	With final tech. file
14.	Hydro test and air test report	-	3	1 week after test	3	With final tech. file
15.	Bill of materials (on drawings)	-	3	1 week after test	3	With final tech. file
16.	Installation instructions Site inspection procedure	-	2	4 weeks	2	With final tech. file
17.	Packing/shipping list with weights and dimensions	-	2	4 weeks before shipping	2	With final tech. file
18.	Material test certificate	-	2	4 weeks before shipping	2	With final tech. file
19.	Painting system description	-	2	1 week after test	2	With final tech. file
20.	List of subcontractors with their scope	-	2	2 weeks	2	With final tech. file
21.	Completed datasheets for all mechanical items like valves, pipes, canopy, filters, flanges with required calculations, PV-lite calculations for filter, GA drawing with part names and MOC etc.	-	2	4 weeks	2	2 Weeks
22.	GA drawing of the skid	-	2	4 weeks	2	2 Weeks

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SUPPLY OF DISTRICT REGULATING SKIDS (DRS) -1500 SCMH,2500 SCMH & 5000 SCMH IN GEOGRAPHICAL AREAS DIMAPUR, NAGALAND FOR HPOIL

	and the Canopy of the skid					
23.	Completed Instrument Index	-	2	4 weeks	2	2 Weeks
24.	Functional Loop Drawing	-	2	4 weeks before shipping	2	With final tech. file
25.	Cable schedule	-	2	4 weeks before shipping	2	With final tech. file
26.	Earthing Drawing	-	2	4 weeks before shipping	2	With final tech. file
27.	Interface Descriptions	-			2	Before shipping
28.	Instrumentation hook-ups	-	3	2 weeks	3	2 weeks
29.	Installation manuals, catalogues		3	2 weeks	3	2 weeks
30.	Statutory approvals / certificates etc. as applicable	1	3	2 weeks	3	2 weeks
31.	Datasheets in compliance with Tender Document	1	3	2 weeks	3	2 weeks

NOTES:

1. FAT procedure document must include clause wise reference of tender specification for its compliance. This document shall be prepared in consultation with owner/ owner's representative.
2. Durations in column B (Required date) are weeks after Purchase Order date. Durations in column C (Required date) are weeks before final dispatch.
3. Final technical document file shall be supplied in hard copy as indicated and in electronic format (.pdf Acrobat files) on two (2 Nos.) Pen Drive.

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SUPPLY OF DISTRICT REGULATING SKIDS (DRS) -1500 SCMH,2500 SCMH & 5000 SCMH IN GEOGRAPHICAL AREAS DIMAPUR, NAGALAND FOR HPOIL

6. LIST OF ATTACHMENTS

The table below lists the documents which are integral part of this Material Requisition. The applicable revision index of each document is mentioned in the column below the current Material Requisition revision index.

When the Material Requisition revision index is "A" or "1", all listed documents are attached. For other Material Requisition revision index, only modified or new documents are attached.

DOCUMENTS	DOCUMENT NO.	REVISION OF DOCUMENTS		
Technical Specification for DRS	C261162-00-ME-MR-3007	C1		
Datasheets for Field Instruments, Instrumentation Cables for DRS	VCS-SS-IN-5801_02	C1		
Standards Specification for Gas Regulators	VCS-SS-IN-5502_02	02		
Standards Specification for Pressure Gauge	VCS-SS-IN-5001_02	02		
Standards Specification for Temperature Gauge with TW	VCS-SS-IN-5101_02	02		
Standards Specification for Pressure Safety Valve	VCS-SS-IN-5504_02	02		
Standards Specification for JB's & Cable Glands	VCS-SS-IN-5802_02	02		
Standards Specification for Instrument Cables	VCS-SS-IN-5801_02	02		
Standards Specification for Tube & Fittings	VCS-SS-IN-5803_02	02		
Standard Specification for Restriction Orifice	VCS-SS-IN-5402_02	02		
Standard Specification for RPD Meter	VCS-SS-IN-5301_02	02		
Standard Specification for Pressure Transmitter	VCS-SS-IN-5003_02	02		
Standard Specification for Temperature Transmitter	VCS-SS-IN-5103_02	02		
Standard Specifications for Fabrication and Erection of Piping	VCS-SS-PP-2509	00		
Standard Specifications for Seamless fittings and flanges	SS-PL-005	00		
Standard Specifications for Inspection, Filling and testing	SS-PL-007	00		
Standard Specifications for Ball valves	VCS-SS-PP-2004	00		

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SUPPLY OF DISTRICT REGULATING SKIDS (DRS) -1500 SCMH,2500 SCMH & 5000 SCMH IN GEOGRAPHICAL AREAS DIMAPUR, NAGALAND FOR HPOIL

Standard Specifications for Painting	VCS – SS – PP - 2502	00		
Standard Specifications for Assorted pipes	VCS – SS – PP - 2503	00		
Piping Material Specification	STD-00-PP-PMS-2001	00		
Valves Datasheets	C261162-CD-PL-DS-3008 A/B/D/E/F/G/H/I/J/K	0		
Datasheets of filters for DRS-1500 SCMH,2500 SCMH & 5000 SCMH	C261162-00-ME-DS-3011	C1		
Instrument Datasheets	C261162-CGD-IN-DS-3008	C1		
Quality Assurance Plan for Skids	C261162-00-IN-ITP-3012	C2		
Inspection and test plan- Ball valve	VCS – ITP – PP – 2007	00		
Inspection and test plan- Globe valve	VCS –ITP –PP –2008	00		
List of third party inspection agency	DOC. NO.- VCS-C&P-TPIA-001	00		
Checklist-Technical	VCS-SD-CK-001	00		
Datasheet for DC-DC Converter	VPC –DS –EL-017	00		
Datasheet for Solar Electric Power System	CS-FMT-001_00	00		
Datasheet for Storage Battery	VPC –DS –EL-012	00		
Standard Specification for Solar Electric Power System	VPC – SS – EL- 012	00		
Standard Specification for DC-DC Converter	VPC – SS – EL - 016	00		
Standard Specification for Sealed Maintenance Free VRLA Batteries	VPC – SS – EL – 042	00		
P&ID for 1500 SCMH,2500 SCMH & 5000 SCMH	C261162-00-PC-PID-1300 C261162-00-PC-PID-1400 C261162-00-PC-PID-1500	C1		

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PROJECT CODE: C261162



**TECHNICAL SPECIFICATION FOR
DISTRICT REGULATING STATION (DRS)**

TOTAL SHEETS

20

DOCUMENT NO.

C261162

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IN

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3007

HPOIL GAS PRIVATE LIMITED (HPOIL)

**CITY GAS DISTRIBUTION PROJECT
OF DIMAPUR, NAGALAND GA**

C1	05.05.2026	ISSUED FOR INTERNAL REVIEW	AB	SA	AB
REV	DATE	DESCRIPTION	PREP	CHK	APPR



CITY GAS DISTRIBUTION PROJECT OF DIMAPUR, NAGALAND GA

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CITY GAS DISTRIBUTION PROJECT OF DIMAPUR, NAGALAND GA

1 DEFINITION

PROJECT	CITY GAS DISTRIBUTION PROJECT OF DIMAPUR, NAGALAND GA
OWNER / COMPANY	HPOIL GAS PRIVATE LIMITED (HOGPL)
CONSULTANT	VCS Quality Services Private Limited (VCSQSPL) the party to act for and on behalf of OWNER for the Engineering Services.
VENDOR / BIDDER	"Vendor" means the person(s), firm, company, Organization from whom contractor procures products/services.

2 CODES & STANDARDS

The design shall be made in accordance with latest Codes & Standards and statutory requirements. In the event that there is no applicable Indian Standard, a corresponding International Standard may be applied to the design, as long as use of substitute standard is approved in writing by principal. Latest revisions of following standards are applicable for the package.

International Electro technical Commission Standards	
IEC 617-12	Graphical Symbols for Diagrams - Binary Logic Diagrams
IEC 751	Industrial Platinum Resistance Thermometers Sensors.
IEC 801	Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment.
IEC-60529	Specification for Enclosures
IEC-60079	Hazardous Area Classification
American Petroleum Institute Standards	
API RP 520	Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries
API 526	Flanged Steel Pressure Relief Valves
ISA Standards	
ANSI/ISA S7.0.01	Quality Standard for Instrument Air
ANSI/ISA SI8.1	Annunciator Sequences and Specifications
ANSI/ISA S51.1	Process Instrumentation Terminology

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ANSI/ISA S75.01	Flow equations for Sizing Control Valves
ANSI/ISA S75.03	Face-to-Face dimensions for flanged globe style control valve bodies (ANSI Classes 125, 150, 250, 300 and 600)
ANSI/ISA S75.04	Face-to-face dimensions for flangeless control valve bodies (ANSI classes 150, 300 and 600)
ASME Standard	ASME section VIII: Boiler and pressure vessel code - Pressure vessels.
OTHER CODES	
AGA 8	Compressibility factors of natural gas and other related Hydrocarbon Gases
PNGRB	Petroleum and Natural Gas Regulatory Board
EN 334	Gas pressure regulators for inlet pressures up to 100 Bar
EN 837	Part-1, 2, 3 for pressure gauges.
OISD-STD-226	Natural gas transmission pipeline and city gas distribution network
OISD-STD-220	Distribution of piped Natural Gas

3 ENVIRONMENTAL CONDITION

The equipment considered and the complete installation shall be suitable for continuous operation under the following site conditions:

Description	Indoor (Air Conditioned)	Indoor (Non-Air conditioned)	Outdoor (Under shade)	Outdoor (Open to sky)
Operating Temperature	0 ~ 35 Deg C	-5 ~ 50 Deg C	-5 ~ 50 Deg C	-5 ~ 55 Deg C
Relative Humidity	20% ~ 80%	90%	95%	

The instruments shall be suitable to the ambient conditions provided in the above table.

4 DESIGN CRITERIA

Operation & Design Life

DRS shall be designed to operate in the site environmental conditions continuously. The life time of the plant is envisaged to be 25 years. However, optimum design life expectancy of the skid shall be 10 years and spare parts availability shall be for 10 years after cease of production.

Hazardous Area Classification

Electrical materials shall in general follow the IEC 60079 standards and shall be compliance with all applicable local regulations.

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The material will be installed in hazardous area zone 1 and classified as "EExd" IIA/IIB T3.
Enclosure protection degree shall be min. IP65 as per IEC 60529.

Ingress Protection

All field instruments and outdoor equipment such as junction boxes and cabinets/panels shall have ingress protection to IP 65 / NEMA 4 or better in accordance with IEC 60529. Panels installed indoors shall have ingress protection of IP 42 as a minimum.

EMC Compliance

All valves shall be immune to Radio Frequency Interference (RFI) and Electro Magnetic Interference (EMI). The design and installation of all electrical / electronic equipment shall meet the RFI/EMI requirements according to IEC 61000, emission (IEC61000-6-4) and immunity (IEC-61000-6-2) requirements for an industrial environment. Power Supply.

Earthing

Instrument and systems shall be connected to the proper earthing system for the protection of personnel and instrument / equipment from fault currents (protective earth) and to minimize electrical interference in signal transmission circuits (instrument earth). The following separate earthing systems are to be provided:

- Protective Earth (PE) – Bonded to the site structure and utilized for electrical safety of metal enclosures and chassis on all instruments and electrical components. This earthing system is used for protection of personnel and equipment from fault currents;
- Instrument Clean Earth (IE) – Insulated from the site structure and other metal work utilized for instrument cable screens and bonded to the main electrical earthing system at a single point. Electronics in the instrument shall be insulated from the metal work.

Cable screens of signal cables shall be segregated from metallic structural earth in the field and earthed at one point only at the cable marshaling point. Cable shields must have a single, continuous path to earth. Earth loops and floating shields shall be avoided. Shield drain wires shall not be daisy-chained to the ground connection.

The purpose of instrument DC & shield earth bus bar is to reduce the effect of electrical interference upon the signal being transmitted. A DC & shield earth bus bar shall be provided within each cabinet for consolidating instrument signal commons and cable shield drain wires. This earth bus shall be isolated from the safety earth system and from the body of the cabinet except at the plant earthing reference point.

Each instrument signal common shall be connected to the isolated instrument DC & shield earth bus with copper wire sized to carry the expected fault current or 1.5 mm², whichever is larger. Two insulated copper conductors shall be connected from the instrument DC & shield earth bus within each cabinet to a single tie point on the master instrument earth bar within the control building in a closed loop configuration. The resistance from the isolated instrument DC & shield earth bus to the plant ground grid shall be less than 1 ohm.

Isolated instrument DC & shield earth bars from all cabinets shall be consolidated into a master instrument earth bus located within that building. The master instrument earth bar shall be connected to the master reference earth. The master reference earth should then be connected in a loop configuration to a single point on the plant earthing. Bonding cabinet AC or DC & shield earth bus bars in a daisy-chain connection is not acceptable.

The bidder shall be responsible for all earthing requirements within his scope of supply.

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Material of Construction

The material of construction of the wetted parts and the body of all the individual instruments / equipment shall be suitable to the process fluid / conditions and the site ambient conditions.

All materials and equipment furnished shall be new and unused, of current manufacture and the highest grade and quality available for the required service and free of defects.

Process wetted parts shall be suitable for process fluid and conditions. Body / trim materials shall be selected based on the applicable pipe class as per Piping Material Specification. Wetted parts material shall be SS316 as a minimum. Tubing and tube / pipe fittings used to hook up instruments to piping / vessel shall be SS316. Material of construction of enclosures and junction boxes shall be cast aluminum (LM6 / LM25) or GRP.

Galvanic compatibility between dissimilar materials is to be ensured to prevent corrosion due to galvanic action.

Painting and Coating

Field instruments shall be epoxy coated as per Manufacturer's standard. The finish of junction boxes (Non IS) shall be light gray shade equivalent to RAL7035 and junction boxes (IS) shall be blue shade. Field mounted panel's surface and inside coating and finish shall be as per manufacturer's recommendation. Field stanchions shall be coated with corrosive resistant coating and finish shall be light gray shade.

Painting shall be carried out by application of one coat (DFT 35-50 microns) of zinc phosphate primer followed by two coats (DFT 60 microns each) of chloro-rubber high build paint of colour canary yellow. Before painting, surfaces shall be thoroughly cleaned by applying mechanical methods.

The following supplies shall be included in Bidder's scope:

- Spare parts for start-up/commissioning operations and pre-commissioning /compulsory spares;
- The engineering documents requested in the DDR attached to the Purchase Requisition;
- The Material Certificates.

Identification & Tagging

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

In addition to the instruments and equipment nameplate, the structural skid (each part of skid) shall be supplied with a permanent, weather resistant, stainless steel nameplate affixed to the skid, with the following details, as a minimum;

- Project Title and SOR item number/ location;
- Owner's logo and Owner name;
- Equipment name and tag number;
- Manufacturer's name and skid serial number, skid capacity;
- Size, rating, flow capacity of individual component like Meter etc.
- Skid part number and overall dimension data;
- Skid weight data;
- Gas Flow directions to be neatly marked on the pipings and tubings conspicuously of the DRS Skid.

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Each skid and each part thereof and all the instruments in the skid shall have a Stainless steel nameplate attached firmly to it at a visible place furnishing the following information:

- Tag number of the skid;
- Project Name with location: "HOGPL, ----- (name of site / station)";
- PO No.-
- Inlet size (in inch) and Outlet Size (in inch) with class rating;
- Min/ Normal/ Max. Flow capacity in SM3/Hr. for each of the DRS;
- Tag number of Instruments, JB as per purchaser's data sheets;
- Body sizes with class rating in inches and the Valve Cg value or flow meter G-Rating (as applicable);
- Rating for all the individual instruments;

All cable should have tag no. at JB / panel end and Instrument end. All wires terminated inside skid and JB should have identification mark, ferrules etc. (for the termination of supplied cables, Identification tag no, ferrule etc. shall be provided by bidder).

5 TECHNICAL REQUIREMENTS

General

The skids shall be designed in accordance with the General specification for the Skid Mounted Assemblies. The vents shall be min. 3 meters high from the highest operating platform.

Contractor shall confirm the size of Skid and furnish the foundation loads and footprints of skid along with the bid. Size of Skid (LXWXH) shall be 5 X 2.5 X 3 m. It shall be kept to as minimum as possible while meeting all the technical requirements

Supply of anchor fasteners, nut-bolts (corrosion proof), angles for installation of cable trays, earthing cables, earth strips for earthing of the skid instruments, panels and copper earth strips across flanges etc. shall be in the scope of contractor.

All piping shall be rigidly and firmly supported with fasteners, clamps, mechanical structure to arrest from vibrational impact of the DRS skid. Adequate pipe supports shall be provided for the filters & regulators. These shall be bolted to the skid structure and shall be designed and located with due regards to weight distribution and operational pipe stress.

Lifting lugs and their supporting structure and spreader bar (one for each skid) shall be designed for a Load equal to two times the weight to be lifted (shipping weight).

All installation and erection materials such as impulse piping, pipe fittings and valves, tubing, tube fittings, cable tray and supports, foundation bolts of the skid, gaskets, companion flanges for tube fittings, instrument supports, tray supports, canopies/ sunshades for all field mounted instruments, cable glands, gland covers etc. shall be in the scope of contractor.

All the cables used for inter-skid cabling shall be IS (Intrinsic safe) type (Blue).

The skid shall be complete in all respect, ready for quick installation and commissioning of equipment with minimum work at site. All field-mounted instruments shall be mounted on the skid and impulse lines properly supported on the skid.

Regulation skid shall be tested at working pressure with the help of Nitrogen gas. The regulator setting shall be done during the FAT only.

Contractor shall furnish material test certificate, Hydrostatic test certificate, certificates of radiography for all line mounted instruments on the skid, Certificates from statutory body for

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hazardous area approval for all electrical items mounted on the skid, Calibration certificates, certificates for the conformity to the standards to be submitted, and all other certificates mentioned in individual general specification.

Contractor shall take single point responsibility for the engineering, design, certification, procurement, inspection, testing, supply, commissioning & performance of the Gas filtration & Regulation skids along with all instruments, equipment and valves of the skids, based on the data sheets and the specifications furnished and taking into consideration successful operation, safety and the established International standards for the complete skids.

Supplier shall note that the complete skid to be pneumatically tested in the factory premises @ 7.7 Barg with N₂/Air. In case of dismantling of the skid due to transportation, same shall be re-tested once again at the installation site @ 7.7 Barg with N₂/Air. For testing at site, all the arrangement shall be in the scope of skid supplier.

The relief valve should be installed and provided with test connections in the impulse pipe work in such a way as to enable them to be set up and tested in-situ.

All required accessories such as filter, regulator, lubricator, etc., if required, for safe and proper operation of SOV shall be in the scope of contractor. It is not shown in the P&ID.

For automatic set point adjustment system, if any instrument not shown in the P&ID and not specified in specifications but required for successful & Safe operation, shall also be in the scope of skid supplier. All the instruments shall be considered for safe and successful operation of the automatic set point adjustment system. Detailed description of automatic adjustment system shall be submitted along with bid offer.

At tapping for gas supply to the automatic pressure regulators set-point adjustment system, ball valve (Lock Open type) shall be provided.

End connection spool piece between the transition fitting and skid end flange shall be in the scope of skid supplier. Transition fitting will not be in the scope of vendor.

All the drains shall be connected to the common drain header with one common outlet at the skid end. End connection of the drain line shall be flanged type and one companion flange shall be provided by skid vendor for the same.

Companion flange with gasket, nut and bolts for the skid inlet shall be in the scope of vendor complying with tender specifications. All flange joints bolts & nuts shall be SS-304.

Vendor shall installed spool pieces in the bypass stream of meter between the two blind valves for the maintenance purpose as shown in P&ID. In the bypass line spectacle blind shall be provided.

DRS skid shall be in full compliance with the PNGRB requirements. If the requirements of PNGRB missing in the tender, it is vendors responsibility to fulfill the requirements without any cost implication.

Contractor / Vendor shall keep all necessary items in their inventory for any kind of replacement up to Defect Liability Period.

Vendor shall keep ready all commissioning spares during commissioning period, if required. Any consumable spares during commissioning such as filter, gasket etc. are in scope of vendors.

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Filtration System

The supply shall include all the required material, instruments along with valves impulse pipes, tubes etc. inside the battery limits of the skid, as shown in the P&ID and tender specification. Filtration shall be 'In to Out' type. The design of the filter shall be in such a way that there shall be provision to remove the dust from the filters by using the filter whenever required. There shall be no possibility for the accumulation of dust.

Design and construction of filter shall meet the requirements as per ASME Boiler & Pressure Vessel (BPV) Code, Section VIII: 2007. The flow of gas shall be of out-to-in type, i.e., the design of the filters shall be such that the (unfiltered) gas from the inlet piping shall enter in the annular space (i.e., the space between the filtering element(s) and the wall of the filter) and then the filtered gas should flow in the skid.

Differential pressure indicator (clogging indicator) shall be provided across the filter. All the filters shall have drain connections with valve (with positive blind arrangement) and shall be suitably located and sized to ensure a reasonably short blow down time. All welded joints shall be radiographically examined and acceptance criteria shall comply with ASME BPV Codes.

A dust concentration of 0 – 0.1 mg/scm shall be considered for designing the filter. The details of calculations that have been considered for designing the filter along with all the drawings (of filter, cartridge, etc.) relevant to the same shall be provided along with the technical bid. The filter element has to be a single cartridge type only.

Regulator System

Pressure regulators shall be provided in DRS skid for regulating pressure in gas service lines supplying to industrial, commercial & domestic customers from steel pipeline distribution systems. In addition, slam shut valves shall be provided as safety devices to protect against excess and lack of downstream pressure.

Each stream shall contain two regulators, so impulse that if any one fails, then the other one will maintain in safe conditions. Under normal conditions, the downstream regulator is considered as the active regulator and upstream regulator performs the monitoring function. The installation of monitoring regulator shall be such that it is the first acting device in the pressure safety system.

Regulator shall be integral strength regulator as per EN 334: 2005+A1:2009 and proved as satisfactory pressure vessels by hydrostatic and pneumatic tests.

Monitor regulator shall be FC type and active regulator shall be FO type.

Pressure shut-off device shall be provided to protect against excess and lack of downstream pressure. Accuracy of slam shut operation should be as per the requirements of BS EN 14382: 2005+A1:2009 or better.

The burst pressure of a diaphragm should be at least three times the maximum working differential pressure.

The material of construction shall be as specified in related technical specification. All the internals / wetted parts shall be SS316. All tubing & tube fittings within the skid shall be SS316. Vendor to ensure that all tube fittings used in the skid shall be procured from single vendor.

Regulators design shall be such that the set point can be varied by the automatic set-point adjustment system as shown in the P&ID.

Vendor to carry out detail engineering and shall submit the operational philosophy and details of the automatic set-point adjustment system in the bid offer.

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It is vendor's responsibility to design the system full proof and if any problem arises in operation of the system, vendor shall resolve it without any cost implication.

Instrumentation Components

5.1.1 Temperature and Pressure Gauges

Temperature gauges shall be used for local indication. These local temperature indicators shall in general be heavy duty, weatherproof, dial type bi-metal thermometers with 150 mm dial size, external zero adjustment, every angle rotatable and rigid stems.

The bi-metal gauges shall be adjustable union stem type with SS 316 material for the stem. The Union size shall be ½" NPT and the diameter shall suit the well diameters. However, Vendor shall verify the compatibility of the material of construction with the site/process requirements and suggest suitable material. Case material for all temperature gauges shall be SS316. Capillary and armor shall be of stainless steel.

Thermowell material in general shall be of AISI 316 SS. temperature gauges shall be installed in a suitable thermowell. Thermowells shall be SS316 as a minimum and shall confirm to the process service and piping class requirements.

Thermowell shall be flanged machined from solid bar stock and with tapered end. Thermowell construction details and insertion length criteria shall be defined during detailed design.

Thermowell shall be designed to withstand vibration stresses caused by stream velocity. Wake frequency at maximum flow velocity shall be less than 80% of the natural frequency of the thermowell. The Contractor shall provide calculations to ASME performance Test Code 19.3, Part 3: Instruments and Apparatus for Temperature Measurement.

Pressure gauge dial shall be white, non-rusting plastic with black figures. The dial face shall be marked with pressure element material. Pointers shall have micrometer adjustment.

Pressure gauges shall be weatherproof with dial size of 150 mm and shall have features like screwed bezels, externally adjustable zero, over range protection and blowout discs. Pressure gauge sensing element shall be SS 316 and movement of SS 316, as a minimum. Connection shall normally be ½" NPTM bottom.

Pressure gauges shall have an accuracy of +/- 1% of FSD. Differential pressure gauges may have an accuracy of +/- 1% of FSD.

Differential pressure gauges shall generally be diaphragm type. Diaphragm seals type shall be used for slurries, viscous and corrosive fluids. All differential pressure gauges shall be installed so as to minimize the length of impulse lines. Necessary isolation valve / manifold shall be provided for all differential pressure gauges.

Over range protector and pulsation dampener, whenever used, shall be of SS 304, as a minimum. Pulsation dampener should be used for all pulsating services. It shall be floating pin type, externally mounted and externally adjustable.

Cases shall normally be cast aluminum alloy or black phenol and weatherproof to IP 65.

5.1.2 Pressure Safety Valves / Creep Relief Valve

Pressure safety valves (PSV) shall be direct acting, spring loaded; full nozzle / full lift, adjustable blow down high capacity type.

PSV shall have flanged end connections, enclosed spring, bolted bonnet, screwed cap, and full one-piece nozzle. Flanges shall be in accordance with ANSI ASME B16.5 requirements.

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Flanges shall be integral part of the body. Weld-on flanges shall not be allowed. Bodies and flanges shall be of the same material. Inlet flange shall be of sufficient rating to withstand the reaction force of the PSV.

PSV sizing shall be carried out based on API RP 520 Part 1. Orifice letter designation shall be in accordance with API Std 526. For blocked discharge case, overpressure shall be 10% above the set pressure. For fire relieving case overpressure shall be 21% above the set pressure.

All wetted parts of PSV shall be SS316. Safety valves shall be provided with test gags and manual test lever. Springs of safety valves shall be selected as per process conditions.

This specification with the attached datasheet covers the minimum of requirement design, material, testing, and marking etc. for the Pressure Safety Valves. It is Bidder's responsibility to select suitable safety valve required.

Creep Relief Valves (CRV) shall be provided in each of the stream as indicated in respective P&ID in order to protect against downstream over pressure at low flows or in the event of seat malfunction and shall be designed and installed as per PNGRB guidelines have capacity of 1% of stream capacity.

A Vent shall be provided to discharge gas from relief valve to safe place at least 3 meters above the ground level and it should be terminated with suitable flame arrestors. Open end of vent pipe shall be provided with weather hood

5.1.3 SSV and Pressure Regulators

Set point of the Gas pressure regulators (PCV's) and Slam shut down valves (SDV's) shall be adjustable. Bidder shall furnish the adjustable range of the PCV's & SDV's.

Valve action on control signal or air failure shall be as indicated in P&ID.

Following are some general points shall be followed by the vendor: -

Valves shall have flanged end connections. The flange rating and facing shall be in accordance with piping class.

Connections for on-off valves shall be in accordance with piping class.

Pressure regulators shall be of flanged type.

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

It is intended to provide slam shut valves on upstream of the self-actuated pressure control valves at gas receiving points for tight shut off at increasing pressure beyond a preset limit to take care of self-actuated pressure control valves failure.

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

The materials selected for the regulators and SSV components shall be conform to the process requirements (minimum SS 316) and shall be specified in the data sheets. Vendor shall seek the approval from owner for the MOC of the parts of the valves prior to start the manufacturing.

Pressure regulators shall be of self-actuating pressure reduction with regulation accuracy of better than +/- 2.5% of set point.

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

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

Slam shut valves shall be provided with limit switches for transmitting position status in FC. All field binary logic instrument switches should be of dual type for redundancy in case of failure of the limit switches.

Resetting of slam shut valves shall be only manual.

Slam shut valves shall be provided with a mechanical indicator to indicate valve open or close position.

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

SSV shall have facility of over and under pressure shut off. Vendor shall mention the over pressure and under pressure set range for the SSV in the datasheet.

The Complete station shall be designed in such a way that the mean gas velocity remains within 20 m/s. Velocity in the piping upstream/downstream of filtration shall be within 18 m/s and 30 m/s respectively. Maximum seat velocity of external SSV shall limited to 40 m/s.

Vendor shall install the pressure regulators & its sensing lines and SSVs with suitable upstream and downstream lengths required for safe and proper operation of the regulators.

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

Vendor shall submit the detailed sizing calculations of the regulators and SSV of all the streams in detail for review and approval during detail engineering, (Vendor to consider all the combinations such as Minimum Pressure and Maximum flow rate, maximum pressure and Minimum flow rate etc for all the streams. The velocity, noise level shall comply in all combinations as specified in the tender document).

Provide ball valve in each of the sensing line for each of the active & monitor regulators and SSVs. Size of the valve shall be minimum 1/2". These ball valves shall have lock open facility.

For all Lock open type valves, Vendor shall provide the locks.

In case, if the size of the regulator and SSV is less than the size of the pipe, vendor shall use the reducer and expander at the inlet and outlet of each regulator and SSV. In no case the velocity in the pipe immediately after the regulator shall not be more than the velocity specified in the tender specification (20 m/s).

The self-actuating Pressure regulating valve shall be designed as per EN334 or Pressure Equipment Directive PED 2014/EU/68 covering the production quality assurance.

The Slam shut valve shall be designed as per EN 14382 or Pressure Equipment Directive PED 2014/EU/68 covering the production quality assurance.

Leakage class for pressure control valve & slam-shut valve shall be class-VI as per ANSI B16.4.

5.1.4 Temperature Instruments

The temperature element shall be RTD PT-100, 2-wire system. Elements shall be spring loaded, mineral insulated and shall have SS316 sheath as minimum. The element head shall be screwed-in type and weatherproof to IP-65 as a minimum.

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Sensor elements of temperature transmitters shall be installed in a suitable thermo well. Thermo wells shall be SS316 as a minimum and shall conform to the process service and piping class requirements.

Thermowell shall be flanged machined from drilled bar stock and with tapered end. Thermowell construction details and insertion length criteria shall be defined Vendor.

Thermowell shall be designed to withstand vibration stresses caused by stream velocity. Wake frequency at maximum flow velocity shall be less than 80% of the natural frequency of the thermowell. The Contractor shall provide calculations to ASME performance Test Code 19.3, Part 3: Instruments and Apparatus for Temperature Measurement.

Temperature transmitters shall not be part of the sensing element assembly. The sensing element shall be RTD 3/4 wire type. The temperature element length shall be selected to suit the thermowell insertion length.

The transmitter shall be head mounted "SMART" type, two wire loop powered at 24V DC with 4-20 mA output with integral digital output meter. Transmitters shall have HART protocol for digital communication.

The range shall be selected so that the normal operating temperature shall fall in the middle third of the span.

Temperature transmitters shall have a built-in linearization function to produce an output linear to temperature range.

Skin type temperature sensors shall be provided where pipe temperature is required to be measured. Skin RTD shall be PT-100, 2 wire system, 4-20mA + HART. A weld pad shall be provided on the pipe with 1/2" NPT entry for RTD sensor. Sensor length shall be decided during detailed engineering stage.

5.1.5 Flow Computer

Single flow computer shall be used for Single stream flow meters.

Flow computer shall be suitable for Field Mounting in safe area location. Power supply to the Flow shall be either 24VDC or 230 VAC +/- 10% UPS for electronics and 230 V AC +/- 10% Non-UPS supply for panel lighting and fans.

Flow computer shall meet the minimum requirements of API MPMS, Chapter 21.2, where applicable. Flow computer shall be capable of operating in a redundant, primary / secondary configuration. Secondary flow computer shall be a hot standby to the primary flow computer.

5.1.6 Cables

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

All armoured multi pair/core cables armour to be earthed at field Junction Box (JB) and solar panel. Spare cores/pairs of the field cables shall be neatly terminated at Field JB end with distinct marking with ferrules and shall be reflected in the JB wiring documentation/diagram prepared by vendor.

Junction Boxes

The material of construction of JB's shall be Corrosion resistant, Cast Aluminum LM6 /25 or FRP. All JB's shall be weatherproof to IP-65 minimum in accordance with IEC 60529.

JB's shall be certified increased safety EEx'd' Explosion proof located in a hazardous area.

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Cable entries shall be generally in the bottom for multi-core cables and in the side for single pair or single triad cables. Top entry into JB's is not permitted. All unused entry holes shall be sealed with the certified blanking plugs. Cable entries shall be ISO metric threads M20 X 1.5 mm minimum.

The cables entering the junction box from the side shall form a drip loop below the junction box before entering the junction box, to avoid water / moisture seeping into the junction box.

Sufficient terminals shall be installed inside the junction boxes to terminate all cable pairs/cores including spares.

All armoured multi pair/core cables armour to be earthed at field Junction Box (JB) and solar panel. Spare cores/pairs of the field cables shall be neatly terminated at Field JB end with distinct marking with ferrules and shall be reflected in the JB wiring documentation/diagram prepared by vendor.

The JB's shall be provided with metallic gland plate inserts to provide earth continuity. Also breather shall be provided for the junction boxes.

Pipe Work & Fittings

DRS skid construction / fabrication, reinforcement pads, etc. shall meet the requirements of codes ASME B31.8: 2010 and or ASME BPV Code, Section VIII: 2010. The design and assembly of all the equipment's shall be such that there is no difficulty in the operation and maintenance of the same.

Pipe work and fittings shall be of seamless type and as per ASTM A106 Gr. B: 2010 / API 5L Gr. B: 2007 and ASTM A 234 Gr. WPB: 2011 & ASTM A105: 2010. All branch connections shall be of weld let type up to d/D ratio less than 0.3 and sweep let type up to d/D ratio less than 0.6. All valves for pressure / vent, pressure gauge and bleed should have positive blind arrangement.

Welders and welding procedures have to be qualified in accordance with ASME BPV Code Section IX: 2010 / API 1104: 2005. All the welded joints shall be radio graphically examined and acceptance criteria shall comply with ASME BPV Code, Section VIII: 2010 / API 1104: 2005.

SCOPE FOR SUPPLY OF CABINET/CANOPY

This specification covers the basic requirements for the design, selection and the installation of canopy to cover entire mechanical, instrumentation and control systems associated with equipment and to be termed as "CABINET"

- These cabinet doors will be lockable from outside.
- Cabinet shall be weatherproof. The thickness shall be minimum 16 SWG (1.6mm) SS304/M.S.
- For all doors, side lowered sheets and roof sheet proper bracing's to be provided.
- Wherever S.S nuts, Bolts are provided, shall be properly sealed to avoid entering of rain water etc. inside canopy.
- All outer locks, handles to be provided at Man Working Height.
- Cupboard Lock shall be used.
- Adequate Stiffener will be provided to avoid vibration.
- A Cabinet should be provided to cover the DRS and to avert the ingress of water. It should be constructed with durable, corrosion resistant and non-inflammable materials and should have adequate strength so that it should not get damaged during handling, transportation and installation.

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- The cabinet should have free ventilation of at least 5% of the surface area. It should have front doors that open fully on either side and also lockable from outside. The rear doors are lockable from inside.
- Regulator vents should protrude through the cabinet wall and terminate with flame arrestors with minimum 03 meters height.
- Sufficient and adequate lighting arrangement shall be provided from operation and maintenance point of view.

6 QUALITY ASSURANCE, INSPECTION AND TESTING

Quality Assurance

The Bidder shall have in effect at all times, a QA / QC program that clearly establishes the authority and responsibility of those responsible for the quality system. Persons performing quality functions shall have sufficient and well-defined authority to enforce quality requirements, initiate, identify, recommend and provide solutions to quality problems and verify the effectiveness of the corrective action.

Quality Control

The Bidder shall submit certified reports of production tests as soon as the tests are completed satisfactorily.

The Company / PMC reserves the right to inspect materials and workmanship at all stages of manufacture and to witness any or all tests. The Bidder, after award but prior to the pre-inspection meeting, shall provide the Company / PMC with a signed and stamped copy of QAP included in this tender as compliance.

Inspection and Testing

Inspection and testing shall be performed in accordance with written procedures prepared by the Bidder and approved by the Company / PMC. Test procedures shall include a schematic of testing arrangement with details of instrumentation used during test.

Visual inspection shall be carried out by Bidder for all package Instrumentation, confirming that the package supplied meets the relevant specifications, design codes and data sheets.

Inspection will be required on all aspects of the Bidder's documentation, including applicable certification and test / material certificates.

Calibration equipment (of an order of magnitude greater than the device being tested) shall be traceable to National Standards and shall have been calibrated within 6 months prior to tests.

The Bidder shall be responsible for the provision of all test and calibration equipment, utilities (e.g. power / air / water) supplies as applicable and the recording of all test results on approved test record sheets.

Inspection and witnessed tests by the Company / PMC and third parties shall not relieve the Bidder of any guarantees, responsibilities or obligations to provide satisfactory equipment.

The Bidder shall provide quality records appropriate to all inspection and test activities. The records shall be referenced against appropriate activities within the inspection and test plan.

Bidder shall collate all such quality records and certification for submission to the Company / PMC as a certification dossier. Note that, where necessary, certificates shall be stamped as approved by the third party inspector.

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Adequate data on capacity, range ability, lock-up, minimum and maximum operating pressure differentials, dynamic performance characteristics and predicted noise level emissions, set points of slam-shut valve, relief valve, etc., shall be given by the manufacturer in order to determine the performance of the regulators under various operating conditions. Results of such tests carried out by the manufacturer to determine operational performance and thereby confirm these design data and Manufacturing Test Certificates (MTC) for all components / parts, NDT results, Welding Procedure Specification (WPS), Welder's Performance Qualification Record (WPQR), Welding Procedure Qualification Record (PQR), etc., shall be made available prior to offering the complete skid for witnessing the performance testing by HOGPL / Third Party Inspection agency appointed by HOGPL.

The final performance test of complete skid shall be carried out in presence of Third Party Inspecting agency / HOGPL representative before accepting the skid and giving clearance for dispatch. Inspection shall be carried out by HOGPL appointed TPI & charges will be borne by HOGPL. Inspection is to be carried out as per the inspection plan stated below.

Inspection and Test Plan

Inspection of the skid shall be carried out as per EN 10204, type 3.2:

- Review / checking of all test certificates;
- Visual inspection of skid assembly;
- Following tests shall be Witnessed:
 - a. Hydrostatic & pneumatic testing of the assembly, as per the parameters given in 'Specific requirements'.
 - b. Performance testing of regulator: Outlet pressure v/s flow (for various inlet pressures), inlet pressure v/s flow (for various outlet pressures), checking of lock up pressure to be within limits, slam shut operation & its setting, regulator and relief valve operation & its setting.
 - c. Stage-wise inspection to be carried out for inspection of workmanship quality and for inspection of surface preparation and primer coat / intermediate coats to ensure proper adhesion / paint quality.

Factory Acceptance Test (FAT)

Factory Acceptance Test (FAT) is an inspection procedure for verification which ensures the functionality of all equipment as per design intend and integrity of the skid. FAT shall be conducted according to the approved FAT procedure.

Prior to notification of FAT to Company / PMC, all the involved contractual documentation shall be approved by Company / PMC and internal testing reports shall be submitted for Company / PMC review. During FAT, all the equipment and components shall be assembled and installed. The system shall be ready in respect.

Bidder shall demonstrate all the functions of the system working properly during the FAT.

Each test shall be carried out on the procedure reviewed and accepted by Company / PMC after submitting Manufacturing Internal Test Certificate.

FAT certificate shall be issued by the bidder at the successful end of the test activities.

All the hardware and software failures and problems shall be documented. All the failures and problems shall be resolved before shipment to site; all series of actions shall be taken in accordance with the FAT procedure.

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Range, calibration span, set points, reports etc. shall be modified as per Company / PMC requirement by the bidder during the FAT.

FAT shall include the following activities as minimum:

- Quantity of all the equipment and components;
- Installation of all the cabinets, equipment and components;
- Tagging of all the cabinets, equipment and components;
- Wiring of all the cabinets, equipment and components;
- Hardware Testing shall include the following activities as minimum;
- Redundancy of Power Supply on failure;
- Diagnostics of the main equipment;
- Redundancy of the main equipment on failure if any;
- Modem communication to data host check.

Hydrostatic Test

Hydrostatic test shall be carried out up to the test pressure as detailed in the specific requirements. Wherever necessary, regulators, relief valves and similar components that have been tested independently shall be removed from the line.

Blind flanges or double flange pipes shall be installed temporarily in their place. All small bore connections and impulse lines shall be disconnected and suitable plugs or blank flanges shall be installed.

Leakage Testing

Pneumatic testing using air or an inert gas shall be undertaken on all installations and shall include all equipment and associated small bore pipe work.

Care must be taken to disconnect equipment, which might get damaged at the testing pressure. All joints, flanges and glands on valves and fittings shall be tested for leakage with a suitable foaming fluid.

Package Test Panels

All testing shall be carried out at the Bidder's test facility. Test equipment shall be supplied by the Bidder and shall be calibrated within six months of the test date. The minimum scope of testing is summarized below. The Bidder shall supply an Inspection & Test Plan (ITP) with the Tender.

The Vendor shall provide the Company with at least 14 calendar days advance notice to witness tests performed in either the Vendor's shop or his sub-Vendor's shops.

Control Panel

Control Panels (as applicable) and associated equipment shall as a minimum be tested and checked upon completion as follows:

- The panel and its contents shall be inspected to ensure that it has been constructed to the specification and latest approved drawings.
- All labels, tags plates and ferrules shall be checked to verify correct text, location and secure attachment.
- All fuse ratings shall be checked and fuse holders shall be marked with rating and service as detailed in the latest drawings. The fuses and isolating switches shall be checked to ensure they are connected to the correct circuits.

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- The circuits shall be checked for correct polarity.
- The total electrical load and power factor shall be measured.
- Electromagnetic interference shall be checked to ensure compliance with the relevant Standards.
- Earthing shall be checked so as to be in accordance with the Bidder's requirements and such additional requirements as may be specified by the Company.

Cables and Wiring

All cables / wiring shall be tested for continuity and inspected to verify installation is in accordance with the drawings. All cables shall be tested for insulation resistance. The test voltage shall be compatible with the cabling being tested. Equipment or devices shall not be connected during testing.

7 TEST CERTIFICATES

A record of all hydrostatic testing and pneumatic testing carried out shall be prepared for every installation. A material test certificate for all components of skid shall be furnished at the time of inspection by third party / HOGPL representative. HOGPL reserves the right to witness all the tests.

Records of all calibrations, tests and conformity checks shall be provided by the Bidder using the Company's acceptance certificates. The acceptance certificates shall be completed by the Vendor and attested by the Company's site engineer prior to commissioning. The procedure for site testing and witnessing shall be agreed in writing by the Company prior to commencement of work.

Instrumentation Test

Skid-mounted instrumentation shall be tested as follows:

Bench calibration of instruments shall be carried out prior to installation, where applicable.

All skid wiring shall be tested for continuity and insulation; the test voltage shall be compatible with the wiring being tested. Equipment or devices shall be disconnected before wiring is tested.

Instrument air systems shall be tested for leakage using dry air at a pressure 110% of maximum working pressure.

Process impulse lines shall be disconnected from the process line and the instrument, and shall be hydraulically tested to 1.5 times line design pressure. All instrumentation equipment and piping shall be thoroughly flushed and dried out on completion of test. Instrument impulse lines on lube oil service shall be pneumatically tested, using air or nitrogen.

All test equipment shall be certified by a recognized calibration authority and be provided by the Vendor. Test equipment shall have an accuracy of 10 times better than that of the equipment to be tested.

Skid mounted instrumentation simulated tests shall be performed with the remote or local panel connected to field instruments.

All alarm, shutdown and control systems shall be tested under simulated operating conditions prior to machine test, after it has been demonstrated that the equipment has been fully installed, properly connected, pressure tested and is fully operable, as proved by support documentation.

All skid mounted instruments including alarms, shutdowns and control systems shall be tested under simulated operating conditions for both remote and local and all test reports with master calibrators traceability to NABL certificates and periodicity validity to be provided along with documents.

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All safety automated operations, shutdown logics and alarming/ tripping mechanism of the DRS should be thoroughly tested, certified as per operating conditions.

Test procedures shall be submitted to the Company / PMC for approval, prior to test.

The test shall simulate, as near as possible, actual working conditions. The Bidder shall provide means whereby any process variable may be measured and adjusted to demonstrate correct functioning of the associated control system.

The Bidder shall provide any temporary cabling necessary for string testing, (i.e. temporary cabling between skid and off skid panel provided by the Bidder).

Acceptable evidence of the satisfactory condition of the test equipment, (e.g. current test certificates) shall be supplied by the Bidder.

7.1.1 Functional Tests

Each pneumatic instrument shall be tested by connecting an input signal of the correct range while monitoring the instrument output. The input signal shall be varied over the full range and each device checked for proper operation.

Temperature instrument input signals shall be simulated over the full range and each temperature instrument checked for proper operation.

7.1.2 Electronic Instrument and Instrument Loop Test

Electronic instruments and loops shall be tested from the junction box to the instrument concerned as all electronic instruments terminate at local skid junction boxes (cable installation from local skid junction boxes to the equipment room is by others).

7.1.3 Relief Valve Test Certificates

The Vendor shall issue a test certificate covering each valve fully compatible with the requirements of API RP 520.

8 INSTALLATION / ERECTION, COMMISSIONING AND STARTUP

Package instrumentation shall be installed mostly in the erection phase and shall be tested for any further defects or leakages during the pre-commissioning phase of the instruments and equipment. Sufficient spares shall be maintained at site during commissioning and start-up phases to facilitate ready availability for replacement in case of failure.

9 PERFORMANCE GUARANTEE

Bidder shall provide performance guarantee for 18 months from the date of delivery of skid.

10 PACKAGING, PRESERVATION / STORAGE AND PREPARATION FOR SHIPMENT

Packing

Preparation for shipment shall be in accordance with the Bidder's standards and as noted herein. Bidder 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 / PMC. All costs occasioned by such rejection shall be to the account of the Vendor. After inspection and test, equipment shall be completely free of water and dry before start of preparation for shipment.

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Instruments or parts, which can be damaged during shipment, shall be packed separately. Each package shall be identified with purchase order number and content list in a weatherproof envelope. All openings shall be sealed. Threaded connections shall be protected with forged steel or molded plastic screwed plugs.

Preservation / Storage

The Bidder shall be solely responsible for the adequacy of the preparation for shipment and shall also state in their offer his recommendations for long term storage (up to 12 months) for both indoors and open air storage.

Instruments and their parts have to be stored in dust-free area at controlled temperature environment. Sensitive parts such as PCBs and chips are to be covered in anti-static sheets.

Marking

The Bidder shall attach a packing list along with all requisition details, in a waterproof enclosure, to the outside of the package.

11 DOCUMENTATION

Vendor shall furnish the complete set of documents in hard copy in English only. The minimum documents submitted by the bidder shall be as follows. Refer Purchase Requisition for detail documentation requirement.

12 SPARES

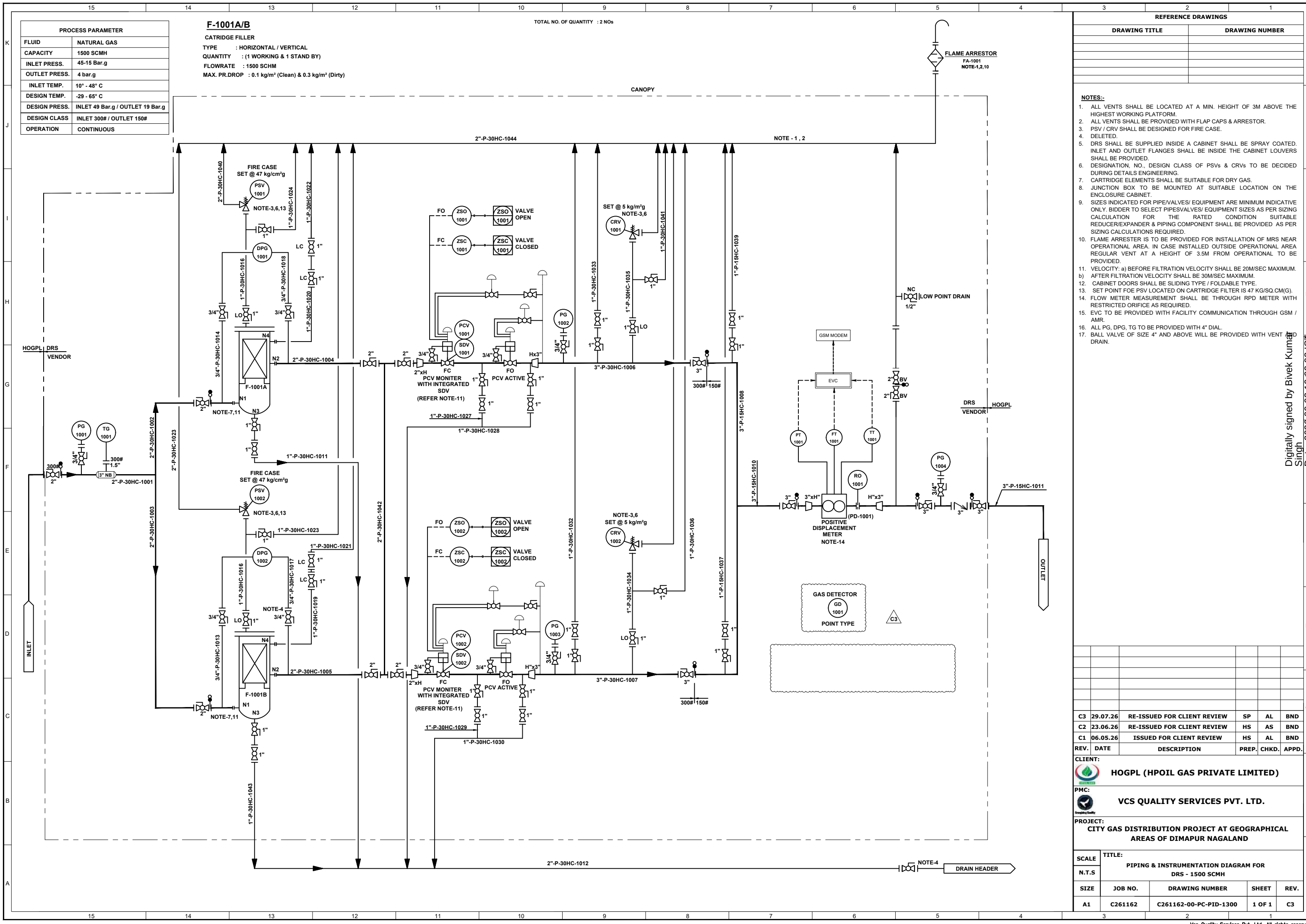
Bidder shall provide the following spare list for all items of skid:

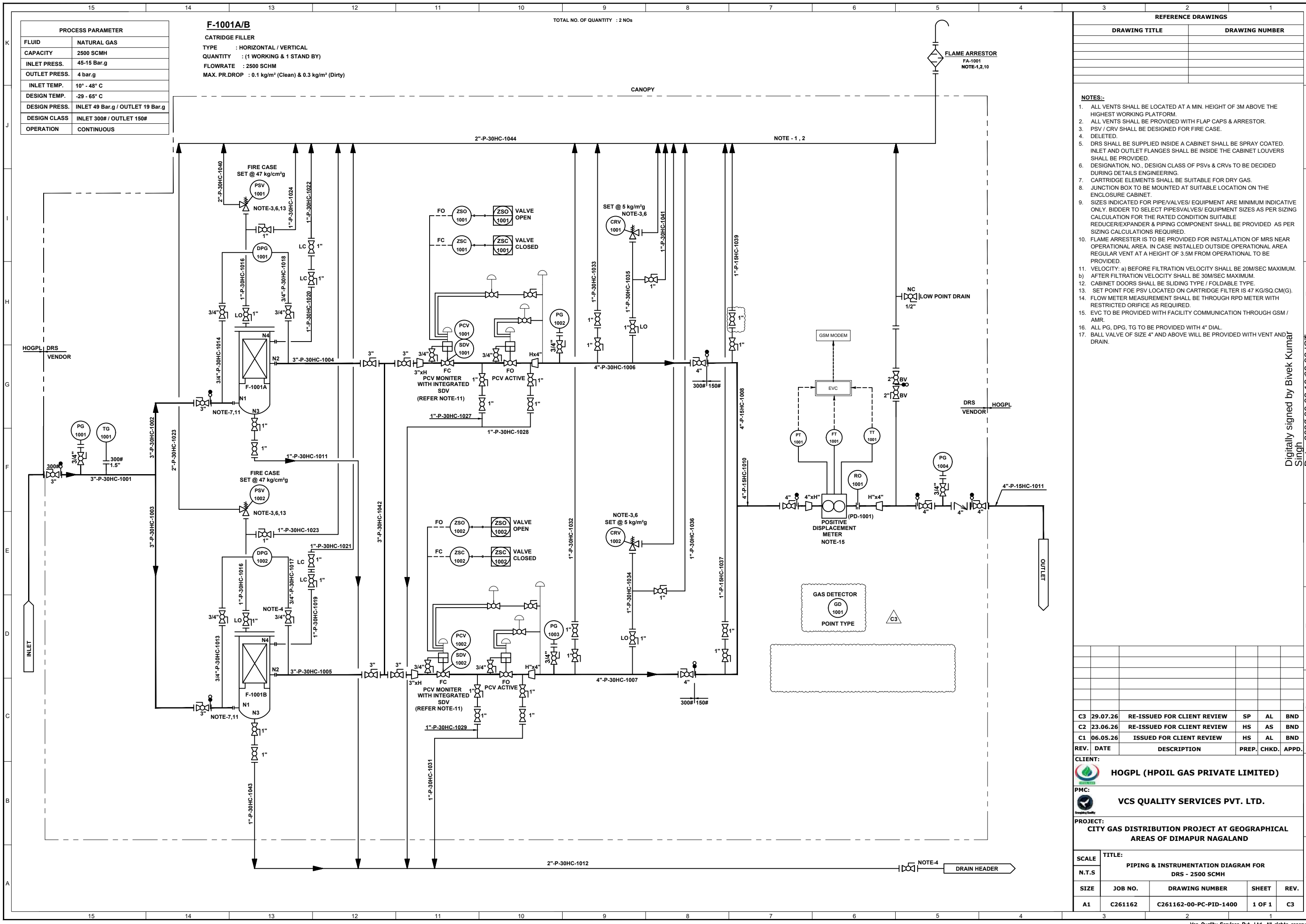
- Mandatory and commissioning spares need to be considered as per mandatory spares list provided in tender document;
- Spares and accessories to be quoted for a period of 5 years for operation and maintenance beyond warranty period.

Following Installed spare criteria shall be considered as a minimum in instrumentation and control system design:

- All pairs of multi-pair cables shall be terminated in the junction boxes as well as at panel side (including the unused spare pairs);
- Field junction boxes shall have 20% spare terminals and 20% cable entries for connecting future instrument cables;
- All multi-pair/multi-core instrument cables shall have 20% spare pairs;
- All Instrument cable trays and trenches shall have at least 20% spare capacity for future cables;
- Instrument cabinets shall have 20% spare space for I/O cards, marshaling terminals, cable entries etc. for future additions;
- I/O cards shall have 20% spares for future use (separate for each I/O card type i.e. AI/AO/DI/DO etc.).

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REFERENCE DRAWINGS						
DRAWING TITLE			DRAWING NUMBER			
NOTES:-						
1. ALL VENTS SHALL BE LOCATED AT A MIN. HEIGHT OF 3M ABOVE THE HIGHEST WORKING PLATFORM.						
2. ALL VENTS SHALL BE PROVIDED WITH FLAP CAPS & ARRESTOR.						
3. PSV / CRV SHALL BE DESIGNED FOR FIRE CASE.						
4. DELETED.						
5. DRS SHALL BE SUPPLIED INSIDE A CABINET SHALL BE SPRAY COATED. INLET AND OUTLET FLANGES SHALL BE INSIDE THE CABINET LOUVERS SHALL BE PROVIDED.						
6. DESIGNATION, NO., DESIGN CLASS OF PSVs & CRVs TO BE DECIDED DURING DETAILS ENGINEERING.						
7. CARTRIDGE ELEMENTS SHALL BE SUITABLE FOR DRY GAS.						
8. JUNCTION BOX TO BE MOUNTED AT SUITABLE LOCATION ON THE ENCLOSURE CABINET.						
9. SIZES INDICATED FOR PIPE/VALVES/ EQUIPMENT ARE MINIMUM INDICATIVE ONLY. BIDDER TO SELECT PIPES/VALVES/ EQUIPMENT SIZES AS PER SIZING CALCULATION FOR THE RATED CONDITION SUITABLE REDUCER/EXPANDER & PIPING COMPONENT SHALL BE PROVIDED AS PER SIZING CALCULATIONS REQUIRED.						
10. FLAME ARRESTER IS TO BE PROVIDED FOR INSTALLATION OF MRS NEAR OPERATIONAL AREA. IN CASE INSTALLED OUTSIDE OPERATIONAL AREA REGULAR VENT AT A HEIGHT OF 3.5M FROM OPERATIONAL TO BE PROVIDED.						
11. VELOCITY: a) BEFORE FILTRATION VELOCITY SHALL BE 20M/SEC MAXIMUM. b) AFTER FILTRATION VELOCITY SHALL BE 30M/SEC MAXIMUM.						
12. CABINET DOORS SHALL BE SLIDING TYPE / FOLDABLE TYPE.						
13. SET POINT FOE PSV LOCATED ON CARTRIDGE FILTER IS 47 KG/SQ.CM(G).						
14. FLOW METER MEASUREMENT SHALL BE THROUGH RPD METER WITH RESTRICTED ORIFICE AS REQUIRED.						
15. EVC TO BE PROVIDED WITH FACILITY COMMUNICATION THROUGH GSM / AMR.						
16. ALL PG, DPG, TG TO BE PROVIDED WITH 4" DIAL.						
17. BALL VALVE OF SIZE 4" AND ABOVE WILL BE PROVIDED WITH VENT AND DRAIN.						
C3	29.07.26	RE-ISSUED FOR CLIENT REVIEW	SP	AL	BND	
C2	23.06.26	RE-ISSUED FOR CLIENT REVIEW	HS	AS	BND	
C1	06.05.26	ISSUED FOR CLIENT REVIEW	HS	AL	BND	
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.	
CLIENT:						
HOGPL (HOIL GAS PRIVATE LIMITED)						
PMC:						
VCS QUALITY SERVICES PVT. LTD.						
PROJECT:						
CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF DIMAPUR NAGALAND						
SCALE	TITLE:					
N.T.S	PIPING & INSTRUMENTATION DIAGRAM FOR DRS - 2500 SCM/H					
SIZE	JOB NO.	DRAWING NUMBER	SHEET	REV.		
A1	C261162	C261162-00-PC-PID-1400	1 OF 1	C3		

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 ENERGISING QUALITY		DISTRICT REGULATING SKIDS (DRS)				 HPOIL GAS	
INSTRUMENT DATASHEETS					TOTAL SHEETS		14
DOCUMENT No.		C261162	00	IN	DS	3008	
HPOIL GAS PRIVATE LIMITED (HOGPL) CITY GAS DISTRIBUTION PROJECT OF DIMAPUR,NAGALAND GA INSTRUMENT DATASHEETS (DRS)							
C1	06.05.2026	ISSUED FOR INTERNAL REVIEW			AB	SA	AB
REV	DATE	DESCRIPTION			PREP	CHK	APPR

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1	Pressure Gauge	Sheet 3 of 14		
2	Diff. Pressure Gauge	Sheet 4 of 14		
3	Temperature Gauge	Sheet 5 of 14		
4	Slam Shut Valve	Sheet 6 of 14		
5	Self actuated Pressure Control Valve	Sheet 7 of 14		
6	Pressure Safety Valve	Sheet 8 of 14		
7	Junction Box	Sheet 9 of 14		
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9	Creep Relief Valve	Sheet 11 of 14		
9	EVC with data logger	Sheet 12 of 14		
10	Restriction orifice	Sheet 13 of 14		
11	Point Gas Detector	Sheet 14 of 14		
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PRESSURE GAUGE						Rev.
GENERAL	1	Tag Number	Quantity	Refer P&ID	Refer MR and P&ID	
	2	Line No	Equipment No.	Refer P&ID	N/A	
	3	P&ID Number	Vendor	Refer P&ID	*	
	4	Manufacturer	Model No.	*	*	
	5	Design Pressure	Design Temperature	49 Kg/cm2g	-29 to 65 degree C	
	6	Service		Natural Gas		
	7	Flow (Min/Max)		Refer P&ID		
GAUGE	8	Type		Bourdon		
	9	Case	Type	Direct		
	10		Material	SS 316		
	11		Mounting	Local		
	12		Bezel	Bayonet		
	13		Glass Type	Shatter Proof Glass (3 mm)		
	14		Blowout Device	Required		
	15	Gasket Material	*			
	16	Dial Size	Dial Color	150 mm	White with Black Marking	
	17	Enclosure Class		IP - 65		
	18	Range		*		
	19					
ELEMENT	21	Type	Accuracy	C-type Bourdon*	±1% FSD	
	22	Element Material	Socket Material	SS316	SS316	
	23	Movement Material		SS316		
	24	Conn. Size/Type	Connection Location	1/2" NPTM	Bottom	
	25	Zero Adjustment		Micropointer		
	26	Blow Out Protection	Over-Rng Protection	Required	Required, 130% of Full Scale	
	27					
	28					
SEAL	29	Type	Model No.	N/A		
	30	Wetted Parts Mat'l	Seal Material			
	31	Housing Lower Mat'l	Housing Upper Mat'l			
	32	Conn. Size/Type	Connection Rating			
	33	Seal Flush Conn.	O-Ring Material			
	34	Seal Fill Fluid				
	35	Design Pressure				
	36					
MISC.	38	Snubber Type	Model No.	*	*	
	39	Siphon Type	Model No.	*	*	
	40	Pulsation Dampner	Model No.	*	*	
	41	Manifold	Model No.	2 valve 3-way Manifold	*	
	42					
Notes:						
1	* By Vendor					
2	Calibration, material and certificates shall be provided by the Vendor.					
3	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).					
4	Pressure gauge shall be selected in such a manner that normal operating pressure is approximately in the middle third of full scale (30% - 70% of range).					
5	Pressure gauge shall be fitted with blow-out protection at back and shall have a over-range protection of 130% of max. reading.					
		CLIENT: HPOIL GAS PRIVATE LIMITED (HOGPL)				
		PROJECT: CITY GAS DISTRIBUTION PROJECT FOR DIMAPUR, NAGALAND GA	C1	20.04.2026	AB	SA
			REV.	DATE	PRPD	CHKD
					APPD	

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SLAM SHUT OFF VALVE										Rev.
GENERAL	1	Tag Numbers			Refer P&ID					
	2	Quantity			Refer MR and P&ID					
	3	Service			Down stream pressure protection					
	4	Governing standard			BS EN 14382:2005+A1:2009					
	5	Inlet Line No.			Refer P&ID					
	6	Outlet Line No.			Refer P&ID					
	7	Line Size & Schedule			Refer P&ID					
	8									
PROCESS DATA	9	Fluid	State		NG		Gas			
	10	Flow Gas	Min.	Nor.	Max.	Refer P&ID's				
	11	Inlet Pressure			Refer P&ID					
	12	Pressure Drop at Various Flow Rates			*					
	13	Shut Off Pressure			*					
	14	Temp.	Oper.		Max.		Refer P&ID			
	15	Oper S.G		Mol Wt.		*				
	16	Cp/Cv	Compress. Factor		*					
BODY	17	Type of Valve			Slam Shut					
	18	Body Size	Port Size		*					
	19	End Conn: Flgd. Size & Rating			Refer P&ID					
	20	Facing & Finish			Flanged & RF					
	21	Body Material			ASTM A 216 WCB or equivalent					
	22	Trim Material			SS 316					
	23	Other Wetted Parts			SS 316					
	24	Leakage Class			Class VI as per FCI 70.2					
	25	Closing Time			Less than 2 secs					
OPTIONS	26	Pilot Operated			Integral Pilot Required					
	27	Manual Reset			Required					
	28	Failure Position			Close					
	29	Limit Switch			2 Nos. (Open & Close)					
	30	Cable Entry			Required					
	31	Valve Position Indicator (Local)			Required					
	32	Radiography			Required					
	33	Charpy V-Notch			Required					
	34	Impulse Tubing/Fittings			Required					
	35	Pressure Indicator			*					
MISC.	36	Installation			Horizontal					
	37	Kg or Cg Min.	Kg or Cg Max.		*					
	38	Kg or Cg Selected			*					
	39	Predicted Sound Level (dBA)			less than 85 dBA					
	40	Inlet Velocity (meters/second)			As per PNGRB guidelines					
	41	Valve Setpoint	Adjustable Range		*					
	42	OPSO	UPSO		*					
	43	Model No.	Make		*					
	44				^					
45										
Notes:										
1	* By Bidder									
2	Calibration, material and certificates shall be provided by the Vendor.									
3	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire(1 mm).									
4	Vendor to provide over pressure shut off (OPSO) and under pressure shut off (UPSO) along with sizing calculations of slam shut off valve for review and approval.									
5	Vendor shall submit detailed GA drawing along with part names and MOC of the part along with MOC.									
6	Vendor shall submit detailed catalogue with model decodification with datasheet.									
 ENERGISING QUALITY	CLIENT:		HPOIL GAS PRIVATE LIMITED (HOGPL)							
	PROJECT:		CITY GAS DISTRIBUTION PROJECT FOR DIMAPUR,NAGALAND GA			C1	06.05.2026	AB	SA	AB
						REV.	DATE	PRPD	CHKD	APPD

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PRESSURE SAFETY VALVE										Rev.
GENERAL	1	Tag Number		Quantity		Refer P&ID		Refer MR and P&ID		
	2	P&ID Number				Refer P&ID				
	3	Line No/Equipment No.				Refer P&ID				
	4	Inlet Line Size/Sch		Outlet Line Size/Sch		Refer P&ID				
	5	Inlet Line Material		Outlet Line Material		*		*		
	6	Corrosion Allowance				As per PMS				
	7									
PROCESS DATA	8	Service				Natural Gas				
	9	State		Phase		Gas		Single		
	10	Corrosive		Erosive		N/A		N/A		
	11	Flow(min/max)	SCMH	Max. Oper Pressure	Kg/cm2g	Refer P&ID		*		
	12	Set Pressure	Kg/cm2g	%Allow Overpressure		22	Kg/cm2g	21%		
	13			Constant						
	14	Back Pressure (Kg/cm2g)		Variable		*				
	Total									
	16	Oper Temperature	DegC	Relief Temperature	DegC	10 to 48	*	DegC		
	17	SG @ Relief		Visc @ Relief		*		*		
	18	MW @ Relief		Density @ Relief		*		*		
	19	Sp HT Ratio (Cp/Cv)		Compressibility (Z)		*		*		
	20	Design Pressure	Kg/cm2g	Design Temperature	DegC	49	Kg/cm2g	-29 / 65	DegC	
	21	Latent Heat of Vap		Barometric Pressure		*		-		
22	Wetted Surface Area (m2)				N/A					
23										
DESIGN BASIS	24	Nozzle				Full Nozzle				
	25	Type				Conventional				
	26	Bonnet Type				Closed				
	27	Design Code				API 520 I/II, API 521, API 526 & API 527				
	28	Sizing Basis				Fire Case				
	29	Relieves To				Vent to Atmosphere				
	30	Calculated Area		Selected Area		*		*		
	31	Orifice Designation				*				
	32	Calculated Capacity				*				
	33									
CONNECTOR	34	Size				*		*		
	35	Type				RF*		RF*		
	36	Rating				*		*		
	37									
	38									
	39									
	40									
MATERIAL	41	Body		Bonnet		ASTM A216 GR. WCB		ASTM A216 GR. WCB		
	42	Nozzle (Seat)		Nozzle Ring		SS 316		*		
	43	Spring		Disc		SS 304		SS 316		
	44	Bellows		Guide		N/A		*		
	45	Main Valve Seat / Seal				*				
	46									
MISC.	47	Cap				Bolted				
	48	Lever		Lever Type		N/A		-		
	49	Test Gag		Range		Required		-		
	50	Rupture Disc		Tag No		N/A		-		
	51	Manufacturer		Model No.		*		*		
	52									
Notes:										
1	* By Vendor									
2	Calibration, material and certificates shall be provided by the Vendor.									
3	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).									
4	Relief Valve shall be sized as per API 520 & 526. Vendor to provide sizing calculations and select material as per detail engineering.									
5	Vendor shall submit detailed catalogue with model decodification sheet with datasheet.									
6	Vendor shall submit detailed GA drawing along with part names and MOC of the parts along with datasheets.									
		CLIENT:	HPOIL GAS PRIVATE LIMITED (HOGPL)							
		PROJECT:	CITY GAS DISTRIBUTION PROJECT FOR DIMAPUR,NAGALAND GA	C1	22.04.2026	AB	SA	AB		
				REV.	DATE	PRPD	CHKD	APPD		
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JUNCTION BOX						Rev.	
GENERAL	1	Tag Number	Quantity	*	*		
	2	Application		For Termination Instrument IS Cables			
	3	Suitable for		*			
	4	Area Classification		Zone-1, Gr. IIA / IIB, T3			
	5	Enclosure Rating		EEx'd' (Explosion Proof)			
	6	Ingress Protection		WP to IP-65 as per IEC-60529 / IS-2147			
	7	Material of Construction		Corrosion resistant , Cast Aluminum LM6 /25 or FRP			
	8	Overall Dimension		*			
	9	Cover		Bolted			
	10	Painting / Finish		Grey			
	11	Rating		Upto 500 VAC			
	12						
	13						
SINGLE CABLE	14	No. of Entry	Left Side	-			
	15		Right Side	-			
	16		Top Side	-			
	17		Bottom Side	*			
	18		Other	-			
	19	Cable Gland	Type	Ex'd', Double Compression Type,Brass with Zinc/ Nickel plated			
	20		Size	*			
	21		Qty	*			
	22	Plugs	Type	Ex'd', Brass with Zinc/ Nickel plated			
	23		Size	*			
	24		Qty	*			
	MULTI CABLE	25	No. of Entry	Left Side	-		
26		Right Side		-			
27		Top Side		-			
28		Bottom Side		*			
29		Other		-			
30		Cable Gland	Type	Ex'd', Double Compression Type,Brass with Zinc/ Nickel plated			
31			Size	*			
32			Qty	*			
33		Plugs	Type	N/A			
34			Size	N/A			
35			Qty	N/A			
TERMINALS		36	Type	Spring Loaded, anti-loosening, vibration proof, screwless			
	37	Quantity	*				
	38	No. of Rows	*				
	39	Numbering System	Terminal strip and terminals shall be suitably numbered				
	40	Size	1.5 mm ²				
	41	Make	*				
	42						
	43						
ACCESSORIES	44	Earthing Busbar (Internal)		Required			
	45	Earthing Screw (External)		Required			
	46	Rail(s) for Terminals		Required			
	47	PVC Shroud along with Cable Gland		Required			
	48	Nameplate Fixture		Required			
	49	Gasket		Required			
	50	Mounting		Suitable for mounting on wall, column and steel structure			
	51						
OTHERS	52	Manufacturer		*			
	53	Model		*			
	54	Certification		DGMS & PESO certified			
	55						
Notes:							
1	* By Vendor						
2	Calibration, material and certificates shall be provided by the Vendor.						
3	Material certificates shall be provided by the Vendor.						
4	Vendor to provide general arrangement drawing of JB supplied , indicating dimensions , layout etc and hazardous area certificates .						
5	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm)						
	CLIENT:	HPOIL GAS PRIVATE LIMITED (HOGPL)					
	PROJECT:	CITY GAS DISTRIBUTION PROJECT FOR DIMAPUR,NAGALAND GA	C1	06.05.2026	AB	SA	AB
			REV.	DATE	PRPD	CHKD	APPD

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RPD FLOWMETER					Rev.	
General	1	Tag No.		Refer P&ID		
	2	Quantity		Refer MR and P&ID		
	3	Line No.		3"-P-15HC-1010		
	4	Line Size & Schedule		* Vendor to submit proper sizing calculations as per process parameters.		
	5	P&ID Number		Refer P&ID		
	6	Service	Governing standard	Natural Gas	EN 12480:2018 or Latest	
Flow Meter	7	End connection	Size and Rating	Flanged*		
	8		Facing & Finish	*		
	9	Pulses / M3		LF & HF/LF		
	10	Flow Range		*		
	11	Enclosure		Weather proof IP65 as per IEC 60529 / IS 2147		
	12	Cable Entry		*		
	13	F-F Distance* (mm)		*		
	14	Material	Body	Cast Aluminium alloy or equivalent		
	15		End Connections	Aluminium Flanged /ASTM A 105 Flanged or equivalent		
	16		Impeller & Shaft	*		
	17		Bearing	SS316 or equivalent		
	18		Other Wetted Parts	SS316		
	19	Accuracy			±2% (Qmin to 0.1Qmax) and ±1% (0.1Qmax to Qmax)	
	20	Rangeability		1:100 or better		
Pre-amplifier	21	Type - 2 wire/ 3 wire		2 wire		
	22	Preamplifier location		Field		
	23	Power supply		24 VDC loop powered from Solar		
	24	Cable Entry		1/2" NPT(F)		
	25	Enclosure		Weather proof IP65 as per IEC 60529 / IS 2147		
	26	Intrinsic safe		Ex'ia'		
	27	Mounting	Accessories	Integral with RPD flow meter	Required	
Pulser	28	Power supply	Cable Entry	*		
	29	Output			Pulses	
	30	Enclosure			Weather proof IP65 as per IEC 60529 / IS 2147	
	31	Intrinsic safe			Ex'ia'	
Options	32	Mounting			Integral with RPD flow meter	
	33	-			-	
	34	-			-	
	35	Local Counter			Required 8 Digit, Mechanical, non-resettable counter	
	36					
	37	Strainer	Size and Mesh	*		
	38	Temperature tap on meter body		Required, 1/4" NPT, Thermowell SS316 , RTD 6mm probe.		
	39	Pressure Tap on Meter Body		Required		
	39	Pressure Tap on Meter Body		Required		
	40	Lubricator with accessories		Required		
	41	Radiography		100 % required for all welded joints (As applicable)		
	Process Conditions	42	Fluid and State		Natural gas	
43		Flow (min/max)SCMH		Refer P&ID		
44		Design Temp(°c)		-29 to 65 °c		
45		Design Pressure(barg)		19 barg		
46		Molecular Wt.		*		
47		Viscosity (cP)		*		
48		Cp/ Cv ratio		*		
49		Max. allowable pressure drop		As per EN-12480 or latest		
50		Compressibility Factor		*		
51		Area Classification		Zone 1 Group IIA /IIB as per IEC, T3		
Misc	52	Model No.		*		
	53	Make		*		
Notes:						
1 Vendor to specify. *						
2 Vendor to submit proper sizing calculations as per process parameters for review and approval.						
3 Vendor to refer P&ID for more information about process data.						
4 Vendor shall provide detailed GA drawing along with all parts name and MOC for the RPD meter along with data sheet.						
5 In addition to first fill, lubricating oil (500 ml) along with feeding accessories shall be supplied with each meter.						
6 Type Approval Certificate and Weights & Measures Certificate along with Model & Make information shall be provided for meters supplied.						
7 Calibration certificate (original + soft copy) shall be provided to Client. One copy of the certificate shall be provided within the packing box of each meter.						
8 Pulse generators shall be provided with means of plugging and sealing arrangement against unauthorized interference. Maximum Velocity through the RPD meter shall be less than 30 m/sec.						
9 Meter casing shall be tamperproof, corrosion resistant suitable for indoor / outdoor installation.						
11 Pressure drop across complete meter assembly consisting of meter, NRV, RO and strainer shall be calculated and provided. Over flow protection shall be 120% of max. flow.						
12 Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm)						
	CLIENT:	HPOIL GAS PRIVATE LIMITED (HOGPL)				
	PROJECT:	CITY GAS DISTRIBUTION PROJECT FOR DIMAPUR,NAGALAND GA				
			C1	06.05.2026	AB	
			SA			
			AB			
			REV.	DATE	PRPD	
			CHKD		APPD	

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CREEP RELIEF VALVE										Rev.	
GENERAL	1	Tag Number		Quantity		Refer P&ID		Refer P&ID			
	2	P&ID Number				Refer P&ID					
	3	Line No/Equipment No.				Refer P&ID					
	4	Inlet Line Size/Sch		Outlet Line Size/Sch		Refer P&ID					
	5	Inlet Line Material		Outlet Line Material		*		*			
	6	Corrosion Allowance				As per PMS					
	7										
PROCESS DATA	8	Service				Natural Gas					
	9	State		Phase		Gas		Single			
	10	Corrosive		Erosive		N/A		N/A			
	11	Flow (Min./Max.)	SCMH	Max. Oper Pressure		Barg	Refer P&ID		Refer P&ID		
	12	Set Pressure	Barg	%Allow Overpressure		Refer P&ID	Barg	10%			
	13			Constant							
	14	Back Pressure (barg)		Variable		*					
	Total										
	16	Oper Temperature	DegC	Relief Temperature	DegC	Refer P&ID	*	DegC			
	17	SG @ Relief		Visc @ Relief		*		*			
	18	MW @ Relief		Density @ Relief		*		*			
	19	Sp HT Ratio (Cp/Cv)		Compressibility (Z)		*		*			
	20	Design Pressure	Barg	Design Temperature	DegC	49	barg	-29 / 65	DegC		
	21	Latent Heat of Vap		Barometric Pressure		*		-			
	22	Wetted Surface Area (m2)				N/A					
23											
DESIGN BASIS	24	Nozzle				Full Nozzle					
	25	Type				Conventional					
	26	Bonnet Type				Closed					
	27	Design Code				To meet the PNGRB requirement for Creep Relief					
	28	Sizing Basis				Creep Relief					
	29	Relieves To				Vent to Atmosphere					
	30	Calculated Area	Selected Area		*		*				
	31	Orifice Designation				*					
	32	Calculated Capacity				*					
	33										
CONNECTOR	34	Size				*		*			
	35	Type				RF		RF			
	36	Rating				*		*			
	37										
	38										
	39										
	40										
MATERIAL	41	Body	Bonnet		ASTM A216 GR. WCB		ASTM A216 GR. WCB				
	42	Nozzle (Seat)	Nozzle Ring		SS 316		*				
	43	Spring	Disc		SS 304		SS 316				
	44	Bellows	Guide		N/A		*				
	45	Main Valve Seat / Seal				*					
	46										
MISC.	47	Cap				Bolted					
	48	Lever	Lever Type		N/A		-				
	49	Test Gag	Range		Required		-				
	50	Rupture Disc	Tag No		N/A		-				
	51	Manufacturer	Model No.		*		*				
	52										
Notes:											
1 * By Vendor											
2 Calibration, material and certificates shall be provided by the Vendor.											
3 Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1											
4 Creep Relief Valve shall be sized as per PNGRB requirements. Vendor to provide sizing calculations and select material as per											
5 Vendor shall submit detailed catalogue with model decodification sheet with datasheet.											
6 Vendor shall submit detailed GA drawing along with part names and MOC of the parts along with datasheets.											
		CLIENT:		HPOIL GAS PRIVATE LIMITED (HOGPL)							
		PROJECT:		CITY GAS DISTRIBUTION PROJECT FOR DIMAPUR, NAGALAND GA		C1	06.05.2026	AB	SA	AB	
				REV.	DATE	PRPD	CHKD	APPD			

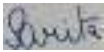
DATA SHEET FOR ELECTRONIC VOLUME CORRECTOR										Rev.
General	1	Type	Microprocessor based battery operated volume corrector with integral pressure transmitter and temperature sensor suitable for mounting in the field location and applicable for custody transfer							
	2	Service	Natural Gas							
	3	Site conditions	Temp.: 0 - 55 deg.C, Hot, Humid, tropical, Saline environment							
	4	Governing Standard	EN 12405-1+A1 or Latest							
	5	Approval	Type Approval Certificate as per Governing Standard							
	6	Area Classification	Zone 1 Group IIA /IIB T3 Ex ' d'							
	7	Enclosure Protection	IP 65							
	8	Quantity	As per P&ID							
	9	Function	To measure actual gas volume, pressure, temperature, and compressibility factors of the gas and based on which calculates standard volume of gas. The unit shall be complete in all respects to achieve functionality.							
	10	Accuracy	Typical accuracy better than ±0.5% as per governing standard							
Electronic Volume Corrector	12	Input	1.EVC input shall be either LF/ HF pulse from RPD meter							
	13		2.Temperature signal form RTD measured value PT100.All interconnecting cable shall be screened and armored							
			3.Pressure sensor shall be directly mounted on the meter and wired to EVC with a range in accordance with max. working pressure and design pressure							
	14		4. DI signal from Gas Detector, 1 tamper switch, 1 Spare							
		Output	1.Correct Flow rate in SCMH, standard cubic meter per hour							
	16		2.Correct Totalized volume (sm3)							
	17		3.Temperature							
	18		4.Pressure							
	19		5.Correction factor							
	20		6.Uncorrected flow rate							
			7.Uncorrected volume							
	21		8. Yesterday's Flow (SCM) and Today's Flow (SCM)							
	22	Isolation	All Inputs, Outputs and power supply shall be individually isolated using analog and digital barriers.							
	23	Display	2-line LCD with 16 characters / 1 Line LCD with 8 characters							
	24	Power Supply (Note 5)	Lithium battery along with mounting hardware as well as provision for External power up from Solar Panel. Any hardware required to have EVC work on battery as well external power , shall be included in scope. This includes GPRS modem polling to Client cloud server.							
	25	Calculations / Corrections	Compressibility: AGA8 latest (Detail method), NX-18,S-GERG							
	26	Features	Built in diagnostics to detect proper functioning							
	27		Data security to password / key-lock. Hardware and software seals required.							
	28		Parameters and programmed constants shall be stored in EEPROM / non- volatile memory							
	29		Conduit connection of 1/2" NPTF with plugs shall be provided for output.							
	30		Alarm output for unit malfunctioning.							
	31		EVC can store hourly data for 30 days							
	32		Large and configurable database and can store hourly, daily, monthly data with date & time stamp for pressure, temperature and corrected flow and consumption up to 1500 records or better.							
			EVC should be supplied with GSM Modem. Modem shall be powered from battery operated by Solar. Separate Junction box shall be provided to house this arrangement.							
	33		Facility for entry and accessing live and stored data through Keypad / Laptop / SCADA system.							
	34	Identification	Unique Addressing Facility							
	35	Communication Ports	1. RS 232/ 485 serial port for SCADA facility (configurable up to 9600 bps) along with required connector, convertor, and cable for USB output.							
			2. EVC shall have an inbuilt GSM modem. Separate battery shall be provided for GSM module which shall be charged by Solar Panel.							
	36	Software	Suitable communication protocol adaptor with 2.5 mtr of communication cable along with driver software to communicate with EVC and Windows 7 and Windows 10 based laptop shall be supplied with each EVC							
	37	Automatic Meter Reading (AMR)	Required, In built AMR with compatible technology for Data transmission							
	38	Mounting Accessories	EVC can be internal or external to the meter. Required mounting hardware ,clamps, fixtures shall be provided.							
	39	Fittings	1. Pressure sensor: 1/4"NPTM							
			2. Temperature Sensor: 1/4" NPTM (RTD Diameter Max.6mm)							
	40	Cable Entry	1/2" NPTF							
	41	Canopy	Prefabricated FRP canopy with required installation accessories							
	42	Communication Cable	Required, 2.5 mtrs length							
Misc.	44	Make	*							
	45	Model	*							
Notes:										
1	Vendor to specify. *									
2	EVC shall be certified for type test from NMI / PTB or equivalent independent international laboratories as per EN standards.									
3	The Calibration certificate for RTD, PT and EVC (original + soft copy) shall be provided to BPCL. One copy of the certificate shall be provided within the packing box of each EVC.									
4	Vendor shall provide 5 sets of volume corrector documentation including product literature, software / hardware manual, operation manual, maintenance instruction, certificates etc.									
5	Battery life shall be not less than 5 years if replaceable if not replaceable battery life shall be 10 years. Battery capacity shall be sufficient for 24 hr. continuous operation with all the equipment powered.									
6	The communication protocol and message structure details to be used on the RS 232 / 485 serial communication port (for SCADA) shall be supplied after placement of order.									
 Energising Quality		CLIENT:	HINDUSTAN PETROLUEM CORPORATION LIMITED							
		PROJECT:	DE-COMPRESSION DCU FOR HPCL GA'S		C1	01.07.2024	AK	RA	SKN	
					B1	28.06.2024	AK	RA	SKN	
					A1	27.06.2024	AK	RA	SKN	
					REV.	DATE	PRPD	CHKD	APPD	



VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION FOR PRESSURE GAUGE

VCS-SS-IN-5001_02

					
02	11.05.2022	SV	KNC	HK	GVW
01	18.01.2020	KS	VB	KNC	AD
00	23.05.2019	ND	UM	KP	KNC
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By
UNCONTROLLED COPY : If printed					
CONTROLLED COPY : If in soft and signed					

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	23.05.2018	Neha Dev	Udit Manichanda	K.Prasanth	Anupam Das	
01	18.01.2020					Format change and document numbering is revised.
		Karan Singh	Vinod Babu	Kedarnath Chakraborty	Anupam Das	
02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	

ABBREVIATION

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BS	British Standards
DIN	Deutsches institute fur Normung
FAT	Factory Acceptance Test
IEC	International Electro-technical Commission
IP	Ingress Protection
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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7	INSPECTION AND TESTING	9
8	MARKING, PACKING AND SHIPMENT	10
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1 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 Gauge along with its accessories.

2 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 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

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

British Standards

BS 1780	Specifications for Bourdon Tube Pressure and Vacuum Gauges

Deutsches Institute fur Normung

DIN 50049	Document on Material Testing

Indian Standards

IS 3624	Specification for Pressure and Vacuum Gauges
IS 2147	Degree of Protection provided for Enclosures

International Electro technical Commission

IEC 529	Degree of Protection by providing Enclosures
EN 837	Pressure Gauges Part-t: Bourdon Type Pressure Gauges, Dimensions, Metrology, Requirements and Testing

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 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 DESIGN

5.1 Pressure Element, Gauge Movement and Socket

The Pressure Gauges shall be used for local indication.

Pressure Gauge sensing element shall be SS316 and movement of SS304, as a minimum. Pressure Gauge measuring element shall generally be Bourdon / Bellows / Diaphragm type. In case of Bourdon type of Gauges, the size of the Bourdon tube shall not be less than 75% of the nominal diameter of the dial size.

The wetted parts of the Pressure Gauge, the Bourdon tube and socket must be compatible with the process media. If not compatible with the wetted parts of the Gauge, corrosion will occur. Corrosion of Gauge wetted parts will eventually cause gauge failure and possibly safety issues.

The material of construction of all accessories wetted by process shall be as per socket material.

Gauge construction shall ensure no leakage of process fluid from the sensor elements to atmosphere and between the high pressure and low-pressure side (in case of differential Pressure Gauges) under normal condition.

Primary elements shall withstand the specified overpressure for at least 30 minutes without having their elastic characteristics affected.

When any Gauge is used for steam pressures, a siphon filled with water must be installed between the Gauge and the line.

All Pressure Gauges with maximum operating pressure exceeding 60 Kg/cm² shall be solid front type.

Over range protector and pulsation dampener, whenever used shall be of SS304, as a minimum. Pulsation Dampener shall be used for all pulsating services. It shall be floating pin type, externally mounted and externally adjustable.

5.2 Cases Dials

Unless specified otherwise the gauges shall be weather proof to IP 65 as per IEC 529/IS 2147 as a minimum.

When safety type cases are specified, they shall consist of a solid partition isolating the pressure element from the dial.

Pressure Gauge dial shall be white, non-rusting plastic with black figures. The dial face shall be marked with pressure element material; dial size shall be 150mm. Pointers shall have micrometer adjustment.

Cases shall normally be cast aluminum alloy or black phenol.

In general, dial markings and dial color shall be as per IS 3624. Protect Gauges from frequent pressure pulsations by using liquid-filled.

5.3 Diaphragm Seals

Diaphragm seals, filled type or mechanical type shall be furnished where plugging of the element may occur or where suitable material is not available in highly corrosive services. When chemical seals are required, they shall be of the clean out type with flushing connection. Gauges specified with diaphragm seals shall have their diaphragms integral with the Gauges.

The sealing liquid for diaphragm seal Gauges shall be an inert liquid, compatible with the process fluid temperature.

For Gauges in oxygen and chlorine service, the sealing liquid shall be fluoro lube or equivalent compatible with the specified service.

For diaphragm seal Pressure Gauges with flanged ends, the diaphragm shall be rated for the maximum allowable pressure of the associated flange.

5.4 End Connection

Process Pressure Gauges with 150mm dial sizes or larger are most often supplied with a ½ NPTM connection to best support the gauge. Where NPT connections have been specified, the threading shall be to ANSI/ASM 81.20.1.

When flanges are specified, unless otherwise stated, they shall be to ANSI / ASME B 16.5. Process connection shall be bottom entry type.

5.5 Accuracy

For a mechanical Pressure Gauge, accuracy is defined as a percentage of the full scale range. The following are general guidelines:

- a. Test Gauges and standards: 0.25% through 0.10% full scale.
- b. Critical processes: 0.5% full scale.
- c. General industrial processes: 1.0% Less Critical Commercial Uses:2.0%

5.6 Range

Ranges shall be so specified that the Gauge normally operates in the middle third of the scale and shall conform to IS-3624 standard dials, wherever possible.

Pressure range is approximately twice the normal operating pressure. The maximum operating pressure should not exceed approximately 75% of the full scale range. Pressure Gauges shall have an accuracy of $\pm 0.5\%$ as a minimum. Over range protection of 130% shall be used.

5.7 Name Plate

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

- d. Tag number as per Data Sheet
- e. Manufacturer's name and trade mark
- f. Gauge type, model no. Serial no.
- g. Range of the Instrument.
- h. Maximum working pressure and maximum vacuum rating of the element.

- i. Area classification

6 FABRICATION AND PAINTING

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

7 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 Gauge 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 Gauges 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 Gauge.

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
- f. 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. Following certificates shall be submitted by the Vendor:
- g. Mill test certificates relevant to the chemical analysis and mechanical properties of the materials as per the relevant Standards and Specifications.
- h. NOT reports for radiography, ultrasonic, magnetic particle and liquid penetrate inspection.
- i. Test report on operation of Gauges including operating time.

- j. Test report on hydrostatic test of Gauges.
- k. Test report on Gauge assembly tests.
- l. All other test reports and certificates as required by this Specification.
- m. The certificates shall be valid only when signed by Purchaser's Inspector. Only those Gauges which have been certified by Purchaser's Inspector shall be dispatched from Manufacturer's works.

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 Pressure Gauge 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 Gauge functions correctly and properly in accordance with the specified requirements.

8 MARKING, PACKING AND SHIPMENT

Following FAT completion, Vendor responsible for the Pressure Gauge 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 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 Gauge, 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 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:

- g. Specifications, Data Sheets;
- h. Bill of materials including Vendor list, details for third party items;
- i. Catalogues, Manuals and relevant drawings and documents;
- j. Dimensional drawings;
- k. Calibration certificates;
- l. Material test certificates;
- m. Procedures for FAT;
- n. Quality Assurance Plan;
- o. 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.



**STANDARD SPECIFICATION
FOR
PRESSURE GAUGE**

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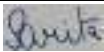
The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION FOR TEMPERATURE GAUGES AND THERMOWELLS

VCS-SS-IN-5101_02

					
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**STANDARD SPECIFICATION
FOR
TEMPERATURE GAUGES AND THERMOWELLS**

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01	18.01.2020					Format change and document numbering is revised.
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02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



**STANDARD SPECIFICATION
FOR
TEMPERATURE GAUGES AND THERMOWELLS**

**DOCNO: VCS-SS-IN-5101
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ABBREVIATION

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
IEC	International Electro technical Commission
IS	Indian Standard
AARH	Average Arithmetic Roughness Heights
NACE	National Association of Corrosion Engineers
SAMA	Scientific Apparatus Makers Association
IP	Ingress Protection
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 Temperature Gauges & Thermowells 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.

ANSI/ASME	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
IEC-529	Degree of Protection by Provided by Enclosures
SAMA	Scientific Apparatus Maker's Association
IS-2147`	Degree of Protection provided for Enclosures for Low Voltages Switch gear and control gear.
IS-7358	Specification for Thermocouples

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:

- Data sheets
- Job Specifications
- Standard Specifications
- 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 Temperature Gauge 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

For all Temperature Gauges, the case & bulb / stem material shall be as a minimum SS316 unless otherwise specified in the Data Sheet. Capillary tubing shall be of SS316 as a minimum with stainless steel flexible armoring and PVC covering over armor.

The casing of the Temperature Gauge shall be as a minimum weather proof to IP-65 & suitable for outdoor installation.



5.0 DESIGN

5.1 General

The following design requirements cover the general requirements of Temperature Gauge & Thermowells. But for the exact requirement and applications, the relevant job specification and design basis shall be referred and complied.

5.2 Temperature Gauges

Local Temperature Gauges shall be Liquid / vapor / Gas filled type in general and shall be manufactured as per relevant SAMA Class. Bimetallic gauges can also consider if approved by Purchaser. All local Temperature Gauges shall have 150 mm dial size. The bulb size shall be selected to suit the Thermowell.

In vibrating service filled type Temperature Gauges with capillary extension shall only be used. Temperature Gauges shall have accuracy of $\pm 1\%$ URV (Upper Range Value). Bimetallic type dial thermometers shall be avoided where excessive vibrations are encountered, such as compressors. Only filled type with capillary extension shall be used in such cases.

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 well shall fit the gauge stem so that maximum transfer rate results. Thermometer stem adjustable gland with union connection and bushing shall be suitable for $\frac{1}{2}$ NPTF connections.

For filled system type Temperature Gauges, the SAMA (Scientific Apparatus Makers Association) classification shall be decoded as below.

SAMA CLASS	FILLING FLUID
I	Liquid
II	Vapor
III	Gas
IV	Mercury

Unless otherwise specified, the Temperature Gauges shall have an over range protection of at least 30% of the specified range.

All other technical details of the Gauges are defined on the Data Sheet

5.3 Name Plate

Each Temperature Gauge Shall have a SS name plate attached firmly to it at a visible place, furnishing the following information:

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



5.4 Thermowell

Thermowell material shall be as a minimum SS316 unless otherwise specified and shall be machined out of forged bar-stock. Built-up Thermowells can be considered for immersion length greater than 500mm and when special pipe materials are needed for the well. Built-up Thermowells shall be used in low pressure and velocity services like in fired heaters.

Thermowells natural frequency calculations, where specified on the Data Sheet, are required for review. The base of the Thermowells shall be chosen to fit the instrument without air gap for minimizing measuring lag.

Immersion length of Thermowells shall be as follows:

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

In special applications, not covered above, Vendor shall decide the immersion length based on actual requirements. Immersion length is based on 200 mm length between flange face and inner wall of pipe.

Thermowells shall be capable of withstanding the maximum design temperature and Pressure of the system. Any pipe line less than 4" nominal bore shall be blown to 4" size to install Thermowell.

Unless otherwise specified, the following shall govern:-

- a. Threaded end connections shall be to NPT as per ANSI/ASME B 1.20.1. b. Flanged end connections shall be to ANSI/ ASME B 16.5.
- b. Where ring type joint flanges have been specified, the groove shall be suitable for octagonal rings as per ANSI/ ASME B 16.20 unless otherwise specified.
- c. Flange face finish shall be serrated concentric to paragraphs 6.3.4.1, 6.3.4.2 and 6.3.4.3 of ANSI/ASME 816.5. The face finish as specified in Data Sheets, shall be as follows:-
 - i. Serrated 250 to 500 AARH
 - ii. 125 AARH: 125 to 200 AARH
 - iii. 63 AARH 32 TO 63 AARH

5.5 NAME PLATE DETAILS

The following information shall be punched on the extension of the Thermowell:

- a. Tag number as per Purchaser's Data Sheets.
- b. Material of the well to the same standards as in Purchaser's Data Sheets.



c. Thermowell immersion length 'U'.

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 to the same standards as per Purchaser's Data Sheets.

6.0 FABRICATION

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Temperature Gauges & Thermowells. Vendor shall submit the required specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing herein. Painting of Temperature Gauges & Thermowells is in accordance with Company Painting Specifications.

All equipment's shall be coated with anticorrosive paints for a corrosive, near shore environment. Vendor in compliance with the written procedures recommended by the manufacturer shall prepare his own coating procedures including surface preparation and application of coating and curing. Vendor's painting/coating system shall be submitted along with the bid for Buyer's review and approval.

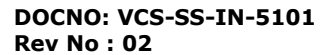
All material shall be new, clean and free from rust, pits and obvious defects.

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).

Unless otherwise specified, Purchaser reserves the right to test and inspect all the items at the Vendor's works. Vendor shall submit following test certificates and test reports for Purchaser's review:-

- a. Material test certificate (MIL Certificate) for Thermowells and flanges.
- b. Certificate of Radiography / X-ray for welded joints. Dye penetration test certificate shall be provided for joints where Radiography / X-ray is not possible.
- c. Certificate for concentricity of bore.
- d. Hydrostatic test report as Para 7.1 of this specification.
- e. Type test report for enclosure class for Temperature Gauges.
- f. Calibration report for Temperature Gauges
- g. Dimensional Test Report





7.4 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 Gauges & Thermowells 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

Temperature Gauges & Thermowells Vendor 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 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;
- e. A list of accessory item together with manufacturer's name and part number.

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:

- f. Specifications, Data Sheets;
- g. Bill of materials including Vendor list, details for third party items;
- h. Catalogues, Manuals and relevant drawings and documents;
- i. Dimensional drawings;
- j. Calibration certificates;
- k. Material test certificates;
- l. Procedures for FAT;
- m. Quality Assurance Plan;
- n. 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.

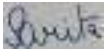
The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION FOR RTD'S AND THERMOCOUPLES

VCS-SS-IN-5102_02

					
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**STANDARD SPECIFICATION
FOR
RTD'S AND THERMOCOUPLES**

**DOCNO: VCS-SS-IN-5102
Rev No : 02**

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02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



ABBREVIATION

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
IEC	International Electro technical Commission
IP	Ingress Protection
IS	Indian Standard
NACE	National Association of Corrosion Engineers
SAMA	Scientific Apparatus Makers Association
SS	Stainless Steel
RTD	Resistance Temperature Detector



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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 RTD'S And Thermocouples RTD'S And Thermocouples 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.

ANSI/ASME	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
IEC-529	Degree of Protection by Provided by Enclosures
IEC-751	Industrial Platinum Resistance Thermometer Sensor
IEC-5842	Thermocouple Tolerances
SAMA	Scientific Apparatus Maker's Association
IS-2147	Degree of Protection provided for Enclosures for Low Voltages Switch gear and control gear.
IS-2148	Flameproof Enclosures for Electrical Apparatus
IS-7358	Specification for Thermocouples
DIN-43760	Temperature Vs resistance curves for RTD's.
NACE	National association of corrosion Engineers MR-01-75

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 following design requirements cover the general requirements of RTD & Thermocouples. But for the exact requirements and applications, the relevant, specific Job Specifications and design basis shall be referred and complied. For remote temperature Indication / recording / control / switch etc., Thermocouples or Resistance Temperature Detector (RTD) shall be used depending on the process requirements. Elements shall be spring loaded, mineral insulated and shall have stainless steel sheath.

To avoid the need to provide barrier glands for electrical entries , RTD'S And Thermocouples shall be of a type which provide positive protection against process fluids entering the electrical housing in the event of element failure i.e., by means of a solid barrier and a vent.

5.1 Resistance Temperature Detectors

The RTD assemblies shall be furnished with threaded heads. The heads shall consist of a case, screwed on cover and terminal block. The RTD shall be screwed to the terminal block. A heat resistant and moisture proof gasket shall be fitted between the case & cover. There shall be an extra terminal in the terminal block connected to the head for grounding the shield.

Unless otherwise specified, the assembly shall conform to the following standards:

- a. The heads shall be weather proof to IP-65 as per IEC-529 / IS-2147.
- b. In case of flame proof construction, heads shall be flame proof as per IEC-79 / IS-2148 & weather proof to IP-65 as per IEC-529 / IS-2147.

The connecting terminals shall be properly numbered and shall be permanently and legibly identified. The leads shall be copper, up to terminal block. The RTD's shall be of three wires unless otherwise specified. The element shall be of highly refined material of reference grade and shall have been stress relieved.

The wire shall be wound on a ceramic core and immobilized against strain or damage. The winding shall be of bifilar type. The element shall be within a metal sheath, in a manner which provides good thermal transfer and protection against moisture.

RTD (Resistance Temperature Detector) shall be platinum element 3-wire type with 100 ohms resistance at 0°C calibrated as per IEC 751 / DIN 43760, unless otherwise specified. RTD shall be used within a temperature range of -200 to 650°C. Three wire systems shall be adopted in connecting the element. RTD shall be used where accuracies of the order of 0.25% or better and smaller measuring spans are required. Twin element sensors, if used, shall have two separate cable entries.



5.2 Thermocouples

Thermocouple assemblies shall be furnished with threaded heads. The heads shall consist of a case, screwed on cover and terminal block. The Thermocouple shall be screwed to the terminal block. Thermocouple assemblies shall be furnished with weatherproof screw type heads.

Unless otherwise specified, the assembly shall conform to the following standards:

- The heads shall be weather proof to IP-65 as per IEC-529 / IS-2147.
- In case of flame proof construction, heads shall be flame proof as per IEC-79 / IS-2148 & weather proof to IP-65 as per IEC-529 / IS-2147.
- Thermocouples shall be as per IEC-5842 / IS-7358 and shall have a wire size of 18 AWG for single and 20 AWG for duplex Thermocouples.

Thermocouples shall be magnesium oxide (MgO) filled undergrounded type, unless necessary otherwise, the type of Thermocouple shall be selected based on temperature.

Following guidelines shall be followed:-

Copper - Constantan (ISA-Type-T)	(-) 200 to 200°C
Chromel - Constantan (ISA-Type-E)	(-) 200 to 600°C
Iron - Constantan (ISA-Type-J)	0 to 600°C
Chromel -Alumel (ISA-Type-K)	600 to 1200°C
Platinum Rhodium- Platinum (ISA Type-S)	600 to 1600°C

A heat resistant and moisture proof gasket shall be fitted between the case and cover. The case shall be suitable for mounting terminal blocks for single or duplex type Thermocouple element assemblies. The Thermocouple assemblies shall be spring loaded. The thermocouple properties and limits of error shall be as per IEC-5842.

The terminals shall be permanently and legibly identified for their polarity. The terminal block shall be permanently and legibly marked with the ISA letter code to designate the type of Thermocouple. There shall be an extra terminal connected to the head for grounding, wherever required. The design of Thermocouple assemblies shall be such that replacement on line is possible.

Thermocouple shall be 316 Stainless Steel sheathed magnesium oxide insulated, ungrounded type, unless otherwise specified.

5.3 Name Plate

Each Thermocouple / RTD assembly shall be provided with a stainless steel nameplate attached firmly to it.

- Tag number as per Purchaser's Data Sheets.



b. Thermocouple type as per ISA/ RTD element type.

6.0 FABRICATION AND TESTING

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Thermocouple & RTD. 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 Pressure Switch 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 RTD'S And Thermocouples 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 Gauge.

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

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 Thermocouple & RTD 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 Switch functions correctly and properly in accordance with the specified requirements.

8.0 MARKING, PACKING AND SHIPMENT

Following FAT completion, Vendor responsible for the Thermocouple & RTD 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 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:

- e. Specifications, Data Sheets;
- f. Bill of materials including Vendor list, details for third party items;
- g. Catalogues, Manuals and relevant drawings and documents;
- h. Dimensional drawings;
- i. Calibration certificates;
- j. Material test certificates;
- k. Procedures for FAT;
- l. Quality Assurance Plan;
- m. 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.

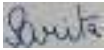
The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION FOR TEMPERATURE TRANSMITTER

VCS-SS-IN-5103_02

					
02	11.05.2022	SV	KNC	HK	GVW
01	18.01.2020	KS	VB	KNC	AD
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**STANDARD SPECIFICATION
FOR
TEMPERATURE TRANSMITTER**

**DOCNO: VCS-SS-IN-5103
Rev No : 02**

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	23.05.2018	Neha Dev	Udit Manichanda	K.Prasanth	Anupam Das	
01	18.01.2020					Format change and document numbering is revised.
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02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



ABBREVIATION

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
	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:

- Data sheets
- Job Specifications
- Standard Specifications
- 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 aluminum 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 aluminum 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.

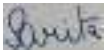
The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION FOR LEVEL TRANSMITTERS

VCS-SS-IN-5202_02

					
02	11.05.2022	SV	KNC	HK	GVW
01	18.01.2020	KS	VB	KNC	AD
00	23.05.2018	ND	UM	KP	AD
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY	:	If printed
CONTROLLED COPY	:	If in soft and signed

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	23.05.2018	Neha Dev	Udit Manichanda	K.Prasanth	Anupam Das	
01	18.01.2020					Format change and document numbering is revised.
		Karan Singh	Vinod Babu	Kedarnath Chakraborty	Anupam Das	
02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	

ABBREVIATION

ASME	American Society of Mechanical Engineers
API	American Petroleum Institute
BS	British Standard
DN	Deutsches Institut fur Normung
FAT	Factory Acceptance Testing
IEC	International Electrotechnical Commission
IS	Indian Standards
ISA	Instrument Society of America
MSS	Manufacturers Standardization Society
NACE	National Association of Corrosion Engineers
NPT	Nominal Pipe Thread
SAT	Site Acceptance Testing
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 Level Transmitters, 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

ASME B 16.10	Face to Face and End to end dimensions for valves
ASME B 16.34	Valves Flanged, threaded and weld ended
ASME 816.5	Pipe flange and flange fittings
ASME 831.3	Process Piping
ASME 81 .20.1	Pipe Threads General purpose
ASMEB 16.11	Forged Fittings, Socket welding and Threaded
ASME B 16.21	Non Metallic Flat Gaskets for Pipe Flanges

American Petroleum institute(API)

API RP 551	Process measurement and Instrumentation
API (MPMS) Chapter 3.3	Standard Practice for Level Measurement of Liquid Hydrocarbons in Stationary Pressurized Storage Tanks
API (MPMS) Chapter 5.4	Accessory Equipment for liquid meters

British Standard(BS)

BS-5345 Parts-1,3,4,5,6 & 8	Code of Practice for the Selection, Installation and Maintenance of Electrical Apparatus for use in Potentially Explosive Atmospheres (BS EN 60079)

Deutsches Institut fur Normung

DIN 50049	Document on material testing

International Electro-Technical Commission

IEC-79	Electrical Apparatus for Explosive Gas Atmosphere
IEC 60529	Classification of Degree of protection provided by enclosures
IEC 801	Electromagnetic compatibility for Industrial Process Measurement and Control Equipment

Indian Standards

IS 2147	Degree of Protection provided by enclosure for low voltage switch gear and control gear
IS 2148	Flame proof enclosures for Electrical Apparatus.
ISA S 5.1	Instrumentation Symbols and Identification

Manufacturers Standardization Society

MSS-SP-25	Standard Marking Systems for Valves, Fittings, Flanges and Union
MSS-SP-55	-Visual Quality standard for steel casting for valves, flanges and fittings and other piping components method

National Association of Corrosion Engineers

NACE MR-0175	Sulphide Stress Cracking Resistant metallic Materials for Oilfield 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.

The cage material shall be compatible with the vessel material, and shall be carbon steel as a minimum. Flange material for external cages shall be carbon steel as a minimum.

All flanges on the level instrument pressure retaining parts shall be of the same type and rating as the process flanges and shall be in accordance with the vessel trim Specification.

Torque tube when used shall be of Inconel / Monel minimum, with nylon bushing type bearings. All other wetted parts shall be SS 316 minimum, unless otherwise specified.

For Level Instruments, especially Switches, the bottom connection shall not be located at the bottom of the vessel on or near the exit / drain of the vessel/equipment, as it may cause erroneous display of level on account of the velocity of the draining liquid.

5.0 DESIGN

5.1 General

Level Transmitter shall in general use a displacer type mechanism.

A local / integral indicator (ex-proof or intrinsically safe) shall be provided with each level Transmitter.

All level instruments shall be provided with piping isolation valves

The drain valves from all level instruments shall be piped into the platform drain System.

The Transmitter's enclosure housing the electrical parts shall be suitable for the hazardous area of, Zone 1, Group II B, Temp Class T3, unless otherwise specified within the instrument data sheets.

Weatherproof housing - to IP 55 as per IEC-529/IS-2147

Flame proof housing -flame proof / Ex (d) as per IEC-79/IS-2148. Flame proof housing shall also be made weatherproof.

All level Transmitters shall be provided with W' NPT as per ASME 81 .20.1.

Level Transmitters installed in any system shall have overpressure limits, which exceed the design pressure rating of the system by 30 %.

5.2 Displacement Type Level Transmitters

Displacement type level instruments shall be used for all process control applications where level variation in the vessel is not beyond 1219 mm (48").

Displacer length shall be selected to fully utilize the surge capacity of the vessel. External displacer cages, segregated from the vessel by two block valves, shall be used. External cage level instruments shall have pressure ratings equal to or greater than the relevant piping classification requirements for flanged block valves on the vessel.

External displacer cages shall be supplied with side/side connections. Where this is not possible top/bottom or side/bottom connections may be provided. Side / top connections shall be used only in cases where this would avoid a pocket in the connecting pipe. Connections for external cages shall be 2" ANSI flanged

Rotatable heads shall be provided with displacer type instruments.

The torque tube material shall be Inconel. The cage to head connection shall be flanged.

For external cages, block valves shall be installed in horizontal position of both lines at the vessels. If a vertical nozzle is used the valve shall be arranged so that no sediment pockets are present. A valve shall be installed to permit draining each displacer cage and piped to drip pans or deck drains.

A positive seal shall be used in transferring float / displacer motion to the external mechanism where a float or displacer element is employed.

5.3 Differential Pressure Type Level Transmitters

Differential Pressure type Level Transmitters may be used where the application requires wide throttling ranges and fluid Specific Gravity is constant.

Differential Pressure type Level measurement is acceptable for remote level indication. For level range of 1219 mm (48") and above, this type of Transmitter shall be used for all services; seals shall be provided as required. These instruments shall have zero elevation/ suppression adjustment wherever required

5.4 Name Plate

Each Level Transmitter 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, Model Number, Serial Number.
- c. Nominal end connection in inches and rating in pounds.
- d. Material of construction for body, displacer / float and torque tube.
- e. Instrument range.
- f. Area classification.

6.0 FABRICATION AND PAINTING

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Level Transmitters. 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 Level Transmitters shall be in accordance with 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 Level Transmitters 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 Level Transmitters 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 Level Transmitters.

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. Material tests
- c. Dimensional test
- d. Hydrostatic test
- e. Calibration
- f. 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)

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 Level Transmitters 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 shall ensure that all equipment and associated materials and accessories for Level Transmitters 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.

All threaded and flanged openings shall be suitably covered to prevent entry of foreign material.

All the items comprising a level Transmitters system shall be individually packed and shipped in the same crate.

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 Level Transmitters, 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, if required

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.

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.

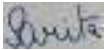


ENERGISING QUALITY

VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION FOR GAS METER

VCS-SS-IN-5306_02

					
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**STANDARD SPECIFICATION
FOR
GAS METER**

**DOCNO: VCS-SS-IN-5306
Rev No : 02**

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ABBREVIATION

AMR	Automatic Meter Reading
ATEX	Atmospheres Explosibles
ANSI	American National Standards Institute
EVC	Electronic Volume Corrector
FAT	Factory acceptance Test
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
MAOP	Maximum Allowable Operating Pressure
MIU	Meter Interface Unit
NACE	National Association of Corrosion Engineers
NPT	Nominal Pipe Thread
NRV	Non Return Valve
OEM	Original Equipment Manufacturer
PNGRB	Petroleum and Natural Gas Regulatory Board
RF	Radio Frequency
RO	Restriction Orifice
SAT	Site Acceptance Test
SS	Stainless Steel
TPIA	Third Party Inspection Agency
WPC	Wireless Planning & Coordination Wing



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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 gas meters used in commercial and industrial applications in CGD industry.

2.0 DEFINITIONS

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

Agreement	Designates the agreement concluded between the Client and the Contractor, under which the latter undertakes to the former the Goods and/or Services according to the stipulations which are agreed and specified in the form of an order.
Client	Designates the purchaser of the Goods and/or Services, which are the subject of the agreement.
Contractor / Supplier	Designates the individual or legal entity with whom the order has been concluded by the Client. The term "Contractor / Supplier" may be used indifferently for a supplier, a manufacturer, an erection Contractor / Supplier, etc.
Days-Weeks-Months	Specify the number of calendar days, weeks or months and not of working days, weeks or months.
Client's Representative	Designates the individual or legal entity to which the Client has entrusted various tasks in relation with the carrying out of his Project.
Goods and / or Services	Designate, depending on the case, all or part of the drawings or documents, substances, materials, materiel, equipment, structures, plant, tools, machinery, to be studied, designed, manufactured, supplied by the Contractor / Supplier under the agreement, including all the studies, tasks, works and services specified by the order. The Terms Goods or Services may be indifferently used one for the other as required by the context.
Project	Designates the aggregate of Goods and/or Services to be provided by one or more Contractor / Supplier.



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.

EN 1359 + A1 Latest	Gas Meters - Diaphragm Meters
OIML R137	Gas Meters
ATEX	94/9/EC Directive
EN 12480	Gas meters - Rotary Displacement Gas Meters
AGA Report No.7	Measurement of Natural Gas by Turbine Meters
AGA Report No.8	Compressibility factor of Natural Gas and other related Hydrocarbon gases
ISO 27001	Information security standards
BS 4161	Specification for diaphragm meters of 6 cubic meters
IEC 60529	Degree of Protection Provided by Enclosures (IP Code)
ASME B1.20.1	Pipe Threads, General Purpose (Inch)
ASME B16.5	Pipe Flanges and Flanged Fittings
EN12405-1 + A1	Electronic Volume Calculator
IEC 60529	Degree of Protection Provided by Enclosures (IP Code)
IEC 60079	Electrical apparatus for explosive gas atmospheres
PNGRB T4S	PNGRB Technical Standards and Specifications

3.2 Order of Precedence

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

- Data sheets
- Job Specifications
- Standard Specifications
- 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 DESIGN CRITERIA

4.1 General

All gas meters shall be designed for continuous operation in the given site conditions with the following design criteria:

- Ease of operation and maintenance;
- Suitability for applicable environmental conditions;
- Suitability for operation in the designated classification of hazardous areas;
- State of art proven technology and instrumentation;
- Safety to operating and maintenance personnel;
- Safety to connected equipment;
- High Redundancy with high reliability (high MTBF and low MTTR) and no single point of failure;
- Minimum cost of ownership.

4.2 Environmental Conditions

The equipment considered and the complete installation shall be suitable for continuous operation under the ambient conditions prevailing at site.

4.3 EMC Compliance

All gas meters and accessories shall be immune to Radio Frequency Interference (RFI) and Electro Magnetic Interference (EMI). The design and installation of all electrical / electronic equipment shall meet the RFI/EMI requirements according to IEC 61000, emission (IEC61000-6-4) and immunity (IEC-61000-6-2) requirements for an industrial environment.

4.4 Hazardous Area Certification

Gas meters shall be certified for use in designated areas when installed in hazardous area classified zones as per IEC 60079.

4.5 Ingress Protection

Gas meters shall have ingress protection to IP 54 or better in accordance with IEC 60529.

5.0 TECHNICAL REQUIREMENTS

Gas meters shall be installed at commercial and industrial applications in order to meter the gas consumed by the Customers. Gas meter type shall be decided based on flow capacity, pressure rating and accuracy requirements. These meters shall be designed to operate on clean and dry natural gas.

This document specifies all types of gas meters used for commercial and industrial applications in CGD industry. However, the exact requirement shall be as defined in Material Requisition and Datasheets.



5.1 Diaphragm Meter

Diaphragm meter shall be suitable for measurement of low gas flows in domestic and light commercial metering applications.

Diaphragm meter shall be designed in accordance to EN 1359:1999 + A1 Amendment 2006 or latest and shall be suitable for outdoor / indoor installations, tamper proof and corrosion resistance for a life period of 10 years.

Diaphragm meters fall into the positive displacement category as they have well defined measurement compartments that alternately fill and empty as the meter reciprocates or rotates. The meter will indicate volumetric flow based on the gear ratio, number of revolutions and fixed volume displaced in each meter revolution.

Diaphragm meter shall have an accuracy class of 1.5 and rangeability of 150:1 or better. Pressure drop across the meter shall be less than 2 mbar at Q_{max}.

Ingress protection of meter shall be IP 54 or better.

Material of construction of meter shall be steel with suitable coating on inside and outside for corrosion protection of casing. Diaphragm material shall be polyester fabric coated with rubber for an endurance life cycle of 80,000 cum. Meter shall be in accordance with EN 1359.

Diaphragm meter shall have 8 digit mechanical index (As per EN1359 – Units in m³). Index shall be provided with sealing arrangement to avoid tampering.

Back-run stop is to be provided to prevent the meter from running backwards in case of tampering or back flow condition. Transmission system shall be tamperproof non-magnetic with transmission rate of 0.01 m³ / rotation for G4 & G6 and 0.10 m³ / rotation for G10 - G25.

Meter shall be provided with a device in the outlet to prevent reverse flow. Over flow protection device (Restriction Orifice) shall be provided at the downstream of meter. Material of construction of restriction orifice shall be PTFE and shall be suitable for natural gas application.

Vendor shall provide brass adaptor with 1" inlet / outlet connection. Washer shall be of PTFE material of construction and provided along with restriction orifice.

The end connection of the meters shall be protected with plastic caps. In case of flange ends, companion flanges with bolts shall be provided in each end. In case the end connections of the meters proposed by the Vendor is not in line with the end connections mentioned in the data sheets, the Vendor shall supply suitable adaptors to suit the desired end connections. Companion flanges with bolts if supplied shall be enclosed within the meter packing box.

Vendor to provide the type approval certification for meter as per EN 1359 and certification from Weights & Measures Department, India with Model & Make details included. Calibration certificate (original + soft copy) shall be provided to Client. One copy of the certificate shall be provided within the packing box of each meter.

If applicable, diaphragm meter shall be provided with Automatic Meter Reading (AMR) and either integral or external Electronic Volume Corrector (EVC). Refer EVC Datasheet for detailed specifications.



5.2 Thermal Mass Meter

Thermal mass meter shall be suitable for measurement of low gas flows in commercial and light industrial metering applications.

Thermal mass flow meter offers excellent sensitivity at low flow rates, high reliability due to no moving parts, high accuracy, high turndown ratio and easy installation. However, the suitability of thermal mass flow meter with the fluid measured is to be checked prior to usage of this meter.

Thermal mass flow meter shall be designed in accordance to latest version of OIML R137 and shall be suitable for outdoor / indoor installations, tamper proof and corrosion resistance for a life period of 10 years.

Thermal mass flow meter measures gas mass flow directly without need for pressure and temperature correction.

These meters measure the amount of heat transfer between two temperature sensors placed symmetrically in a heated flow sensor. The amount of heat transfer is directly proportional to mass flow rate.

The amount of power in the form of heat to the sensor shall be very low, permitting the use of this technology in natural gas and flammable gas applications.

Thermal mass meter shall have an accuracy class of 1.5 and rangeability of 150:1 or better. Pressure drop across the meter shall be less than 2 mbar at Q_{max} .

Material of construction of meter shall be steel with suitable coating on inside and outside for corrosion protection of casing. Sensor material of construction shall be in accordance with OIML R137.

Ingress protection of meter shall be IP 54 or better. Meter shall be provided with integral LCD digital display.

Thermal mass flow meters shall be tamper proof and shall provide all diagnostic information to end user.

The end connection of the meters shall be protected with plastic caps. In case of flange ends, companion flanges with bolts shall be provided in each end. In case the end connections of the meters proposed by the Vendor is not in line with the end connections mentioned in the data sheets, the Vendor shall supply suitable adaptors to suit the desired end connections. Companion flanges with bolts if supplied shall be enclosed within the meter packing box.

Vendor to provide the type approval certification for meter as per OIML R137 and certification from Weights & Measures Department, India with Model & Make details included. Calibration certificate (original + soft copy) shall be provided to Client. One copy of the certificate shall be provided within the packing box of each meter.

Thermal mass meter shall be provided with in-built Automatic Meter Reading (AMR) with encrypted communication capability via GSM / GPRS and integral antenna.

An optional optical communication port shall be provided in order to access meter metrological information and diagnostic database.



Meter shall be powered by lithium-ion battery. The life of battery shall be optimum with respect to the performance and communication capability of the meter.

Refer EVC Datasheet for detailed specifications.

5.3 Ultrasonic Meter

Ultrasonic meter shall be suitable for measurement of low gas flows in commercial and light industrial metering applications.

Ultrasonic flow meter offers excellent sensitivity at low flow rates, high reliability due to no moving parts, high accuracy, high turndown ratio and easy installation. However, the suitability of ultrasonic flow meter with the fluid measured is to be checked prior to usage of this meter.

Ultrasonic meter shall be designed in accordance to latest version of OIML R137 and shall be suitable for outdoor / indoor installations, tamper proof and corrosion resistance for a life period of 10 years.

Ultrasonic gas meter shall be based on single path ultrasonic sensors. The meter shall be configurable to provide temperature and fixed factor pressure conversion on the measured gas volume.

Temperature shall be measured by a thermistor located within the gas meter. The measured temperature shall be used to calculate a temperature scaling factor, which is used to obtain a temperature converted volume.

Fixed factor pressure conversion shall be provided in the meter and shall convert the volume record using the pressure scaling factor stored in the meter in to a pressure converted volume.

The measuring element shall comprise of a flow tube fitted between an inlet chamber and outlet chamber. One ultrasonic transducer shall be fitted on the upstream and one on the downstream end of the flow tube.

Material of construction of meter casing shall be either steel or die-cast aluminium with suitable coating on inside and outside for corrosion protection of casing. Sensor material of construction shall be in accordance with OIML R137.

Ingress protection of meter shall be IP 54 or better. Meter shall be provided with integral LCD digital display.

Ultrasonic flow meters shall be tamper proof and shall provide all diagnostic information to end user.

The end connection of the meters shall be protected with plastic caps. In case of flange ends, companion flanges with bolts shall be provided in each end. In case the end connections of the meters proposed by the Vendor is not in line with the end connections mentioned in the data sheets, the Vendor shall supply suitable adaptors to suit the desired end connections. Companion flanges with bolts if supplied shall be enclosed within the meter packing box.

Meter shall be powered by lithium-ion battery. The life of battery shall be optimum with respect to the metrological performance of the meter.



Vendor to provide the type approval certification for meter as per OIML R137 and certification from Weights & Measures Department, India with Model & Make details included. Calibration certificate (original + soft copy) shall be provided to Client. One copy of the certificate shall be provided within the packing box of each meter.

The gas meter shall provide a pulse output interface to external monitoring device such as automatic meter reading unit to transmit gas volume flow rate information.

Ultrasonic meter shall have provision to integrate with Automatic Meter Reading (AMR) and either integral or external Electronic Volume Corrector (EVC), with encrypted communication capability via various communication options.

An optional optical communication port shall be provided in order to access meter metrological information and diagnostic database.

AMR and EVC shall be powered by lithium-ion battery. The life of battery shall be optimum with respect to the performance and communication capability of the AMR.

Refer EVC Datasheet for detailed specifications.

5.4 RPD Meter

The in line Positive Displacement Meters (PD meters) with its associated systems shall be designed for natural gas flow measurement required for both custody transfer and non-custody transfer applications. And it shall be field proven and no prototype shall be offered.

RPD meter shall be designed in accordance to EN 12480 or latest and shall be suitable for outdoor / indoor installations, tamper proof and corrosion resistance for a life period of 10 years.

Positive Displacement flow meters measure the volume or flow rate of a moving fluid or gas by dividing the media into fixed, metered volumes. These devices consist of a chamber that obstructs the media flow and a rotating or reciprocating mechanism that allows the passage of fixed-volume amounts. The number of parcels that pass through the chamber determines the media volume. The rate of revolution or reciprocation determines the flow rate.

There are two basic types of Positive Displacement flow meters. Sensor-only systems or transducers are switch-like devices that provide outputs for processors, controllers, or data acquisition systems. Complete sensor systems provide additional capabilities such as an integral display and/or user interface. For both types of Positive Displacement Flow Meters, performance Specifications include operating pressure, temperature range, maximum material density, connection size, and percent accuracy. Suppliers indicate whether devices are designed to move fluid or gas.

RPD meter shall have an accuracy of $\pm 1\%$ or better and rangeability of 100:1 or better. Ingress protection of meter shall be IP 54 or better.

Material of construction of meter casing shall be either steel or die-cast aluminium with suitable coating on inside and outside for corrosion protection of casing. Meters internal parts material of construction shall be SS 316.

RPD meter shall be tamper proof. Ingress protection of meter shall be IP 54 or better.



There are several metering technologies for Positive Displacement Flow Meters. Gear meters have two rotating gears with synchronized, close-fitting teeth. Oval, spur and helical gears are often used because shaft rotation can be monitored to obtain specific flow rates. Vortex meters measure the frequency with which vortices are shed from a bluff body placed in the flow stream.

Typically, the frequency is proportional to the material velocity. Nutating disc meters use media pressure to rock a disc in a circulating path without causing the disc to rotate about its own axis. A pin that extends from the disc is connected to a counter that monitors the disc's rocking motions. Meters that measure incremental volumes of flow with a piston are also available.

The straight length (if required) of calibrated pipe forming the upstream and downstream parts of the meter tubes shall be cut from one piece of pipe without any intermediate girth weld.

Meters shall be marked with the direction of the flow on the meter and the marking shall be clearly visible.

The meters design shall also ensure protection against damage due to hydraulic shock which may be caused by quick opening / closing of upstream / downstream valves.

Meter shall be provided with non-return valve (NRV) and restriction orifice (RO) in order to prevent reverse rotation and meter over run. Pressure drop across NRV, RO and meter shall be calculated by Vendor. Over flow protection shall be 20% of maximum flow.

Vendor to provide the type approval certification for meter as per OIML R137 and certification from Weights & Measures Department, India with Model & Make details included. Calibration certificate (original + soft copy) shall be provided to Client. One copy of the certificate shall be provided within the packing box of each meter.

RPD meter shall provide a pulse output interface to external monitoring device such as automatic meter reading unit to transmit gas volume flow rate information.

RPD meter shall have provision to integrate with Automatic Meter Reading (AMR) and either integral or external Electronic Volume Corrector (EVC), with encrypted communication capability via various communication options.

An optional optical communication port shall be provided in order to access meter metrological information and diagnostic database.

AMR and EVC shall be powered by lithium-ion battery. The life of battery shall be optimum with respect to the performance and communication capability of the AMR.

Refer EVC Datasheet for detailed specifications.

5.4.1 Non Return Valve and Restriction Orifice

Non return valve (NRV) shall be swing type check valve and shall be provided downstream of RPD meter in order to prevent meter reverse rotation. Check valve shall be suitable for natural gas application.

Check valve size, pressure rating and end connections shall be in accordance with the meter supplied. Valve accessories such as carbon steel companion flanges and spare gaskets shall be provided by Vendor.



Maximum allowable pressure drop across the valve shall be 50 mbar.

Material of construction (MOC) of body, cover and hinge shall be ASTM A216 Gr.WCB or equivalent. MOC of disc, seat and hinge pin shall be Alloy 20 and gasket shall be PTFE.

Restriction orifice (RO) shall be provided between meter and NRV in order to prevent meter over run. Material of construction (MOC) of RO shall be SS 316.

5.5 Turbine Meter

The turbine meter shall be axial flow type gas turbine meter in which the entire gas stream passes through the turbine meter rotor. The turbine metering of natural gas shall be designed, manufactured and tested, as per AGA report no. 7.

Transmitter and other electrical accessories of Turbine meter shall be suitable for area classification. Enclosure of intrinsically safe system shall be weather proof as per NEMA 4. Explosion proof enclosure shall also be made weather proof as per NEMA 4 + 7.

Vendor shall furnish the sizing calculations to justify the selection of turbine meters considering the density/compressibility of the given composition of the gas. The sizing shall be done at the minimum operating pressure with compressibility factor of 1.0. The maximum velocity through the Turbine meter shall be less than 20 m/sec.

Material of construction of meter casing shall be either steel or die-cast aluminium with suitable coating on inside and outside for corrosion protection of casing. Meters internal parts material of construction shall be SS 316.

The pulse generator shall be non-contact proximity switches mounted near turbine wheel and reference wheel or non-contact type pulse pick up unit. The unit shall be tropicalized hermetically sealed and shall be either intrinsically safe or explosion proof and shall be weatherproof to NEMA 4.

Turbine meter shall have local index head with mechanical / electronic 8-digit totalizer. Electronic totalizer (when supplied) shall have LCD indication and shall be complete with dry cell batteries for power lasting for one year. The system shall be immune to RF / FM interferences in that area.

Straightening vanes shall be provided to eliminate swirls and cross current setup by the pipe-fittings, valves or regulators preceding the meter inlet piping. Straightening vanes shall be designed according to latest revision of AGA Report No-3. Straightening vanes shall be tube bundle of 316 SS tubes and shall be designed and approved by the meter manufacturer.

Vendor shall furnish pressure drop figures for each turbine meter, flow straightener at normal operating conditions and at maximum flow condition. Turbine meter shall have a continuous monitoring feature for detecting missing blades or bearing problems and to give alarm in such situation.

The meters shall be certified by Weights and Measures department, and shall be calibrated to an accuracy of $\pm 0.5\%$ band. Vendor shall furnish the documentary proof in support of the above along with certified calibration curve.



All meters selected shall be of field proven quality with respect to design, material and application. Field mounted instruments shall be capable of working under high ambient Temperature and environmental condition without any degradation in accuracy and repeatability.

The turbine meter shall be calibrated with /natural gas near operating pressure and shall have following performance: -

- Range-ability: Range-ability of Turbine meter shall be 20: 1 for Meter sizes above G100 and for Turbine meters with size less than or equal to G 100 range-ability shall be 10:1 Repeatability: $\pm 0.1\%$;
- Accuracy: For flow rates between 5% and 20% (of Meter max) at operating pressure the calibration curve shall be within an envelope of $\pm 1\%$ and for flow rates between 20 % to 100% (of meter max.) at operating pressure the calibration curve (min. 7 points) shall be within an envelope of $\pm 0.5\%$;
- Repeatability: The repeatability of meter shall be $\pm 0.1\%$ from Q_{min} to Q_{max} .

The turbine meters shall have HF pulses on the meter head and shall be connected to the flow computer. For Turbine meter of size up to 2", one (1) HF pulse and one (1) LF pulse is also acceptable. However, for Turbine meter of size 3" and above, two (2) nos. of HF pulse is required.

The turbine flow meter shall be wet calibrated (at average operating/ skid outlet pressure) as per operating conditions along with its supplied flow conditioner. The supplied bundled tube flow conditioner/ straightener shall be used during flow calibration.

The meter tubes/ meter run of other make/ supply can also be used during calibration. Rotor and all wetted parts shall be of Metallic and no Plastic / Non-metallic parts shall be not be used in internal parts of Turbine meter.

Turbine meter shall have an accuracy of $\pm 1\%$ or better, rangeability of 20:1 or better and repeatability of $\pm 1\%$ or better for calibrated range. Ingress protection of meter shall be IP 54 or better.

Vendor to provide the type approval certification for meter as per OIML R137 and certification from Weights & Measures Department, India with Model & Make details included. Calibration certificate (original + soft copy) shall be provided to Client. One copy of the certificate shall be provided within the packing box of each meter.

Turbine meter shall provide a pulse output interface to external monitoring device such as automatic meter reading unit to transmit gas volume flow rate information.

Turbine meter shall have provision to integrate with Automatic Meter Reading (AMR) and either integral or external Electronic Volume Corrector (EVC), with encrypted communication capability via various communication options.

An optional optical communication port shall be provided in order to access meter metrological information and diagnostic database.

AMR and EVC shall be powered by lithium-ion battery. The life of battery shall be optimum with respect to the performance and communication capability of the AMR.

Refer EVC Datasheet for detailed specifications.

5.6 Automatic Meter Reading and Electronic Volume Corrector (EVC)

The AMR system of each meter shall be supplied with integral / external EVC, GPRS modem and SIM cards to record gas consumption and diagnostics from the meters. The meter reading data collected through AMR system shall be uploaded to Bidder's cloud server.

Electronic Volume Corrector (EVC) with built-in pressure and temperature sensors shall be used to convert measured gas volume from operating conditions to reference pressure and temperature conditions.

Electronic Volume Corrector (EVC) with integral battery, modem and data logging capability shall be provided with gas meter.

Vendor shall supply the EVC installed on the suitable mounting frame / arrangement as per HPOIL site requirements. Pressure inputs shall be connected using suitable SS tube fitting and the other end of the tubing will be terminated in a 2-way manifold valve.

Vendor shall provide cables (2.5 meter length) along with cable connectors required between meters and EVC device.

Bidder to ensure compatibility of gas meter, EVC and modem and their performance shall be demonstrated in presence of Client.

Gas meters along with EVC & Modem shall be commissioned in presence of meter supplier service engineer only. Bidder shall ensure his presence at time of commissioning and shall include all cost in their rates. Bidder will ensure presence of their representative for technical assistance during commissioning of skid and no extra cost will be payable to Bidder.

Bidder shall supply software for remote data monitoring through GSM modem. The software shall be installed in HPOIL office / control room and actual performance of software for remote data monitoring shall be carried out by Bidder. All necessary arrangement required to perform software operation shall be done by Bidder at no extra cost.

This SIM card shall not be in scope of bidder. SIM card to be provided by end user.

For Data Hosting details, refer attached "Data Hosting and Service Agreement".

Refer EVC data sheet for detail requirements of volume correction.

5.7 Materials

All the wetted parts including actuating mechanism shall be suitable for the fluid being handled. Material of construction of meter casing shall be either steel or die-cast aluminium with suitable coating on inside and outside for corrosion protection of casing in line with the applicable governing standards.

In case of diaphragm meters, diaphragm material shall be polyester fabric coated with rubber for an endurance life cycle of 80,000 cum. Other Internal parts shall be non – metallic to prevent from tampering like magnet.

Vendor shall use suitable material parts, provide proper surface finish, hardness and clearances, wherever possibilities of galling exists.



For corrosion service, the material selected shall be in compliance with the requirements of NACE MR-0175 / ISO-15156 latest editions.

5.8 Name plate

Each gas meter shall be marked in legible characters, which are permanently visible in accordance with BS EN 1359 / OIML R137 or latest:

- a. Type approval mark and number;
- b. Manufacturer's name and Identification Mark;
- c. Serial Number, Model Name and Model Number;
- d. Flow Rate – Max (Q_{max}) & Min (Q_{min}) - (m^3/h);
- e. Maximum Working Pressure p_{max} (bar);
- f. Flow Direction;
- g. Nominal value of the cyclic volume, V (dm^3);
- h. Number and date of EN Standard;
- i. Ambient temperature range ($^{\circ}C$);
- j. Gas temperature range ($^{\circ}C$);
- k. Accuracy class of the meter, e.g. Class 1.5;
- l. Month & Year of Manufacture.

Type approval number shall be issued by Department of Legal Metrology (W&M) (Government of India). ATEX Marking shall be as per directive 94/9/EC on the electrical / electronic device or module certified.

Owner unique serial number shall be marked on the meter as per the standard procedure followed by Owner, which will be communicated to the successful bidder.

6.0 FABRICATION AND PAINTING

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

Painting shall be such that there is no rust formation on the Meter when exposed continuously to the corrosive atmosphere. All carbon steel bolting shall be hot dip galvanized or cadmium plated and bi-chromated.

Aluminium components shall be anodized then coated with epoxy paint.

The Supplier's painting standard will be considered as an alternative offer provided it meets or exceeds the preceding requirements.

7.0 INSPECTION AND TESTING

Vendor shall perform all inspection and testing as per project specification requirements and as per relevant codes, prior to shipment. The inspection and testing for diaphragm meters shall be carried out as per approved Inspection and Test Plan (ITP).



Vendor shall submit the Inspection and Testing Plan for proprietary items / special items for approval. Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process hazardous area certification test and calibration test.

For any control, test or examination required under the supervision of TPIA / Owner / Owner's representative later shall be informed in writing one (1) week in advance by vendor about inspection date and place along with production schedule.

The Supplier shall provide calibration certificate and accuracy at MAOP of the diaphragm meter for the following flow rates (As per EN 1359):

Q_{MIN}	$0.1Q_{MAX}$	Q_{MAX}

Supplier shall hire Third Party Inspection Agency (to be approved by the Client) to perform inspection work. This agency shall inspect all the equipment/material and issue all inspection certificates/reports as per specifications and codes.

Supplier shall furnish all the material test certificates, proof of approval/ license from specified authority as per specified standard, if relevant, internal test/ inspection reports, accuracy test report for individual meter, as per technical specification and specified code for 100% material, at the time of final inspection of each supply lot of material.

Vendor to provide calibration certificates for review of all the measuring instruments at the time of inspection, i.e., used for checking and testing, along with the Master calibration certificate of the measuring instruments from which the instruments is calibrated.

All meters shall be sealed properly by the Manufacturer after final inspection clearance and before dispatch. Meters found in an unsealed condition shall not be accepted.

If the performance of any of the sample meter is not in compliance with the acceptance norms of the respective standards then that the lot of respective item will be rejected.

Vendor should follow the QAP provided in this tender and inline with 1359:1999+A1 2006.

Even after third party inspection, Owner reserves the right to select a sample of diaphragm meters randomly from each manufacturing batch and have these independently tested. Should the results of these tests fall outside the limits specified in Technical specification, then Owner reserves the rights to reject all production supplied from the batch.

7.1 Visual Inspection

A visual inspection and physical check shall be made for compliance of the material with requirements of the specifications of the original Purchase Order and all subsequent change orders including the relevant attachments and with Manufacturer's catalogue description and certified drawings furnished. Included are:

- Check for satisfactory workmanship, materials compliance and freedom from surface defects and broken glass;
- Check for compliance with certified drawings including dimensions;
- Check for all accessories on Purchase Order;
- Check for required cable length, if any
- Check paint for imperfections.

Verify that each component has a tag of corrosion resistant material permanently fastened to the unit and stamped with information

Verify that all terminals for interconnecting wiring between units are accessible for connecting and checking. Terminal blocks should be numbered and where 2 or more are present, should have block identification. Interconnecting cables shall be colour coded or numbered.

All electrical wiring shall be checked for continuity and insulation test.

7.2 Functional Testing

Each gas meter shall be accurately calibrated and tested by the Manufacturer at the normal working conditions specified in the attached data sheet. All test equipment used for testing shall have traceability to national standards.

7.3 Installation, Testing & Commissioning

The Supplier shall assist during erection, testing and commissioning of gas meters at site. The bidders shall indicate separate pricing for this purpose in their offers, if applicable.

7.4 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.

Generally the 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.

The job specifications / data sheets shall be referred for any specific warranty / guarantee.

8.0 MARKING, PACKING AND SHIPMENT

Vendor responsible for gas meter and its accessories shall ensure that all equipment, associated materials and accessories are designed properly packed, and secured for transit to site without damage.

Supplier / Vendor shall provide a detailed packing list for all the items been supplied. Necessary accessories supplied shall be packed in the main package box for which accessories are been supplied.

The calibration certificates of each item shall be enclosed within the package box. Each package box shall be tagged with the Purchase Order number (unique identification is required).

The package box shall be suitable for inland transport or seaworthy (if imported). Necessary precautions and pre-requisites shall be considered by Supplier for package delivery to the concern Client site / location / workshop.

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

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 job site.

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 with the bid, recommended spare parts list for start-up, pre-commissioning and two year operation as per following:

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

In case of RPD meters, spare gaskets for meter, NRV and RO installation shall be provided by Vendor.

In case of RPD meters, lubricating oil (500 ml) along with feeding accessories shall be supplied with each meter. Lubricating oil bottle (200 ml) shall be included in each meter box packing.

Vendor shall submit recommended accessories and special tools required for operation and maintenance of gas meters for Company's 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 requirements shall be fulfilled by the Vendor at various stages of bidding and execution of order.

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

Documentation provided by Vendor shall be in English language only.

Client and/or Client's representative approval shall always be given in writing.

10.1 Documentation Required with Technical Bid

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

- a. Specification, Data Sheets along with sizing calculations;
- b. Bill of Materials including Vendor List, Details for third party items;
- c. Catalogues and manuals;



- d. Quality Assurance Plan;
- e. Weights & Measures Approval Certificate;
- f. Type approval / Compliance / Examination Certificate confirming to the governing standard;
- g. Pressure Drop Calculations;
- h. Performance Curves;
- i. Deviations from technical specification, if any, with proper justification;
- j. Supplies against major orders for natural gas application (PTR).

The Vendor shall provide at the time of tendering a complete detailed engineering package in accordance with the Purchaser's data requirement and shall include but not necessarily be limited to the same.

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. Datasheets of meters and all accessories supplied;
- b. Bill of materials including Vendor list, details for third party items;
- c. Catalogue and Technical literature of commercial meters in English;
- d. Weights & Measures Approval Certificate;
- e. Type approval / Compliance / Examination Certificate confirming to the governing standard;
- f. Installation, Operation and Maintenance Manual;
- g. Sizing Calculations;
- h. Assembly drawings with overall dimensions;
- i. Detailed sectional drawings showing all parts with reference numbers and material specifications of meters and all accessories supplied;
- j. Welding, heat treatment, inspection and testing procedures;
- k. Painting Specification;
- l. Calibration Certificates;
- m. Material Test Certificates;
- n. Quality Assurance Plan;
- o. Any other documents.

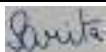
Upon approval and completion of testing, full set of above documentation shall be submitted to Client in 2 sets of hardcopy format and 1 no. of CD in soft copy (PDFs) format.



VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION FOR GAS REGULATORS

VCS-SS-IN-5307_02

					
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**STANDARD SPECIFICATION
FOR
GAS REGULATORS**

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01	18.01.2020					Format change and document numbering is revised.
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		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



ABBREVIATION

ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
CV	Valve Coefficient
FAT	Factory acceptance Test
FCI	Fluid Controls Institute
FM	Factory Mutual
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 gas regulators along with its accessories used in commercial and industrial applications in CGD industry.

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 Petroleum Institute (API)

ASME B 16.10	Face to Face and End to end dimensions for valves
ASME B 16.20	Ring joint Gasket, and grooves for Steel Pipe Flanges
ASME B16.5	Pipe flange and flange fittings
ASME B1.20.1	Pipe Threads
ASME B 16.34	Valves Flanged, threaded and weld ended
EN 334 / BS EN 13785	Gas pressure regulator for inlet pressure up to 100 Bar
EN 14382	Safety devices for gas pressure regulating stations and installations. Gas safety shut-off devices for inlet pressures up to 100 bar
API 598	Valve Inspection and testing
API 6D	Specification for Pipeline valves
BS 6755	Testing of Valves
FC170-2	Control Valve seat leakage Classification
MSS SP-25	Standard Marking System for Valves, Fittings, Flanges and Unions
DIN-50049	Document on Material Testing
ISA-S-75.03	Face to Face Dimensions for Flanged Globe-Style Valve Bodies.

3.2 Order of Precedence

In the event of conflict between specifications, data sheets, related standards, codes etc., and 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 TECHNICAL REQUIREMENTS

Regulator shall be double stage pilot pressure loading. The regulators shall be provided with built-in slam shut off device having over and under pressure shut-off. If required, actual flow rates provided for regulators can be converted into SCMH based on downstream pressure for selection of regulators.

These regulators have fail-open and fail-close configuration. Direct acting regulator is fail-to-open type as per requirements and as defined in EN334 standard. However, when equipped with integrated slam shut-off valves, it is treated as fail-to close due to presence of SSV.

Direct acting pressure regulator with spring control & diaphragm with in-built pressure balance regulating unit to ensure a constant outlet pressure. Pressure sensing shall be internal, external sensing is not acceptable. Regulators shall have Integral Filter. If external filter is supplied, then filter should not cause a pressure loss of more than 5% of line pressure.

Materials selection of the valve shall be in accordance with the Data Sheets and Company's Standard specifications. For corrosive service, the material selected shall be in compliance with the requirements of NACE MR-0175 / ISO-15156 latest editions.

Casing and body shall be of cast Aluminum alloy or WCB (or as per EN 334), all the wetted parts including actuating mechanism shall be suitable for the fluid being handled.

Diaphragm material shall be synthetic rubber and water proof / corrosion resistant for outdoor installation. Pressure parts of the valve shall be suitable for shut-off pressure. Regulators for downstream regulation shall be provided with integral relief valve.

Supplier shall indicate the set range for OPSO, UPSO and relief pressures. The regulators shall be factory-set to the pressures indicated in the respective data sheets.

Vendor shall use suitable material parts, provide proper surface finish, hardness and clearances, wherever possibilities of galling exists.

The regulator body rating shall be equal to or better than the flange rating specified in the data sheets.

Flow direction shall be stamped or cast on the body.

Unless otherwise mentioned, end connection details shall be as below:

- a. Threaded end connections shall be NPT as per ANSI/ASME B 1.20.1;
- b. Flanged end connections shall be as per ANSI / ASME B16.5;
- c. Flanged face finish as specified in the Data Sheets shall have cone serrations as follows:



Serrated	250 to 500 AARH
125 AARH	125 to 200 AARH
63AARH	32 to 63 AARH

Face to face dimensions of flanged valves shall be in accordance with ISA S75.03. The allowable error in dimensions shall be ± 2 mm.

The term "trim" covers those parts of body assembly (excluding the body, bonnet and bottom flange) which are exposed to and in contact with the line medium consisting of but not limited to the seat ring, plug stem, plug, plug guide, guide bushing and cage.

Single seated valves shall have heavy top guiding. Double seated valves shall have top and bottom or cage guiding and shall be of the pressure balanced type. Guide bushing shall be of a sufficiently hard material to resist side thrust on the plug.

Vendor shall furnish the sizing calculations for minimum, normal and maximum flow. Cv selected shall also be indicated. Droop for regulator shall not be more than 5 % over set point. Noise level shall be limited to 85 dB.

The regulators are meant for installation at various Client's premises, where space availability is the main constraint. The model shall be selected in such a way that it is compact and robust to suit the site conditions. Client has right to reject any model, proposed by the bidder, considering the size and shape of the regulator offered by them.

Refer the attached datasheet of regulator for further details.

4.1 Name Plate

All Regulators 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. Certification;
- b. Manufacturer's Name and Identification Mark;
- c. Serial Number, Model Name and Model Number;
- d. Body and port sizes in inches;
- e. Stem travel in millimeters;
- f. Regulation upstream / downstream;
- g. Set Pressure;
- h. Nominal end connection size in inches and rating in Ibs;
- i. Flow Direction;
- j. Area Classification;
- k. Standard for body / trim materials;
- l. Accuracy Class;



m. Month & Year of Manufacture.

Owner unique serial number shall be marked on the regulator as per the standard procedure followed by Owner, which will be communicated to the successful bidder.

5.0 FABRICATION AND PAINTING

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

Vendor shall submit painting specification for Client's approval, prior to start of regulator manufacturing. Painting scheme shall be suitable to environmental conditions prevailing at the place of installation of regulator.

6.0 INSPECTION AND TESTING

Vendor shall perform all inspection and testing as per project specification requirements and as per relevant codes, prior to shipment. The inspection and testing for regulators shall be carried out as per approved Inspection and Test Plan.

Vendor shall submit the Inspection and Testing Plan for proprietary items / special items for Client approval, before commencing production. Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process such as hydro test, material test, hazardous area certification test and calibration test.

For any control, test or examination required under the supervision of TPIA / Owner / Owner's representative later shall be informed in writing one (1) week in advance by vendor about inspection date and place along with production schedule.

Supplier shall hire Third Party Inspection Agency (to be approved by the Client) to perform inspection work. This agency shall inspect all the equipment/material and issue all inspection certificates / reports as per specifications and codes.

Supplier shall furnish all the material test certificates, proof of approval/ license from specified authority as per specified standard, if relevant, internal test/ inspection reports, accuracy test report for individual meter, as per technical specification and specified code for 100% material, at the time of final inspection of each supply lot of material.

Vendor to provide calibration certificates for review of all the measuring instruments at the time of inspection, i.e., used for checking and testing, along with the Master calibration certificate of the measuring instruments from which the instruments is calibrated.

All regulators shall be sealed properly by the Manufacturer after final inspection clearance and before dispatch. Regulators found in an unsealed condition shall not be accepted.

If the performance of any of the sample regulator is not in compliance with the acceptance norms of the respective standards then that the lot of respective item will be rejected.

Leak testing shall be carried out by pressurising the body with air at 1.5 MAOP of the regulator, immersed in water for observance of leakage. The Supplier shall carryout calibration for 100% quantity.



The regulators shall be tested as per EN334 and relevant international standards.

Even after third party inspection, Client reserves the right to select a sample randomly from each manufacturing batch and have these independently tested. Should the results of these tests fall outside the limits specified in Client Technical specification, then Client reserves the right to reject all production supplied from the batch.

6.1 Visual Inspection

A visual inspection and physical check shall be made for compliance of the material with requirements of the specifications of the original Purchase Order and all subsequent change orders including the relevant attachments and with Manufacturer's catalogue description and certified drawings furnished. Included are:

- a. Check for satisfactory workmanship, materials compliance and freedom from surface defects and broken glass;
- b. Check for compliance with certified drawings including dimensions;
- c. Check for all accessories on Purchase Order;
- d. Check paint for imperfections.

Verify that each component has a tag of corrosion resistant material permanently fastened to the unit and stamped with information

6.2 Functional Testing

Each regulator shall be accurately calibrated and tested by the Manufacturer at the normal working conditions specified in the attached data sheet. All test equipment used for testing shall have traceability to national standards.

6.3 Installation, Testing & Commissioning

The Supplier shall assist during erection, testing and commissioning of regulator at site. The bidders shall indicate separate pricing for this purpose in their offers, if applicable.

6.4 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.

Generally the 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.

The job specifications / data sheets shall be referred for any specific warranty / guarantee.

7.0 MARKING, PACKING AND SHIPMENT

Vendor responsible for regulator and its accessories shall ensure that all equipment, associated materials and accessories are designed properly, marked and packed, and secured for transit to site without damage.



Supplier / Vendor shall provide a detailed packing list for all the items been supplied. Necessary accessories supplied shall be packed in the main package box for which accessories are been supplied.

The calibration certificates of each item shall be enclosed within the package box. Each package box shall be tagged with the Purchase Order number (unique identification is required).

The package box shall be suitable for INLAND transport or seaworthy (if imported). Necessary precautions and pre-requisites shall be considered by supplier for package delivery to the concern client site / location / workshop.

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

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 job site.

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.

8.0 SPARES AND ACCESSORIES

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

The Vendor shall include with the bid, 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 submit recommend accessories and special tools required for operation and maintenance of regulators 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.



9.0 DOCUMENTATION

The following documentation requirements shall be fulfilled by the Vendor at various stages of bidding and execution of order.

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

Client and/or Client's representative approval shall always be given in writing.

9.1 Documentation Required with Technical Bid

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

- a. Specification, Data Sheets along with sizing calculations;
- b. Bill of Materials including Vendor List, Details for third party items;
- c. Catalogues and manuals;
- d. Quality Assurance Plan;
- e. Weights & Measures Approval Certificate;
- f. Type approval / Compliance / Examination Certificate confirming to the governing standard;
- g. Pressure Drop Calculations;
- h. Performance Curves;
- i. Deviations from technical specification, if any, with proper justification;
- j. Supplies against major orders for natural gas application (PTR).

The Vendor shall provide at the time of tendering a complete detailed engineering package in accordance with the Purchaser's data requirement and shall include but not necessarily be limited to the same.

9.2 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. Datasheets of regulators and all accessories supplied;
- b. Bill of materials including Vendor list, details for third party items;
- c. Catalogue and Technical literature of regulators in English;
- d. Weights & Measures Approval Certificate;



- e. Type approval / Compliance / Examination Certificate confirming to the governing standard;
- f. Installation, Operation and Maintenance Manual;
- g. Sizing Calculations;
- h. Assembly drawings with overall dimensions;
- i. Detailed sectional drawings showing all parts with reference numbers and material specifications of regulators and all accessories supplied;
- j. Welding, heat treatment, inspection and testing procedures;
- k. Painting Specification;
- l. Calibration Certificates;
- m. Material Test Certificates;
- n. Quality Assurance Plan;
- o. Any other documents.

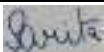
Upon approval and completion of testing, full set of above documentation shall be submitted to Client in 2 sets of hardcopy format and 1 no. of CD in soft copy (PDFs) format.



VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION FOR RESTRICTION ORIFICE PLATES

VCS-SS-IN-5402_02

					
02	11.05.2022	SV	KNC	HK	GVW
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**STANDARD SPECIFICATION
FOR
RESTRICTION ORIFICE PLATES**

**DOCNO: VCS-SS-IN-5402
Rev No : 02**

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	23.05.2018	Neha Dev	Udit Manichanda	K.Prasanth	Anupam Das	
01	18.01.2020					Format change and document numbering is revised.
		Debayan Ghoshal	Vinod Babu	Kedarnath Chakraborty	Anupam Das	
02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



ABBREVIATION

AARH	Arithmetic Average Roughness Height
AGA	American Gas Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BS	British Standard
FM	Factory Mutual
GPA	Gas Processors Association
ISA	Instrument Society of America
IS	Indian Standards
ISO	International Organization for Standardization
NACE	National Association of Corrosion Engineers
NPT	Nominal Pipe Thread
RTJ	Ring Type Joint
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, inspection and testing, documentation, marking, packing and shipping of Restriction Orifice Plates

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.

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
AGA Report No 3 / API-2530 / GPA 8185	Manual of Petroleum Measurement Standards, Chapter 14 – Natural Gas Fluid Measurement. Orifice Metering of Natural Gas.
AGA Report no 7	Measurement of Gas by Turbine flow meter
BS-1042	Measurement of Fluid Flow in closed conduits
ISO-5167	Measurement of fluid flow by means of orifice plates, nozzles and venturi tubes inserted in circular cross-section conduits running full
ISO 5168	Measurement of fluid flow-estimation of uncertainty of a flow-rate measurement
NACE MR-01-75	Sulphide Stress Cracking Resistant Metallic Materials for Oil Field 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.

The material used for the flow element shall be SS-316 as minimum unless and otherwise specified in the Job Specifications / Data Sheets.

5.0 DESIGN

5.1 General

Restriction Orifice Plates are devices which are used to create a certain pressure drop or to limit the flow rate. For high pressure drops consideration should be given to hard facing of the plate, or the selection of a material which can be hardened throughout.

Unless or otherwise mentioned in project specifications / datasheets, Restriction Orifice Plates shall be concentric, square edged type. For very high pressure drop across the plate, Vendor shall consider multistage Restriction orifice design, either of concentric or eccentric type. The multi stages shall be calculated by considering the required downstream pressure, DP across and Beta ratio.

Vendor shall be responsible for the supply of all the necessary accessories like carrier ring, gaskets, nuts, bolts, etc. to make a complete assembly. Where weld-in type Restriction Orifice plates have been specified, the welding and preparation shall be as per ANSI / ASME B 36.10, unless otherwise specified in project specifications. Where the Restriction Orifice plate is mounted between ring-type joint flanges, Vendor shall supply the plate with a plate carrying holder. Each Restriction Orifice Plate shall have an integral handle which shall, upon assembly with flanges, extend to a distance of 50mm.

The internal and external diameter of the pipe, the orifice bore diameter of the pipe, the Orifice bore diameter (whenever bore diameter calculations fall under the Purchaser's scope of work) etc. The Restriction Orifice diameter resulting from sizing, the required dimension shall be calculated dimension rounded off to the nearest 0.1 mm.

The need of bleed hole shall only be specified for Restriction Orifice plates in horizontal piping of 2" or larger. Vendor shall confirm the "Stress and deflection" calculation for the Restriction Orifice plates and confirm the plate thickness. The calculations shall be submitted along with the bids for approval and after placement of order.

Noise calculation shall be furnished for all the Restriction Orifice Plates and the plate design shall be such that the noise level shall be kept below 85 dBA for normal continuous applications. The calculations shall be submitted along with the bids for approval and after placement of order. When Noise limit is exceeded, Vendor shall provide multi-hole or multi-plate design.

For intermittent operations such as blow down applications where the noise exceeds 85 dBA, the higher noise levels may be permitted depending on the duration and exposure or as specified in the Project Specifications / Data sheets.



The project specifications, datasheets shall be referred for exact value & requirements, Vendor shall size the Restriction Orifice plate as ISO 5167 (latest Edition) or R.W.Miller "sizing of Restriction Orifice Plates for flow measurement "and submit the calculation sheet for approval.

5.2 Name Plate Details

- a. Tag Number as provided in the Data Sheet.
- b. Manufacturer's name or trade Mark.
- c. type, model no., serial no.
- d. Material of construction.
- e. Nominal pipe size in inches rating in pounds.

6.0 FABRICATION AND PAINTING

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Restriction Orifice Plates. Vendor shall submit the required specification, drawings & documents for approval. Also vendor shall refer the relevant codes and standards for manufacturing herein. Painting of Restriction Orifice plates shall be in accordance with Company Painting Specifications or as per Project Specifications for Restriction Orifice plates.

Restriction Orifice Plate surface shall be thoroughly cleaned, freed from rust and grease and applied with sufficient coats of corrosion resistant paint suitable for marine/industrial environment as indicated in the data sheet.

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 Restriction Orifice Plates 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 numbers of Orifice plates and accessories 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 restriction orifice plates and its accessories.

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. Hydrostatic Test at 1.5 times the maximum operating pressure
- c. Radiography Test
- d. Material and chemical analysis tests Hydrostatic 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.

Unless otherwise specified, purchaser reserves the right to test and inspect all the items at the vendor's works.

Vendor shall submit following test certificates and test reports for Purchaser's review:-

- a. Material test certificate (MIL Certificate) with detailed chemical analysis from the foundry for Restriction Orifice plates and flanges.
- b. Certificate of Radiography / X-ray for any welded joints and any casting of 600# and above. Dye penetration test certificate shall be provided for joints where Radiography / X-ray is not possible.
- c. Dimensional test report.
- d. All other test reports & certificates required for NACE compliance.

If specified in the Purchase Order the orifice assemblies shall be inspected by the Purchaser's designated inspector before despatch unless otherwise specified. Inspection by the Purchaser's inspector shall be restricted to the following:

- i. Visual examination and dimensional check of the process connection.
- ii. Verification of testing as mentioned under factory testing.
- iii. Verification of material certificates.
- iv. Verification of NACE compliance if applicable.

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 Restriction Orifice Plates and its accessories, 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 Restriction Orifice Plates and its accessories are functioning correctly and properly in accordance with the specified requirements.



8.0 MARKING, PACKING AND SHIPMENT

Following FAT completion, Vendor responsible for Restriction Orifice Plates and its accessories 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 / Contractor's inspectors. All costs occasioned by such rejection shall be to account of the Vendor.

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

Restriction Orifice plates shall be packed inside polythene bags with suitable protective packing outside. Each plate shall be packed separately if necessary in carton boxes suitable for Air/Sea shipment.

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 with the bid recommended spare parts list for start-up, pre-commissioning and two year operation as per following:

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

The Vendor shall submit recommended accessories and special tools required for operation and maintenance of flow elements for 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. Specification, Data Sheets.
- b. Bill of Materials including Vendor List, Details for 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. NACE Compliance Certificate
- i. Radiography and Hydrostatic test certificates
- j. Sizing calculation for Restriction Orifice plates

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.

Generally the 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.

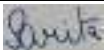
The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION FOR PRESSURE SAFETY RELIEF VALVE

VCS-SS-IN-5504_02

					
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00	23.05.2018	ND	UM	KP	AD
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

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STANDARD SPECIFICATION
FOR
PRESSURE SAFETY RELIEF VALVE

DOCNO: VCS-SS-IN-5504
Rev No : 02

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		Debayan Ghoshal	Vinod Babu	Kedarnath Chakraborty	Anupam Das	
02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



ABBREVIATION

AARH	Arithmetic Average Roughness Height
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
FAT	Factory Acceptance Test
IBR	Factory Acceptance Test
ISO	International Organization for Standardization
MOP	Maximum Operating Pressure
NACE	National Association of Corrosion Engineers
NPS	Nominal Pipe Size
NPT	Nominal Pipe Thread
PSV	Pressure Safety Relief Valve
SAT	Site Acceptance Test
Sec	Section



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1 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 Safety Relief Valves along with its accessories.

2 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 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 National Standard Institute (ANSI) / American Society of Mechanical Engineers (ASME)

B1.20.1	Pipe Threads
B 16.5	Steel Pipe Flanges and Flanged Fitting
B 16.20	Ring Joint Gaskets and Grooves for Steel Pipe Flanges
B 16.34	Valves- Flanged, Threaded and Welding End

American Society of Mechanical Engineers (ASME)

Sec-VIII	Boiler and Pressure Vessel Code Section VIII 'Pressure Vessels'
Sec-I	Boiler and Pressure Vessel Code Section-I 'Power Boilers'

American Petroleum Institute (API)

API-520	Sizing, selection and installation of pressure relieving devices in refineries
	Part I Sizing & Selection
	Part II Installation
API-521	Guide for Pressure Relieving and Depressurizing systems
API-526	Flanged Steel Pressure Relief Valves
API-527	Seat Tightness of Pressure Relief Valves
EN10204	Inspection Documents for Metallic Products
IBR	Indian Boiler Regulations

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 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 DESIGN

5.1 Valve Design

5.1.1 The definitions of various terminologies used in Purchaser's Data Sheets are as per clause 1.2 of API RP 520 PART 1.

The design of pressure relief valves in steam service under IBR design code shall be governed by regulation 294 and regulation 295 of IBR. However where design code is specifically indicated as ASME SECTION-I, the valve design shall meet the pressure safety relief valve requirements specified in ASME SECTION-I.

Adequate support of relief valves shall be provided, since they are subjected to high reaction forces when they are relieving.

The Valve body, end connections shall be of the same material as the piping material Specification. The body and internal material shall meet the design temperature. Material selection should be in accordance with API STANDARD 526.

Pressure loss between the equipment / vessel nozzles and the inlet of the Valve shall not exceed 3% of the Valve set pressure.

5.2 Type and Selection of Safety Relief Valve

Safety Valves shall be primarily used for Compressible fluids and Safety Relief Valves shall be used for incompressible fluids.

Unless otherwise specified, the Safety Relief Valves shall be non-balanced closed bonnet direct spring-loaded type, i.e. conventional. For special applications pilot operated Safety / Relief Valves or air-assisted Relief Valves may be employed. Safety Valve sizing shall be as per API 520 and the allowable accumulation shall be as per ASME CODE. The Valve sizes, inlet/outlet connections, orifice area shall be sized as per API 526. The range of standard sizes used and the set pressure limits shall be sized in accordance with standard API 526.

The orifice designations, materials, area, end connection sizes and rating shall be as per API RP 526 for flanged steel Safety Relief Valves. Seat tightness requirements and testing shall be as per API RP 527.

Set pressure and accumulation pressure shall be as per the applicable pressure vessel design code:

ASME section VIII Pressure Vessels

ASME section I Power boilers / Steam generators

Generally the Thermal Relief Valve shall be modified or semi-nozzle type. Thermal Relief Valves shall have an orifice area of 0.11 Sq. in. and minimum size shall be 101 unless otherwise specified.



Where a number of Relief Valves are provided in parallel, the set pressures may be staggered to avoid valve chatter.

The criteria for the selection of a Relief Valve shall be as given below:

5.2.1 Conventional Safety Relief Valve

The Blow down shall not exceed 3% of the valve set pressure as per standard ASME SECTION I and shall not exceed 7% of the valve set pressure as per standard ASME SECTION VIII.

a. Non-balanced spring-loaded relief valves

A conventional Pressure Safety Relief Valve shall be a self-actuated spring loaded Pressure Safety Relief Valve which shall be designed to open at a pre-determined pressure and protect a vessel or system from excess pressure by removing or relieving fluid from that vessel or system.

- i. A conventional Safety/Relief Valve shall be used in the following cases:
- ii. Back pressure (super-imposed and built-up) is constant.
- iii. Superimposed back pressure is less than 5% and built-up back pressure is less than 10% of the set pressure with overpressure at 10%.
- iv. Superimposed back pressure is less than 10% and built-up back pressure is less than 20% of the set pressure with accumulation at 21%.

For cases where a constant back pressure is exerted, the spring of the Safety Relief Valve should be selected and set for the difference between the set pressure (being the maximum allowable working pressure) and the constant back pressure. Spring-loaded Relief Valves connected to a closed discharge system shall always have a closed Bonnet.

Blow down ring shall be provided to adjust the blow down line within 2.5% to 7% of the Valve set pressure.

b. Non-balanced spring-loaded relief valves

A balanced Pressure Safety Relief Valve shall be a spring loaded Pressure Safety /Relief Valve which incorporates a bellows or other means of balancing the Valve disc to minimize the effects of back pressure on the performance characteristics of the Valve.

A balanced type of Safety/Relief Valve shall be provided when the variable back pressure (gauge) is higher than allowed for a conventional Valve.

The maximum superimposed and built-up back pressure (gauge) shall not exceed 65 % (Preferably 50%) of the set pressure (gauge) for relief of vapors or flashing liquids.

Safety/Relief Valves of the balanced type shall have a vented bonnet which shall be vented to atmosphere in such a manner as to prevent the ingress of rain and dirt. Hazards to personnel should be avoided. However, any flow from the vent should be visible.

Whenever the balanced bellow spring type Valve is used, there is always a potential risk of bellow rupture or damage. In such applications, the Valve with supplementary piston shall be provided. The outlet Valve line size shall be large enough to accommodate the internal drain or in case of the balanced bellow spring type Valve, the vent shall be directly routed to the flare atmosphere.



5.2.2 Pilot – Operated Relief Valve

Pilot Design shall be inherently fail safe. Self-actuated Pilot operated Valves shall be of pop / modulating action and it shall be supplied with main Valve and pilot Valve completely piped and tubed along with other accessories specified such as back-flow preventer. Pilot-operated Safety Relief Valves may be used in a clean gas or liquid service where proper operation of the pilot Valve is always assured, provided that, where required, permission has been obtained from local authorities. The pilot Valve shall be of the non-flowing type. With this type, the flow through the pilot lines and pilot valve ceases immediately when the main valve opens, thus minimizing the likelihood of foreign matter being drawn into the small bore sections of the Valve.

Situations in which pilot-operated Safety Relief Valves are particularly suitable are:

- a. Where the pressure loss between the protected equipment and the inlet flange of the Relief Valve exceeds 3 % of the set Pressure of the Relief Valve;
- b. Where high back-pressures (50 % to 70 % of set pressure) are possible;
- c. If the margin between the maximum operating pressure (MOP) of the protected system and the Relief Valve set pressure is less than 10 % of the relief valve set pressure.

The O-ring and diaphragm material of pilot shall be suitable for the pressure and temperature conditions specified in the data sheet.

All Pressure Safety Relief Valves in oxygen and chlorine service shall be thoroughly degreased using reagents like trichloro-ethylene or carbon tetrachloride. End connections shall be blinded / plugged after this degreasing process to avoid images of oil particles.

Normally pilot operated Valves are provided with soft seals which give a better valve tightness.

5.2.3 Rupture Disc

Generally Rupture discs shall be used where:

- a. Relief loads caused by unexpected sources cannot be handled fast enough by Safety Relief Valves.
- b. On the inlet side of a Relief Valve to protect the valve if the process fluid is extremely corrosive, or polymerizes, or to ensure against valve leakage of hazardous and toxic fluids.

When the rupture disc is used in association with the Safety Relief valve to protect the valve internals, the line pressure of rupture disc/valve void shall be monitored using Pressure gauge.

Unless otherwise specified, the bursting tolerance of the disc shall be as follows:

- a. For bursting pressure of 1 bar gauge and above, tolerance shall be $\pm 5\%$ of the specified bursting pressure or less.



- b. For bursting pressures below 1 bar gauge Vendor's stated bursting tolerance is acceptable.

Where Vacuum services are encountered, Vendor shall provide vacuum supports. Retainer ring shall also be provided to hold the vacuum support and the rupture disc in place.

5.3 Valve Sizing

- 5.3.1 Sizing shall be carried out using the formulae mentioned in the following standards whenever the sizing code mentioned in the Purchaser's Data Sheets refers to these;

Sizing Code	Standard
API	API RP 520 Part I API RP 521
ASME	Boiler and Pressure vessel code Section VIII 'Pressure Vessels'. Boilers and Pressure vessel code Section-I. - 'Power Boilers'
IBR	Indian Boiler Regulations, paragraph - 293

5.3.2 Discharge Co-efficient

Following discharge coefficient values shall be used for sizing of Pressure Relief Valves;

- For all Valves in gas, vapor or steam service with design code as ASME Sec VIII or ASME Section I discharge co-efficient of 0.975 as per API 520 shall be used.
- For all Valves in steam service covered under IBR design code, discharge coefficient shall either be selected as per Regulation 293 or as tested and certified by IBR as per Appendix 'L' of IBR.
- For Valves in liquid service, the discharge coefficient of 0.62 shall be used as per API 520. However Vendor may use the ASME certified valve coefficients when Pressure Safety Relief Valve with liquid trim design are offered.
- For the selected orifice letter designation and inlet and outlet size of the Pressure Safety Relief Valve, relieving area of the valve offered by Vendor shall meet those in API-526.
- The discharge capacity of the selected Pressure Safety Relief Valves shall be calculated based on certified ASME capacity curves or by using ASME certified discharge coefficient and actual orifice area. Higher valve size shall be selected in case pressure safety relief valve discharge capacity so computed, is less than the required flow rate.
- For Pressure Safety Relief Valve covered under ASME SEC-I design code, the Valve design shall conform to ASME SECTION I requirements with selected area higher of the area calculated as per ASME SECTION I requirements and that calculated as per regulation 293 of IBR.



5.4 Valve Construction

5.4.1 Body

- a. The Valve body material shall be in accordance with the piping material Specification and rating with a minimum of ANSI 150 Ibs. Minimum inlet connections for flanged valves are 1-inch.
- b. Flanges shall be integrally cast type, slip-on or weld-on flanges shall not be allowed, except as approved by the Company.
- c. Unless otherwise mentioned, end connection details shall be as below:
 - i. Threaded end connections shall be to NPT as per ANSI/ASME B 1.20.1.
 - ii. Flanged end connections shall be as per ANSI/ASME B 16.5.
- d. Flanged face finish shall be as per clauses 6.4.4.1, 6.4.4.2 and 6.4.4.3 of ANSI/ASME B 16.5. The face finish as specified in the Data Sheets, shall be as follows;

125 AARH	125 to 200 AARH
63 AARH	32 to 63 AARH
- e. For flanged Valves, inlet and outlet sizes and ratings and centre to flange face dimensions shall be in accordance with API-526. Dimensional tolerance shall be as mentioned therein.
- f. Body drain with a plug shall be provided as a standard feature on every pressure relief valve.
- g. For the pilot operated Pressure Relief Valves, where Vendor's standard model provides only semi nozzle design (i.e. the body is part of the inlet flow path), body material shall be of the same material as that of nozzle specified in Purchaser's Data Sheets, as a minimum.

5.4.2 Trim

- a. The term 'trim' covers all the parts of the valves exposed to and in contact with the process fluid except for the body and bonnet assembly i.e. nozzle, disc, disc holder, stem etc.
- b. Wherever stellite of disc and nozzle has been specified, it stands for stellite of the seat joint and the entire disc contour, unless otherwise mentioned.
- c. For high temperature application, the materials for the internals shall be selected to avoid galling.
- d. Pressure Relief Valves with design as per ASME Section I shall have two adjustable rings to adjust Valve over-pressure and blow down.



- e. Resilient seat, seals or O-rings wherever used shall be suitable for pressure and temperature conditions specified.
- f. Gaskets wherever used shall be metallic type. Gaskets with asbestos filler or with asbestos bearing material shall not be used.

5.4.3 Nozzle Disc

- a. The Valves shall be full Nozzle - full lift type. The nozzle shall be of forged construction. A full nozzle shall be used for conventional and balance bellows type, for Valve size 1" and larger. Semi-nozzle are acceptable for pilot operated PSV, in accordance with API RP-520.
- b. Valves shall be of the full nozzle type of design with the exception as per clause 5.3.4 and Valves in Thermal Relief application.
- c. Modified nozzle shall be provided for Thermal Relief Valve services for Valve sizes not greater than 3/4"x 1" unless otherwise specified.
- d. The disc is a piston type held against process pressure by a spring, Disc, nozzle, guide and ring are Vendor's standard stainless steel as a minimum except where the line classification dictates a better material.

5.4.4 Bonnet & Spring

- a. Lifting lever shall be provided whenever the fluid to be relieved is steam and air or water above 65°C.
- b. Bonnet shall be of the closed type for all process applications in general. Open type bonnet shall be used only for steam and non-hazardous/non-toxic fluids. For all steam applications under design code IBR or ASME Section-I with open bonnet design, weather protection cover shall be provided.
- c. Carbon steel springs shall be made corrosion resistant through plating/coating as per Manufacturer's standard design or as specified in the Purchaser's Data Sheets.
- d. Spring material is carbon steel up to 230°C and tungsten steel for higher temperatures. The spring is adjustable for popping pressures within Code allowances above and below initial set pressure.
- e. The spring shall be designed for specified set pressure and suitable for a minimum range of adjustment within +/-10% of set pressure specified for set pressure range below 17 bar and within +/-5% of set pressure above 17 bar.
- f. The allowable tolerance in set pressures are as below:
 - i. ± 0.14 kg/cm²g for set pressure upto and including 5 kg/cm²g.
 - ii. $\pm 3\%$ for set pressure above 5 kg/cm²g.
- g. The springs of safety relief valves shall be protected with a suitable coating to prevent the occurrence of general corrosion and / or sulfide stress corrosion cracking.



5.4.5 Cap

All Valves shall be provided with a cap over the adjusting bolt. Cap shall be of either bolted type or screwed type as specified in the Purchaser's Data Sheets with the cap material being the same as for the body. The cap and bonnet will be provided with lugs for wire seal after setting the Valve. Bolted cap will also be provided as per the requirements.

5.5 Name Plate

All Pressure Gauges 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 serial number and / or model number;
- c. Manufacturer's name / trade mark;
- d. Nominal Flange size in inches and rating in pounds for both inlet and outlet;
- e. Orifice letter designation;
- f. Valve set pressure;
- g. Cold Bench test set pressure.

6 FABRICATION AND PAINTING

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Pressure Safety Relief Valve. Vendor shall submit the required Specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing herein. Painting of Pressure Safety Relief Valve shall be in accordance with Company painting Specifications.

7 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 Safety Relief Valve 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 Safety Relief Valve 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 Relief Valve.

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. Cold bench set pressure test
- e. Functional test
- f. Non-Destructive examination of individual components of PRV.
- g. Hydrostatic pressure Test
- h. Seat tightness Test
- i. Hardness test as per NACE MR01-75 (If Applicable)
- j. Any other tests

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 Pressure Safety Relief Valve 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 Safety Relief Valve functions correctly and properly in accordance with the specified requirements.

8 MARKING, PACKING AND SHIPMENT

Following FAT completion, Vendor responsible for the Pressure Safety Relief Valve 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 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 Safety Relief Valve, 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 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. Sizing calculations;
- c. Bill of Materials including Vendor list, details of third party items;
- d. Catalogues and Manuals;
- e. Quality Assurance Plan;
- 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. Sizing calculations;
- c. Bill of materials including Vendor list, details for third party items;
- d. Catalogues, Manuals and relevant drawings and documents;
- e. Dimensional drawings;
- f. Detailed sectional drawings showing all parts with reference numbers;
- g. Calibration certificates;



- h. Material test certificates;
- i. Installation procedures for PSV and its accessories
- j. Procedures for FAT;
- k. Quality Assurance Plan;
- l. 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.

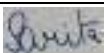
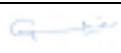
The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION FOR INSTRUMENTATION CABLES

VCS-SS-IN-5801_02

					
02	11.05.2022	SV	KNC	HK	GVW
01	18.01.2020	RB	VB	KNC	AD
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Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY	:	If printed
CONTROLLED COPY	:	If in soft and signed



**STANDARD SPECIFICATION
FOR
INSTRUMENTATION CABLES**

**DOCNO: VCS-SS-IN-5801
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		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



ABBREVIATION

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



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1 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 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 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 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 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 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 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 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 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 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.

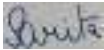
The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION FOR JUNCTION BOXES AND CABLE GLANDS

VCS-SS-IN-5802_02

					
02	11.05.2022	SV	KNC	HK	GVW
01	18.01.2020	RB	VB	KNC	AD
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**STANDARD SPECIFICATION
FOR
JUNCTION BOXES AND CABLE GLANDS**

**DOCNO: VCS-SS-IN-5802
Rev No : 02**

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Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	23.05.2018	Neha Dev	Udit Manichanda	K.Prasanth	Anupam Das	
01	18.01.2020					Format change and document numbering is revised.
		Rakesh Bhardwaj	Vinod Babu	Kedarnath Chakraborty	Anupam Das	
02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



**STANDARD SPECIFICATION
FOR
JUNCTION BOXES AND CABLE GLANDS**

**DOCNO: VCS-SS-IN-5802
Rev No : 02**

ABBREVIATION

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
FAT	Factory Acceptance Test
IEC	International Electro-technical Commission
IP	Ingress Protection
IS	Indian Standards
ISO	International Organization for Standardization
NACE	National Association of Corrosion Engineers
SAT	Site Acceptance Test



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1 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 Junction Boxes and Cable Glands along with its accessories which include the following types:

- a. Electrical junction boxes
- b. Pneumatic junction boxes
- c. Cable glands.

2 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 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.

ASME B1.20.1	Pipe Threads
DIN 50049	Document on Material Testing
IS 5	Colours for ready mixed paints and enamels.
IS 2147	Degree of Protection provided for Enclosures
IS 2148	Flame proof Enclosure of Electrical Apparatus.
IEC 529	Degree of Protection by providing Enclosures
IEC 79	Electrical Apparatus for Explosive Gas Atmosphere
EN 837	Pressure Gauges Part-t: Bourdon Type Pressure Gauges, Dimensions, Metrology, Requirements and Testing

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 MATERIALS

Materials selected of the Junction Boxes and Cable Glands 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 DESIGN

5.1 Junction Boxes

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.



The enclosure shall be as per IS-2147 and IP-65 for weather proof Junction Boxes and for flameproof it shall be as per IS-2148 suitable for the area classification specified.

Number of entries and locations shall be as per Data Sheets and all the cable entries shall be bottom entries.

Junction Boxes shall be provided with telephone sockets and plugs for connection of hand powered telephone set.

5.1.1 Electrical Junction Boxes

Material shall be die-cast aluminium of minimum 5 mm thick (LM-6 alloy)

Flame proof Junction Boxes shall have detachable cover which is fixed to the box by means of cadmium plated triangular head /hexagonal head screws.

Weatherproof Junction Boxes shall have doors which shall be hinged type and these shall be fixed by plated countersunk screws.

Flameproof Junction Boxes shall have a warning engraved/integrally cast on the cover as given below;

"Isolate power supply elsewhere before opening."

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.

All terminals shall be suitable for accepting minimum 2.5 sq. mm copper conductor, in general. However, for power supply distribution boxes, terminal detail shall be as per job specification/data sheets.

The Junction Box shall be sized for termination of all cores and screens including spares without the need for more than 1 core per terminal. In addition a minimum of 10 % spare terminals shall be provided, unless specified otherwise in Data Sheet.

The Junction Boxes shall have sufficient space to ensure ease of termination. Sizing shall be done with due consideration for accessibility and maintenance in accordance with the following guidelines;

- 50 to 60 mm between terminals and sides of box parallel to terminal strip for upto 50 terminals and additional 25 mm for each additional 25 terminals.
- 100 to 120 mm between terminals for up to 50 terminals and additional 25 mm for each additional 25 terminals.
- Bottom/top of terminal shall not be less than 100mm from bottom/top of the Junction Box.

Terminals shall be marked as per various types indicated in Data Sheets.

Shall be provided with external earthing lugs.

5.1.2 Pneumatic Junction Boxes

Pneumatic Junction Boxes shall be made of 3 mm thick hot rolled steel. They shall have necessary neoprene gasket between door and body. Door shall be flush with the box and shall be hinged type and provided with wing nuts.

Single tube entries shall be suitable for 6 mm 0.0 copper tube with bulk head fittings. Multi tube bundle entry shall be suitable for the data furnished in Data Sheets.

5.2 Cable Glands, Plugs and Reducers / Adaptors

Cable Glands shall be supplied by Vendor whenever specified.

Cable Glands shall be double compression type for use with armoured cables.



The Cable Glands shall be of nickel plated brass material unless specified otherwise in Data Sheet.

The Cable Glands shall be weather proof. Whenever specified they shall also be flameproof and certificate from statutory body shall be furnished.

Cable Glands shall be supplied to suit the Cable dimensions indicated along with tolerance 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 above tolerances of Cable dimensions.

Each Cable Gland shall be supplied as a kit complete with locknut, shroud, and earth tag and sealing washer with proper identification of Gland size. Shrouds provided for additional protection to the Cable Gland termination. Earth tag shall be of nickel plated brass material.

Reducers/Adaptors shall be supplied as per details indicated in Data Sheets. They shall be nickel plated brass. These shall be weather proof in general. These shall also be flame proof wherever specified and certificate from statutory body for flame proofness shall be furnished.

Stopper plugs to seal spare cable entries in the Instrument Junction Boxes shall be provided wherever specified in Data Sheet. They shall be of nickel plated brass for metallic Junction Boxes and glass fibre reinforced polyamide for non-metallic junction boxes.

Plugs shall be certified flameproof when used with Flameproof Junction Boxes.

All Cable Glands and accessories such as reducers, adaptors, stopper plugs shall be stamped with type and size of Cable Glands, type and size of entry thread and the relevant approval details.

5.3 Name Plate

All Junction Boxes 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 Purchaser's Data Sheets.
- b. Type of enclosure such as terminal capacity, size, IP rating, serial no etc.
- c. Name of Manufacturer.
- d. Type of explosion protection (as applicable)
- e. Name of certifying agency and certificate number

The Tag no shall be generally white character on red background for fire & gas, white character on blue background for intrinsically safe circuits and black character on white background for all other applications.

6 FABRICATION AND PAINTING

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Junction Boxes and Cable Glands. Vendor shall submit the required Specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing herein. Painting of Junction Box shall be in accordance with Standard Painting Specifications.

Surface shall be prepared for painting. It shall be smooth and devoid of rust and scale

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.



The colour shall be as specified in Data Sheets.

7 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 Junction Box and Cable Glands 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 Certificate from statutory body for suitability to install in specified area classification, dimensional test report, material 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 Junction Box and Cable Glands 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 Junction Box and Cable Glands.

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. Calibration
- c. 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)

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 Junction Box and Cable Glands 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 Junction Box and Cable Glands functions correctly and properly in accordance with the specified requirements.

8 MARKING, PACKING AND SHIPMENT

Following FAT completion, Vendor responsible for the Junction Box and Cable Glands 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.

Each packing shall have its weight clearly marked on it and shall be identified with the contents, purchase order no and item number.

All entries shall be installed with plastic plugs to prevent unwanted material and insects entering the instrument junction boxes.

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 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 Junction Box and Cable Glands, 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 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;

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.

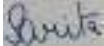
The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION FOR INSTRUMENT TUBE FITTINGS

VCS-SS-IN-5803_02

					
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01	18.01.2020	RB	VB	KNC	AD
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Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

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CONTROLLED COPY	:	If in soft and signed



**STANDARD SPECIFICATION
FOR INSTRUMENT TUBE FITTINGS**

**DOCNO: VCS-SS-IN-5803
Rev No : 02**

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	23.05.2018	Neha Dev	Udit Manichanda	K.Prasanth	Anupam Das	
01	18.01.2020					Format change and document numbering is revised.
		Rakesh Bhardwaj	Vinod Babu	Kedarnath Chakraborty	Anupam Das	
02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



ABBREVIATION

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 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 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 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

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

Instrument society of America

ISA RP 42.1	Nomenclature for Instrument tubing fittings

Indian Standards

IS-319	Specification for free cutting Brass Bars, Rods and Sections

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:

- Data sheets
- Job Specifications
- Standard Specifications
- 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 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 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 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 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 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 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 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:

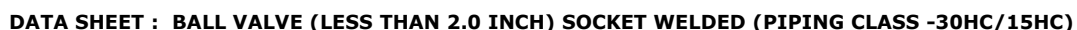
- a. Specifications, Data Sheets;
- b. Bill of materials including Vendor list, details for third party items;
- c. Material test certificates;
- d. Procedures for FAT;
- e. Quality Assurance Plan;

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.

		DATA SHEET : BALL VALVE (LESS THAN 2.0 INCH) SOCKET WELDED (PIPING CLASS -30HC/15HC)					
PMC		VCS QUALITY SERVICES PVT. LTD.					
GENERAL SPECIFICATION							
Process Fluid	NG	ANSI Pressure Rating			800#		
Design Temperature	(-)29°C to 65°C	Design Pressure			90.22 barg		
Size, Inch (DN)	Less than 2" (50)						
Valve Type	Full Bore, Floating Ball						
End Connection Type	Socket Welded	Design Standard			BS EN ISO 17292		
Face Finish	Not Applicable	Locking Arrangement			As per P&ID		
VALVE DESIGN CONDITIONS							
Corrosion Allowance	1.5 mm	Design Factor			0.5		
Installation	Above Ground	Stem Ext Length (mm)			Not Applicable		
VALVE OPERATION							
Actuation Type	Not Applicable	Type of Actuator			Not Applicable		
PUP PIECE DETAILS							
100mm extension pups in ASTM A106 Gr.B, Sch 160 (for 3/4") and Sch XS (for 1 1/2")							
VALVE MATERIAL SPECIFICATION							
PART DESCRIPTION	MATERIAL SPECIFIED			MATERIAL OFFERED (Equivalent or Higher)			
Body	ASTM A105						
Ball	13% Cr Steel						
Body Seat	RPTFE/ DELRIN						
Gland	13% Cr Steel						
Stem (No Casting)	13% Cr Steel						
Body Seal	Grafoil						
Stem Seal	Grafoil						
Body Studs/ Nuts	ASTM A193 Gr. B7/ A194 Gr. 2H						
TESTING REQUIREMENT							
Hydrostatic Test Pressure & Time	Body: 205.94 barg & 30 Minutes			Seat: 152 barg & 30 Minutes			
Pneumatic Test Pressure & Time	5.49 - 6.86 barg & 15 Minutes						
Hardness Test	248 HV10 max.						
Charpy Impact Test @ Temperature	Yes (at -29°C)						
Anti-Static Testing Requirement	As per BS EN ISO 17292						
Fire Safe Test	API 607 / API 6FA						
DOCUMENT NO.							
STD-00-PP-DS-2001A							
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SHEET NO.	1 OF 2	REV	DATE	PRPD	CHKD	APVD	REMARKS



PMC

VCS QUALITY SERVICES PVT. LTD.**Valve Painting Specification :**

1	Surface Preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
2	For above ground installation - Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.
3	Lock open/ lock close requirement : As indicated in P&ID / Schedule of Rates (SOR).

NOTES :

1	This Data Sheet shall be read in conjunction with Tender Documents & Specifications.
2	Material test certificates and hydrostatic test reports shall be furnished prior to dispatch.
3	Gland Packing Assembly shall permit repair of gland packing under full line pressure.
4	Detailed dimensional drawings showing cross-section with part numbers and materials shall be submitted for purchaser's approval prior to manufacture of the valves.
5	All valves shall be provided with valve position indicator.
6	Separate wrench shall be provided with each wrench operated valve.
7	Stops shall be provided to ensure positive alignment of ball with ports and ensure proper installation of handle.
8	The Charpy Impact Test temperature specified in datasheet shall supersede the specification requirements.
9	Painting procedure of valves shall be as per Manufacturer's standard.
10	All tests shall be as per BS EN 12266.
11	Inspection and Testing shall be as per attached QAP, this datasheet, BS EN 12266, other relevant standards.
12	Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.

DOCUMENT NO.							
STD-00-PP-DS-2001A							
		C1	13.04.2026	YK	DK	DK	ISSUED FOR CLIENT REVIEW
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**DATA SHEET : BALL VALVE (LESS THAN 2.0 INCH) FLANGE END (PIPING CLASS - 15HC, 150#)****PMC****VCS QUALITY SERVICES PVT. LTD.****GENERAL SPECIFICATION**

Process Fluid	NG	ANSI Pressure Rating	150#
Design Temperature	(-)29 °C to 65 °C	Design Pressure	18.63 barg
Size, Inch (DN)	Less than 2" (50)		
Valve Type	Full Bore / Reduced Bore, Floating Ball		
End Connection Type	Flange End	Design Standard	BS EN ISO 17292
Face Finish	ASME B16.5, 150#, RF/125AARH	Locking Arrangement	As per P&ID
Material Requisition Item No.			

VALVE DESIGN CONDITIONS

Corrosion Allowance	1.5 mm	Design Factor	0.5
Installation	Above Ground	Stem Ext Length (mm)	Not Applicable

VALVE OPERATION

Actuation Type	Not Applicable	Type of Actuator	Not Applicable

PUP PIECE DETAILS

Not Applicable

VALVE MATERIAL SPECIFICATION

PART DESCRIPTION	MATERIAL SPECIFIED	MATERIAL OFFERED (Equivalent or Higher)
Body	ASTM A105	
Ball	13% Cr Steel	
Body Seat	RPTFE/ DELRIN	
Gland	13% Cr Steel	
Stem (No Casting)	13% Cr Steel	
Body Seal	Grafoil	
Stem Seal	Grafoil	
Body Studs/ Nuts	ASTM A193 Gr. B7/ A194 Gr. 2H	

TESTING REQUIREMENT

Hydrostatic Test Pressure & Time	Body: 27.95 barg & 30 Minutes	Seat: 20.49 barg & 30 Minutes
Pneumatic Test Pressure & Time	5.49 - 6.86 barg & 15 Minutes	
Hardness Test	248 HV10 max.	
Charpy Impact Test @ Temperature	Yes (at -29 °C)	
Anti-Static Testing Requirement	As per BS EN ISO 17292	
Fire Safe Test	API 607 / API 6FA	

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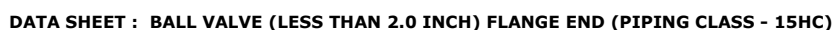
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PMC

VCS QUALITY SERVICES PVT. LTD.

Valve Painting Specification :

NOTES :	
1	This Data Sheet shall be read in conjunction with Tender Documents & Specifications.
2	Material test certificates and hydrostatic test reports shall be furnished prior to dispatch.
3	Gland Packing Assembly shall permit repair of gland packing under full line pressure.
4	Detailed dimensional drawings showing cross-section with part numbers and materials shall be submitted for purchaser's approval prior to manufacture of the valves.
5	All valves shall be provided with valve position indicator.
6	Separate wrench shall be provided with each wrench operated valve.
7	Stops shall be provided to ensure positive alignment of ball with ports and ensure proper installation of handle.
8	The Charpy Impact Test temperature specified in datasheet shall supersede the specification requirements.
9	Painting procedure of valves shall be as per Manufacturer's standard.
10	All tests shall be as per BS EN 12266.
11	Inspection and Testing shall be as per attached QAP, this datasheet, BS EN 12266, other relevant standards.
12	Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.

DOCUMENT NO.							
STD-00-PP-DS-2001B							
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**DATA SHEET : BALL VALVE (LESS THAN 2.0 INCH) FLANGE END (PIPING CLASS - 30HC, 300#)****PMC****VCS QUALITY SERVICES PVT. LTD.****GENERAL SPECIFICATION**

Process Fluid	NG	ANSI Pressure Rating	300#
Design Temperature	(-)29 °C to 65 °C	Design Pressure	48.06 barg
Size, Inch (DN)	Less than 2" (50)		
Valve Type	Full Bore / Reduced Bore, Floating Ball		
End Connection Type	Flange End	Design Standard	BS EN ISO 17292
Face Finish	ASME B16.5, 300#, RF/125AARH	Locking Arrangement	As per P&ID
Material Requisition Item No.			

VALVE DESIGN CONDITIONS

Corrosion Allowance	1.5 mm	Design Factor	0.5
Installation	Above Ground	Stem Ext Length (mm)	Not Applicable

VALVE OPERATION

Actuation Type	Not Applicable	Type of Actuator	Not Applicable

PUP PIECE DETAILS

Not Applicable

VALVE MATERIAL SPECIFICATION

PART DESCRIPTION	MATERIAL SPECIFIED	MATERIAL OFFERED (Equivalent or Higher)
Body	ASTM A105	
Ball	13% Cr Steel	
Body Seat	RPTFE/ DELRIN	
Gland	13% Cr Steel	
Stem (No Casting)	13% Cr Steel	
Body Seal	Grafoil	
Stem Seal	Grafoil	
Body Studs/ Nuts	ASTM A193 Gr. B7/ A194 Gr. 2H	

TESTING REQUIREMENT

Hydrostatic Test Pressure & Time	Body: 72.09 barg & 30 Minutes	Seat: 53 barg & 30 Minutes
Pneumatic Test Pressure & Time	5.49 - 6.86 barg & 15 Minutes	
Hardness Test	248 HV10 max.	
Charpy Impact Test @ Temperature	Yes (at -29 °C)	
Anti-Static Testing Requirement	As per BS EN ISO 17292	
Fire Safe Test	API 607 / API 6FA	

DOCUMENT NO.

STD-00-PP-DS-2001C

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**DATA SHEET : BALL VALVE (LESS THAN 2.0 INCH) SOCKET WELDED (PIPING CLASS -30HLT/15HLT)****PMC****VCS QUALITY SERVICES PVT. LTD.****GENERAL SPECIFICATION**

Process Fluid	LPG	ANSI Pressure Rating	800#
Design Temperature	(-)45 °C to 65 °C	Design Pressure	49 Barg
Size, Inch (DN)	Less than 2" (50)		
Valve Type	Full Bore / Reduced Bore, Floating Ball		
End Connection Type	Socket Welded	Design Standard	BS EN ISO 17292
Face Finish	Not Applicable	Locking Arrangement	As per P&ID

VALVE DESIGN CONDITIONS

Corrosion Allowance	1.6 mm	Design Factor	0.5
Installation	Above Ground	Stem Ext Length (mm)	Not Applicable

VALVE OPERATION

Actuation Type	Not Applicable	Type of Actuator	Not Applicable

PUP PIECE DETAILS

100mm extension pups at both ends, Pipe material and thickness as per PMS

VALVE MATERIAL SPECIFICATION

PART DESCRIPTION	MATERIAL SPECIFIED	MATERIAL OFFERED (Equivalent or Higher)
Body	ASTM A352 GR. LCB/ ASTM A350 GR. LF2 CL. 1	
Ball	SS-304 / SS-316	
Body Seat	RPTFE WITH SECONDARY METAL TO METAL	
Gland	SS 316 / SS 304	
Stem (No Casting)	SS 304 / SS 316 (FORGED, NO CASTING), ANTI BLOW-OUT DESIGN	
Body Seal	GRAFOIL / PTFE	
Stem Seal	GRAFOIL / PTFE V-RINGS + GRAFOIL	
Body Studs/ Nuts	ASTM A 320 Gr. L4 / ASTM A 194 Gr. 4	

TESTING REQUIREMENT

Hydrostatic Test Pressure & Time	Body: 205.94 barg & as per BS EN ISO 17292	Seat: 152 barg & as per BS EN ISO 17292
Pneumatic Test Pressure & Time	5.49 - 6.86 barg & as per BS EN ISO 17292	
Hardness Test	248 HV10 max.	
Charpy Impact Test @ Temperature	Yes (at -45 °C)	
Anti-Static Testing Requirement	As per BS EN ISO 17292	
Fire Safe Test	API 607 / API 6FA	

DOCUMENT NO.

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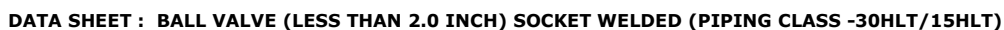
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REMARKS



PMC

VCS QUALITY SERVICES PVT. LTD.

Valve Painting Specification :

1	Surface Preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
2	For above ground installation - Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.
3	Lock open/ lock close requirement : As indicated in P&ID / Schedule of Rates (SOR).

NOTES :

1	This Data Sheet shall be read in conjunction with Tender Documents & Specifications.
2	Material test certificates and hydrostatic test reports shall be furnished prior to dispatch.
3	Gland Packing Assembly shall permit repair of gland packing under full line pressure.
4	Detailed dimensional drawings showing cross-section with part numbers and materials shall be submitted for purchaser's approval prior to manufacture of the valves.
5	All valves shall be provided with valve position indicator.
6	Separate wrench shall be provided with each wrench operated valve.
7	Stops shall be provided to ensure positive alignment of ball with ports and ensure proper installation of handle.
8	The Charpy Impact Test temperature specified in datasheet shall supersede the specification requirements.
9	Painting procedure of valves shall be as per Manufacturer's standard.
10	All tests shall be as per BS EN 12266.
11	Inspection and Testing shall be as per attached QAP, this datasheet, BS EN 12266, other relevant standards.
12	Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.

DOCUMENT NO.							
STD-00-PP-DS-2001D							
		C1	13.04.2026	YK	DK	DK	ISSUED FOR CLIENT REVIEW
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 Energising Quality		DATA SHEET OF FE/BW, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 300# , PIPING CLASS - 30HC, SPLIT /WELDED BODY DESIGN		DOC. NO.: STD-00-PP-DS-2001G		
				No. of Pages : 02	Revision	
					C1	
		13.04.2026				
Location				MR No.	-	
Sr. No.		-		P.O No.	#	
1	GENERAL	Valve Manufacturer				
2		Tag Numbers / Material Requisition Item No.		AS PER P&ID		
3		Company's Specification No.		VCS-SS-PP-2004		
4		Category		Station Piping Ball Valve		
5		Pipeline Line No		Not Required		
6		Class		30HC		
7	DESIGN AND TEST REQUIREMENTS	Size		DN 50 (NPS 2") to DN 400 (NPS 16")		
8		Type of Valve		Trunnion Mounted, Double Block and Bleed, Antistatic, Vent Drain/ Flush Connection with Anti Blowout Stem, Split Body Design/ Fully Welded Body Design as specified in MR, Tight Shut Off (As Applicable)		
9		Type of Port (Full/ Reduced)		Refer Material Requisition		
10		Design Temperature (°C)	Maximum	65		
11			Minimum	-29		
12		Corrosion Allowance (mm)		1.5		
13		Installation (Aboveground/Underground)		AboveGround/UnderGround		
14		Service		Natural Gas (NG)		
15		End Connection		AS PER P&ID		
16		Flange Face Finish		RF/125AARH for Flanged Ends (As applicable)		
17		Design Standards		API 6D		
18		End Connection Standard		ANSI B16.5 for Flanged Ends (As applicable)/ ANSI 16.25 for Butt Welded Ends (As applicable)		
19		ASME Class		300#		
20		Stem Extension Requirement (If required, Note - 20)		Not Required		
21		Length of Stem Extension		Not Applicable		
22		Orientation of Stem		Perpendicular to Valve axis		
23		Type of Valve Operator		DN ≤ 100 mm (4") - Wrench / Lever - Pull Force 350N max. DN ≥ 150 mm (6") - Gear Operated		
24		Valve Actuator Operating Time		Not Applicable		
25		Requirement of Locking Mechanism (LO / LC)		AS PER P&ID		
26		Length of Pup Piece / Nipple (mm), (If Required) (Note-16) (Integrally welded to the BW valve on each side)		Required for Welded End Valves, as per Standard Valve Specification		
27		Pup Piece Size / Material Grade / Schdeule/ Thickness (Note-16)		As per Piping Material Specification		
28		Operator Specification No.		Not Applicable		
29		Valve Design Pressure (kg/cm ²)		49 kg/cm ²		
30		Hydrostatic Test Pressure (kg/cm ²) & Time		Body : 73.5 kg/cm ² & Test Duration - 30 Minutes	Seat : 54 kg/cm ² & Test Duration 30 Minutes	
31		Pneumatic Test Pressure (kg/cm ²) & Time		7.0 kg/cm ² & Test Duration - 15 Minutes		
32		Charpy Impact Test (° C)		Yes (at -29 °C)		
33		Fire Safe Design (Note-25)		API 6FA / ISO10497		
34		Anti Static Testing Requirement		As per API 6D Latest Edition		
35		Hardness Test		248 HV10 max		
36		Painting (Note-21)		As per specification (Suitable for Highly Corrosive Environment) Note-21		
37	Operator Data Sheet No.		Not Applicable			
38	PROCESS DATA (Applicable for Actuator)	Flow (Min/Nor/Max) (m ³ /hr)		Not Applicable		
39		Pressure (Min/Nor/Max) (barg)		Not Applicable		
40		Temperature (Min/Nor/Max) (° C)		Not Applicable		
41		Max Shutoff DP (barg)		Not Applicable		
42		Viscosity (cP)		Not Applicable		
43		Density (Kg/m ³)		Not Applicable		
44		Mol . Wt		Not Applicable		
45		Sp Heat Ratio (Cp/Cv)		Not Applicable		
46		Compressibility (Z)		Not Applicable		
47		Ambient Temperature		Not Applicable		
48	CONNECTING PIPE DETAIL	Outside Diameter (Inch)		DN 50 (NPS 2") to DN 400 (NPS 16")		
49		Thickness (mm) / Schedule		As per Piping Material Specification		
50		Pipe Material		As per Piping Material Specification		
51		Design Code		ASME B31.8		
52		ASME Rating		300#		
53		Piping Class		30HC		
54		Orientation of Pipe		Suitable for all orientation		

 Energising Quality		DATA SHEET OF FE/BW, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 300# , PIPING CLASS - 30HC, SPLIT /WELDED BODY DESIGN		DOC. NO.: STD-00-PP-DS-2001G			
				No. of Pages : 02		Revision	
						C1 13.04.2026	
Location		MR No.		-			
Sr. No.		P.O No.		#			
55	VALVE MATERIAL	Part Description	Material Specified	Material Offered (By Bidder)			
56		Body	ASTM A216 GR. WCB/ASTM 105				
57		Ball (Single Piece, Solid Construction)	SS-304 / SS-316 (Solid) OR (ASTM A105/ ASTM A216 Gr. WCB) + 75 micron ENP				
58		Seat Rings (No Casting)	(AISI 4140 +75 micron ENP)/ AISI 410/ SS 304/ SS 316				
59		Seat Seal	Primary Devlon V/ PEEK/ Viton with Secondary Metal to Metal				
60		Stem (No Casting)	(AISI 4140 +75 micron ENP)/ AISI 410 / SS 304 / SS 316				
61		Stem Seal	GRAFOIL / R-PTFE				
62		Body Seal	GRAFOIL / R-PTFE				
63		Gland	13% Cr. Steel/ SS 316 / SS 304 / ASTM A105				
64		Stud Bolts/Nut	ASTM A 193 Gr. B7/ ASTM A 194 Gr. 2H				
65		Handle / Lever / Hand Wheel	Carbon Steel				
66		DATA TO BE PROVIDED BY VENDOR (If Applicable)	Valve Model No.		*		
67	Flow Coefficient, Kv (Cubic Meters per Hour)		*				
68	Valve Cavity Volume(CC)		Open position	*			
69			Closed position	*			
70	Operator Manufacturer / Model No.		*				
71	Break-away Torque Under Max. Diff Pressure(Nm)		*				
72	Running Torque (Open - Close/Close - Open) (Nm)		*				
73	NOTES	NOTES:					
74		1. Bidder to submit in offer, 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 welding of valve ends at site.					
75		2. This Data Sheet shall be read in conjunction with Material Requisition, Piping Material Specification, valve Specification & other Tender Documents.					
76		3. Dimension / Input Data as & where marked " * " shall be supplied by Vendor.					
77		4. Manufacturer shall have valid API 6D license to use API monogram. API monogram is required.					
78		5. Valve design shall ensure repair of stem seals / packing under full line pressure.					
79		6. 100.0 % Valve castings shall undergo Radiographic Examination.					
80		7. Valves shall have support foot & lifting lugs as per valve Specification.					
81		8. Valve design shall ensure repair of stem seals / packing under full line pressure.					
82		9. Wrench operated valves shall be supplied with wrench.					
83		10. The Charpy Impact temperature shall be -29°C as specified in data sheet and it shall superceded the Specification (VCS-SS-PP-2004) requirement at 0°C					
84		11. A supplementary air seat test as per API 6D (Annex I, Para I.9 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.					
85		12. Design of weld end valves shall be such that during field welding operations, the soft seals or plastic components of the valve (where ever used) is not liable to be damaged. The manufacture shall furnish necessary field welding instructions and post-weld test procedure to demonstrate integrity and leak-tightness of valves after field welding operations.					
86		13. 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					
87		14. 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.					
88		15. 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".					
89		16. 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 packings, seats & seals.					
90		17. Name plate material shall be minimum stainless steel. Marking shall be as per MSS-SP-25					
91		18. 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.					
92		19. For tag No./ Fluid Data/ Operating Data refer Process Document , P&IDs					
93		20. Stem extension length shall be finalized during drawing approval stage after award of order.					
94		21. For the valves to be installed underground the external surfaces of buried portion of the valve shall be painted with 100% Solid high build epoxy(Powcrete R-95) with a minimum dry film thickness of 1000 microns or 1.5 mm thick polyurethane coating					
95		22. 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". Flanges of flanged end cast/ forged body shall be integrally cast/ forged with the body of valve.					
96		23. 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.					
97		24. Not only during commissioning, but also during life cycle of all valves, sediments/corrosion deposits/ silica/ mill scale of less than 40 mesh percent in process fluid have to be tolerated by all valves with malfunctioning.					
98		25. Fire Safe test certificate qualifying the valves as per API 6FA/ API 607/ ISO 10497 carried out in last 10 years shall be furnished.					
99		26. Flanges of flanged end cast/ forged body shall be integrally cast/ forged with the body of valve. Vendor to guarantee the suitability of seat/ seal material for the given service condition					
100		27. Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.					
101		28. Cyclic test is required. The valve shall be subjected to at least 200 open close cycle with maximum differential pressure corresponding to valve rating.					
102		29. Stem seal / body seal, gland packing materials shall be provided with corrosion inhibitor.					
103	30. Vendor to guarantee the suitability of seat/ seal material for the given service condition						

		DATA SHEET : PLUG VALVE (LESS THAN 2.0 INCH) FLANGED END (PIPING CLASS - 30HC, 300#)					
PMC		VCS QUALITY SERVICES PVT. LTD.					
GENERAL SPECIFICATION							
Process Fluid	NG	ANSI Pressure Rating		300#			
Design Temperature	(-)29 °C to 65 °C	Design Pressure		48.06 barg			
Size, Inch (DN)	Less than 2" (50)						
Valve Type	Regular Pattern						
End Connection Type	Flanged End	Design Standard		BS 5353			
Face Finish	ASME B16.5, 300#,RF/125AARH	Locking Arrangement		As per P&ID			
VALVE DESIGN CONDITIONS							
Corrosion Allowance	1.5 mm	Design Factor		0.5			
Installation	Above Ground	Stem Ext Length (mm)		Not Applicable			
VALVE OPERATION							
Actuation Type	Not Applicable	Type of Actuator		Not Applicable			
PUP PIECE DETAILS							
100mm extension pups at both ends, Pipe material and thickness as per PMS							
VALVE MATERIAL SPECIFICATION							
PART DESCRIPTION	MATERIAL SPECIFIED			MATERIAL OFFERED (Equivalent or Higher)			
Body	ASTM A105						
Plug (Lubricated)	ASTM A105 + 75 microns ENP						
Stem (No Casting)	(AISI 4140 + 75 microns ENP Coating)/ AISI 410						
Stem Seal	GRAFOIL/ PTFE V-RINGS + GRAFOIL						
Gland	ASTM A 105						
Gland Packing	Graphite/ PTFE						
Gasket	N.A						
Body Studs/ Nuts	ASTM A193 Gr. B7/ A194 Gr. 2H						
Lubricant Screw	Manufacturer's Standard						
TESTING REQUIREMENT							
Hydrostatic Test Pressure & Time	Body: 72.09 barg & 30 Minutes			Seat: 52.86 barg & 30 Minutes			
Pneumatic Test Pressure & Time	7 barg & 15 Minutes						
Hardness Test	248 HV10 max.						
Charpy Impact Test @ Temperature	Yes (at -29 oC)						
Fire Safe Test	API 607 / API 6FA						
DOCUMENT NO.							
STD-00-PP-DS-2003A							
		C1	13.04.2026	YK	DK	DK	ISSUED FOR CLIENT REVIEW
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PMC

VCS QUALITY SERVICES PVT. LTD.

Valve Painting Specification :

1	Surface Preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
2	For above ground installation - Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.
3	Lock open/ lock close requirement : As indicated in P&ID / Schedule of Rates (SOR).

NOTES :

1	This Data Sheet shall be read in conjunction with Tender Documents & Specifications.
2	Material test certificates and hydrostatic test reports shall be furnished prior to dispatch.
3	Gland Packing Assembly shall permit repair of gland packing under full line pressure.
4	Valve shall have an inherent feature using the line pressure to ensure that the line pressure cannot cause taper locking of the plug / plug movement into the taper i.e. valves shall be of " pressure balanced design"
5	All valves shall be provided with valve position indicator.
6	Separate wrench shall be provided with each wrench operated valve.
7	Stops shall be provided to ensure positive alignment of plug with ports and ensure proper installation of handle.
8	Valve body & other pressure containing parts shall be designed as per ASME Sec-VII Div.-1. Minimum thickness shall not be less than ASME B16.34.
9	The Charpy Impact Test temperature specified in datasheet shall supersede the specification requirements.
10	Valve design shall ensure repair of stem seals / packing under full line pressure.
11	Painting procedure of valves shall be as per Manufacturer's standard.
12	Inspection and Testing shall be done as per data sheet, specification & BS:12266 (Part-I).
13	Minimum port area for regular pattern shall be 55%.
14	26. Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.

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Singh
Date: 2026.09.03 19:02:02 IST



**DATA SHEET : PLUG VALVE (LESS THAN 2.0 INCH) SOCKET WELDED
(PIPING CLASS -30HC/15HC)**

PMC

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GENERAL SPECIFICATION

Process Fluid	NG	ANSI Pressure Rating	800#
Design Temperature	(-)29 °C to 65 °C	Design Pressure	90.22 barg
Size, Inch (DN)	Less than 2" (50)		
Valve Type	Regular Pattern		
End Connection Type	Socket Welded	Design Standard	BS 5353
Face Finish	Not Applicable	Locking Arrangement	As per P&ID

VALVE DESIGN CONDITIONS

Corrosion Allowance	1.5 mm	Design Factor	0.5
Installation	Above Ground	Stem Ext Length (mm)	Not Applicable

VALVE OPERATION

Actuation Type	Not Applicable	Type of Actuator	Not Applicable

PUP PIECE DETAILS

100mm extension pups at both ends, Pipe material and thickness as per PMS

VALVE MATERIAL SPECIFICATION

PART DESCRIPTION	MATERIAL SPECIFIED	MATERIAL OFFERED (Equivalent or Higher)
Body	ASTM A105	
Plug (Lubricated)	ASTM A105 + 75 microns ENP	
Stem (No Casting)	(AISI 4140 + 75 microns ENP Coating)/ AISI 410	
Stem Seal	GRAFOIL/ PTFE V-RINGS + GRAFOIL	
Gland	ASTM A 105	
Gland Packing	Graphite/ PTFE	
Gasket	N.A	
Body Studs/ Nuts	ASTM A193 Gr. B7/ A194 Gr. 2H	
Lubricant Screw	Manufacturer's Standard	

TESTING REQUIREMENT

Hydrostatic Test Pressure & Time	Body: 205.94 barg & 30 Minutes	Seat: 152 barg & 30 Minutes
Pneumatic Test Pressure & Time	7 barg & 15 Minutes	
Hardness Test	248 HV10 max.	
Charpy Impact Test @ Temperature	Yes (at -29 oC)	
Fire Safe Test	API 607 / API 6FA	

DOCUMENT NO.

STD-00-PP-DS-2003B

SHEET NO.

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C1

13.04.2026

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VCS QUALITY SERVICES PVT. LTD.

1

Surface Preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.

2

For above ground installation - Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.

3

Lock open/ lock close requirement : **As indicated in P&ID / Schedule of Rates (SOR).**

1

This Data Sheet shall be read in conjunction with Tender Documents & Specifications.

2

Material test certificates and hydrostatic test reports shall be furnished prior to dispatch.

3

Gland Packing Assembly shall permit repair of gland packing under full line pressure.

Valve shall have an inherent feature using the line pressure to ensure that the line pressure cannot cause taper locking of the plug / plug movement into the taper i.e. valves shall be of " pressure balanced design"

5

All valves shall be provided with valve position indicator.

6

Separate wrench shall be provided with each wrench operated valve.

7

Stops shall be provided to ensure positive alignment of plug with ports and ensure proper installation of handle.

Valve body & other pressure containing parts shall be designed as per ASME Sec-VII Div.-1. Minimum thickness shall not be less than ASME B16.34.

8

valve body & other pressure containing parts shall be designed as per ASME Sec VIII Div. 1. Minimum thickness

9

The Charpy Impact Test temperature specified in datasheet shall supersede the specification requirements.

16

Valve design shall ensure repair of stem seals / packing under full line pressure.

Painting procedure of valves shall be as per Manufacturer's standard.

15

Inspection and Testing shall be done as per data sheet, specification & BS:12266 (Part-I).

14

Inspection and testing shall be done as per data sheet
Minimum port area for regular pattern shall be 55%.

Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.

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Energising Quality

PIPING MATERIAL SPECIFICATION

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PIPING MATERIAL SPECIFICATION

ABBREVIATION

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AARH	Arithmetic Average Roughness Height
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
FF	Flat Face
PBE	Plain Both End
PE	Plain End
RF	Raised Face
SCRF	Screwed End - Female
SCRM	Screwed End - Male
CA	Corrosion Allowance
M	To Match Pipe

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PIPING MATERIAL SPECIFICATION

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PIPING MATERIAL SPECIFICATION

1.0 INTRODUCTION

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

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:

ASME 31.3	:	Process Piping
ASME 31.8	:	Gas Transmission and Distribution Piping Systems
OISD STD-226	:	Natural Gas Transmission Pipeline and City Gas Distribution Networks
PNGRB	:	Petroleum and Natural Gas Regulatory Board

All codes, standards and specifications referred herein shall be the latest edition of such documents.

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.

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.

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4.0 CLASS DESIGNATION CODE

The piping class designation shall generally consist of three digits made up of a letter, number & letter e.g. 15HC, 15HLT, 30HC, 30 HLT etc. as follows:

First two numerals letter indicates ASME class rating, e.g.

15	-	150 Class
30	-	300 Class
60	-	600 Class

The first alphabet indicates differences in the Fluid Services within the same class rating and material, e. g. H stands for Hydrocarbon, W stands for Water, G stands for Galvanize etc.

The last one or two letter (as applicable) indicates type of material, e.g.

C	-	Carbon steel
LT	-	Low Temperature (Carbon Steel)

5.0 TECHNICAL REQUIREMENTS

5.1 General Notes

1. All piping materials selected under this specification shall be in compliance with the project specification.
2. Material selections shall comply with the maximum pressure and temperature limitation as specified in the service summary.
3. Substitution of equivalent materials is subject to approval of the Client /PMC. All requests for substitution shall be accompanied with sufficient data, drawings, and descriptive details to permit evaluation by the Client /PMC.
4. Cast iron, ductile or malleable iron, aluminum, plastic, or copper-bearing alloys shall not be used in hydrocarbon service.
5. Piping design pressure is based on flange maximum-allowable working pressure, unless otherwise noted in Job Specification.
6. When required, impact testing shall comply with applicable standards and material specifications.
7. All gaskets shall be asbestos free.
8. Aluminum jumper shall be provided across the flanged joint and length of the bolt shall be taken such that at least two threads remain exposed after the nut for fixing the continuity jumper.

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5.2 Units

1. All units are expressed in SI system with the exception of nominal pipe sizes (NPS) and bolting diameters, which are in inches.
2. Pressures are gauge pressures (in Kg/cm²g) and temperatures are in deg. Celsius (°C).
3. Pressures and Temperatures ratings are based ASME 16.5.

6.0 PIPELINE

- Line pipe material grade and wall thickness details are indicated in PMS.

7.0 PIPES

- 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.
- 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.
- All pipe threads shall conform to American Standard taper as per ASME B 1.20.1 NPT, unless otherwise specified.
- For butt weld end, bevel shall be in accordance with API specification 5L or ASME B16.25 as applicable.
- Where difference in thickness of matching pipe ends exist, bevels for such matching pairs shall be prepared in accordance with ASME B 31.8.
- Pipes shall be supplied with beveled end. Beveling shall be in accordance with ASME B16.25. Where plain end pipes are specified, as for small bore pipes for socket welded piping, the pipes shall be supplied with square cut ends.
- All pipe threads shall conform to American Standard taper as per ASME B 1.20.1 NPT, unless otherwise specified.
- Dimensions of socket weld ends shall confirm to ASME B 16.11. Bore shall match pipe OD and pipe ID.
- Pipe to pipe joints shall be made as follows:

For sizes up to & including DN40

Socket weld/ As per Piping Class

For size DN50 and above

Butt Welded

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8.0 FITTINGS

- 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.
- Threaded joints, if used, shall conform to American Standard taper as per ASME B1.20.1 NPT.
- Dimensions of socket welded/screwed fittings shall conform to ASME B 16.11. Swage shall be as per BS 3799.
- Dimensions of steel butt welded fittings shall be as per ASME B 16.9.
- Bore of socket welded fittings shall suit outside diameter (OD) of pipe and its thickness.
- 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.
- 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.
- Fittings thickness tolerances shall match pipe thickness tolerance.

9.0 BENDS

- Unless otherwise specified for process piping, elbow of radius $R = 1.5 D$ shall only be used.
- In order to accommodate changes in vertical and horizontal alignment in piggable section of pipeline, Elastic bends/ Cold field bends/ Hot formed long radius bends shall be used. Radius of bend shall be as per Design Basis.

$D = \text{Specified Outside Diameter}$

- Miters shall not be used.

10.0 FLANGES

- Pressure Temperature rating of flanges shall conform to B16.5/ MSS-SP44/ B16.47 Series A, as applicable.
- Dimensions of flanges shall be in accordance with B16.5/ MSS-SP44/ B16.47 Series A, as applicable.
- Neck of weld neck (WN) flanges shall suit pipe bore and thickness.
- Bore of socket welded (SW) flanges shall suit pipe O.D. and its thickness.
- Threads for screwed flanges, if used, shall conform to American Standard taper as per ASME B 1.20.1 NPT.
- Sizes for blind flanges shall be indicated by nominal pipe size.

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- Unless specified otherwise in Piping Material Specification the flange face finish shall be as per ASME B16.5.
- Butt welding ends of WN flanges shall conform to ASME B 16.25.
- Spectacle blind/spacer & blinds shall be in accordance with ASME B 16.48/ manufacturer's standard.
- Flange face finish for raised face flanges shall be as per ASME B16.5/ ASME B 16.47 as applicable. For RTJ flanges groove finish shall be 32-63 micro inches AARH as per MSS-SP-6. Hardness of groove surface shall be minimum 140 BHN.
- Butt welding ends of WN flanges shall conform to ASME B 16.25.
- Spectacle blind/spacer & blinds shall be in accordance with ASME B16.48 / manufacturer's standard.
- Two jackscrews, 180° apart shall be provided for all RTJ flange assemblies and Spacer blind/ Figure 8 assemblies. Holes for jackscrews shall be drilled and tapped at site. Jackscrews shall be as per ASTM A193 Gr. B7. Heads of jackscrews shall be heavy hexagonal type and jackscrew end shall be rounded. Dimensions shall be as per ASME B18.2.1.
- Flanges shall be packed and shipped in such a way as to prevent damage of machined parts.
- All machined or threaded parts shall be protected in accordance with ASTM A700. Suitable protection shield, or cover shall be provided on the gasket contact surface.
- Carbon steel forgings shall be supplied with a maximum carbon content of 0.25% and CE of 0.45 by product analysis.
- The finish of contact faces of pipe flanges & connecting end flanges of valves & fittings shall be governed by ASME B16.5 & following:
Roughness requirements (Finish: AARH standards per ASME B46.1):
 - a) Raised Face (RF): Serrated finish 125 to 250 µin Ra.
 - b) Flat Face (FF): Serrated finish 125 to 250 µin Ra.
 - c) Ring Type Joint (RTJ): Extra-smooth finish 63 µin Ra max.
- Flat face flanges, unless specified on the Piping Specifications, shall not be used without specific Client/PMC approval. Full-face gaskets shall be used with flat-face flanges as per ASME B16.20.
- All flanged joints shall be installed with a single gasket between contact faces.
- Spectacle blank (figure 8 blank), blank (blind) & spacer shall conform to the requirement of ASME B16.48 up to sizes 24". For 150#, 300# and 600# spectacle blank shall be used up to 8", blank (blind) & spacer for sizes 10" & above

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11.0 GASKETS

- Spiral wound metallic gasket with Graphite filled winding with SS304 inner ring and CS outer ring/ Soft iron octagonal ring type joint gasket, and shall conform to ASME B 16.20/ API 601
- Spiral wound gaskets shall be self-aligning type.

12.0 BOLTING & THREADS

- Nuts for stud bolts shall be American Standard Hexagon Heavy Series and double chamfered.
- Dimension and tolerances for stud bolts and nuts shall be as per ASME B18.2.1 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 B16.5/ASME B16.47 with full threading.
- 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
- 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
- Threads for threaded pipe, fitting, flanges and valve shall be in accordance with B1.20.1 taper threads, unless specified otherwise.
- 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.

13.0 THREAD SEALANT

- Threaded joints shall be made with 1" wide PTFE jointing tape.

14.0 VALVES

- Valve ends shall be as per valve data sheets for various piping class.
- 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.
- All buried valves shall be provided with stem extension shall have Butt Welded ends as per relevant specification/ data sheet.
- All valves in the piggable section of pipeline and Main Process Flow Line shall be Full Opening valve as per API 6D. Other valves shall be Reduced Opening type unless specified otherwise in P&ID.

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- Flange dimensions and face finish of flanged end valves shall conform to clause 10.0 of this specification.
- Butt welding ends of Butt-Welded valves shall conform to ASME B 16.25.
- Face to face and end to end dimensions shall conform to applicable standards.
- 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 Valve	:	BS EN ISO 17292
Plug Valve	:	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 Valve	:	API 6D
Plug Valve	:	API 6D

- All manual operated valves shall be provided with wrench / hand wheel or gear operator as specified here in below.

- **Gate Valves**

For ANSI class 150 and 300	-	Hand wheel operated for size ≤ 12" NB. Gear operated for size ≥ 14" NB.
For ANSI class 600	-	Hand wheel operated for size ≤ 10" NB. Gear operated for size ≥ 12" NB.

- **Globe Valves**

For ANSI class 150, 300, 600 and 900 - Hand wheel operated for all Size.

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- **Ball Valves & Plug Valves**

For all ANSI class

- Wrench operated for size ≤ 4 " NB.
Gear operated for size ≥ 6 " NB.

- **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.

15.0 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.

16.0 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.

17.0 PIPING SPECIALTY ITEMS

- Primary material Pipeline specialty items viz. flow tees, insulating joints, LR bends etc. shall be as per respective data sheets and specification.
- For mainline items, corrosion allowance shall be as per respective data sheet.

18.0 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.

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- 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.

18.1 Insulating Gaskets, Sleeves and Washer Materials Properties

Compressive Strength	:	65000 psi
Average Dielectric Strength	:	15 kV or more
Electrical Resistance	:	>1 MΩ (When tested with 500-1000 V DC merger)
Max. Operating Temperature	:	302°F (150°C)
Min. Operating Temperature	:	(-) 200°F (-129°C)
Water Absorption	:	5%
Flexural Strength	:	70000 psi
Tensile Strength	:	50000 psi
Bond Strength	:	2600 lb.
Shear Strength	:	22000 lb.

18.2 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,

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- 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.

19.0 CHARPY V-NOTCH TEST & HARDNESS 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)

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PIPING MATERIAL SPECIFICATION

Sr. No.	Piping Class	Rating	C. A. (MM)	Spl. Reqt.	Basic Material	Service	Remarks
1	15HC	150	1.5	NON-IBR	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE /NONFLAMMABLE, NON- LETHAL- HYDROCARBONS	Page 17
2	15HLT	150	1.5	LOW TEMPER ATURE SERVICE	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE /NON-FLAMMABLE, NON- LETHAL- HYDROCARBONS	Page 22
3	30HC	300	1.5	NON-IBR	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE / NONFLAMMABLE, NON- LETHAL- HYDROCARBONS	Page 28
4	30HLT	300	1.5	LOW TEMPER ATURE SERVICE	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE / NONFLAMMABLE, NON- LETHAL- HYDROCARBONS	Page 35
5	60HC	600	1.5	NON-IBR	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE / NONFLAMMABLE, NON- LETHAL- HYDROCARBONS	Page 40
6	60HLT	600	1.5	LOW TEMPER ATURE SERVICE	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE / NONFLAMMABLE, NON- LETHAL- HYDROCARBONS	Page 47

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PIPING MATERIAL SPECIFICATION

Appendix – B

Piping Class

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PIPING MATERIAL SPECIFICATION

PIPE CLASS	15HC
DESIGN CODE	ASME B31.8
RATING	150#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Non-IBR
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	-29	38	93	149	204	260	316	343	371
Pressure	20.03	20.03	18.28	16.17	14.06	11.95	9.84	8.78	7.73

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.
- All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
- 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. Drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. Drawing
Vents	ON LINES <= 1.5"	Refer std Drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. Drawing

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PIPING MATERIAL SPECIFICATION

Temp. Connection	1.5"	Flanged, installation as per std. Drawing, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std. Drawing

Branch Table

																T	24	BRANCH PIPE (INCH)										
																T	T		20									
																T	T		T	18								
																T	T		T	T	16							
																T	T		T	T	T	14						
																T	T		T	T	T	T	12					
																T	T		T	T	T	T	T	10				
																T	T		T	T	T	T	W	8				
																T	T		T	T	T	W	W	W	6			
																T	T		T	W	W	W	W	W	W	4		
																T	T		T	W	W	W	W	W	W	W	3	
																T	T		T	W	W	W	W	W	W	W	2	
																T	T		T	S	S	S	S	S	S	S	1.5	
																T	T		T	S	S	S	S	S	S	S	S	1
																T	T		T	S	S	S	S	S	S	S	S	0.75
T	T	T	T	S	S	S	S	S	S	S	S	S	S	S	S	0.5												
0.5	0.75	1	1.5	2	3	4	6	8	10	12	14	16	18	20	24													
PIPE RUN Size (INCH)																												

CODES

T
W
S

DESCRIPTION

Tees
Weldolet
Sockolet

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PIPING MATERIAL SPECIFICATION

Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
PIPE GROUP						
PIPE	0.5	0.75	S160	B-36.10	ASTM A 106 GR. B	PE, SEAMLESS
PIPE	1.0	1.5	XS	B-36.10	ASTM A 106 GR. B	PE, SEAMLESS
PIPE	2.0	2.0	XS	B-36.10	ASTM A 106 GR. B (Charpy)	BE, SEAMLESS
PIPE	3.0	14.0	STD	B-36.10	ASTM A 106 GR. B (Charpy)	BE, SEAMLESS
PIPE	16.0	24.0	STD	B-36.10	API 5L Gr. X52 PSL-2	BE, HSAW/LSAW
NIPPLE	0.5	1.5	M	B-36.10	ASTM A 106 GR. B	PBE, SEAMLESS
FLANGE GROUP						
FLNG.SW	0.5	1.5	M	B-16.5	ASTM A 105	150, RF/125AARH
FLNG.WN	2.0	14.0	M	B-16.5	ASTM A 105 (Charpy)	150, RF/125AARH
FLNG.WN	16.0	24.0	M	B-16.5	ASTM A694 Gr. F52 (Charpy)	150, RF/125AARH
FLNG.BLIND	0.5	1.5		B-16.5	ASTM A 105	150, RF/125AARH
FLNG.BLIND	0.5	24.0		B-16.5	ASTM A 105 (Charpy)	150, RF/125AARH
FLNG.FIG.8	0.5	8.0		ASME B16.48	ASTM A 105 (Charpy)	150, FF/125AARH
SPCR&BLND	10.0	24.0		ASME B16.48	ASTM A 105 (Charpy)	150, FF/125AARH
FITTING GROUP						
ELBOW.90	0.5	1.5		B-16.11	ASTM A 105	SW, 6000
ELBOW.90	2.0	12.0	M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW, 1.5D
ELBOW.45	0.5	1.5		B-16.11	ASTM A 105	SW, 6000
ELBOW.45	2.0	14.0	M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW, 1.5D
T. EQUAL	0.5	1.5		B-16.11	ASTM A 105	SW, 6000
T. EQUAL	2.0	14.0	M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW

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PIPING MATERIAL SPECIFICATION

T.RED	0.5	1.5		B-16.11	ASTM A 105	SW, 6000

Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
T.RED	2.0	14.0	M, M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW
REDUC. CONC	2.0	14.0	M, M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW
REDUC. ECC	2.0	14.0	M, M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW
SWAGE. CONC	0.5	3.0	M, M	BS-3799	ASTM A 105 (Charpy)	PBE
SWAGE.ECC	0.5	3.0	M, M	BS-3799	ASTM A 105	PBE
CAP	0.5	0.75		B-16.11	ASTM A 105	SCRF, 6000
CAP	1.0	1.5		B-16.11	ASTM A 105	SCRF, 3000
CAP	2.0	14.0	M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW
PLUG	0.5	0.75		B-16.11	ASTM A 105	SCRM, 6000
O'let						
WELDOLET	2.0	6.0	M, S160	MSS-SP97	ASTM A 105 (Charpy)	BW
SOCKOLET	0.5	0.75		MSS-SP97	ASTM A 105	SCRF, 6000
SOCKOLET	1.0	1.5		MSS-SP97	ASTM A 105	SW, 3000
VALVES GROUP						
VLV.GLOBE	0.25	1.5		BS EN 150 15761	BODY-ASTM A 105, TRIM-STELLITED, STEM-13%CR STEEL	SW, 800, 3000, B-16.11
VLV.GLOBE	2.0	24.0		BS-1873	BODY-ASTM A 216 GR.WCB, TRIM- 13% CR. STEEL	FLGD, 150, B-16.5, RF/125AARH
VLV.CHECK	0.25	1.5		BS EN 150 15761	BODY-ASTM A 105, TRIM-STELLITED	SW, 800, 3000, B-16.11
VLV.CHECK	2.0	24.0		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	0.5	1.5		BS EN 15017292	BODY-ASTM A 105, TRIM-13% CR. STEEL, SEAT- RPTFE	SW, 800, B-16.11, RF/125AARH
VLV.BALL	2.0	24.0		API-6D	BODY-ASTM A216 GR.WCB, TRIM/BALL SEAT-(AISI 4140 + 0.003"ENP)/AISI 410	FLGD, 150, B-16.5, RF/125AARH
VLV.BALL	2.0	24.0		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	0.5	1.5		BS-5353	BODY-ASTM A 105, PLUG - A105 + 0.003" ENP	SW, 800, 3000, B-16.11,
VLV.PLUG	2.0	24.0		API-6D	BODY- A 216GR. WCB, PLUG: A216 GR.WCB + 0.003" ENP	FLGD, 150, B-16.5, RF/125AARH
VLV.PLUG	2.0	24.0	M	API-6D	BODY-ASTM A 216 GR.WCB, PLUG: A216 GR.WCB + 0.003"ENP	BW, 150, B-16.25
BOLT GROUP						
BOLT.STUD	0.5	48.0		B-18.2	BOLT: A193 GR.B7, NUT:A194 GR.2H	
GASKET GROUP						
GASKET	0.5	24.0		B-16.20-ANSI B16.5	SP.WND METTALIC WITH GRAPHITE FILLER	SPIRAL, 150
GASKET	26.0	48.0		B-16.20-ANSI B16.47A	SP.WND METTALIC WITH GRAPHITE FILLER	SPIRAL, 150

Note: For all Valves, valve data sheets shall also be referred, stringent requirement among data sheet and above details shall be followed.

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PIPING MATERIAL SPECIFICATION

PIPE CLASS	15HLT
DESIGN CODE	ASME B31.8
RATING	150#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Low Temperature Service
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	-45	38	93
Pressure	18.63	18.63	17.92

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 (-) 45°C.
- All branch connections including vent, drain, pressure, and temperature connection shall be as per branch connection table.
- 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. Drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. Drawing
Vents	ON LINES <= 1.5"	Refer std. Drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std Drawing

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Temp. Connection	1.5"	Flanged, installation as per std. Drawing, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std. Drawing

Branch Table

							T	6	BRANCH PIPE (INCH)
						T	T	4	
					T	T	T	3	
			T	T	T	T	W	2	
		T	T	T	T	T	S	1.5	
	T	T	T	T	S	S	S	1	
T	T	T	T	T	S	S	S	0.75	
T	T	T	T	S	S	S	S	0.5	
0.5	0.75	1	1.5	2	3	4	6		
PIPE RUN Size (INCH)									

CODES

T	Tees
W	Weldolet
S	Sockolet

DESCRIPTION

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PIPING MATERIAL SPECIFICATION

Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
PIPE GROUP						
PIPE	0.5	0.75	S160	B-36.10	ASTM A 333 GR.6	PE, SEAMLESS
PIPE	1.0	1.5	XS	B-36.10	ASTM A 333 GR.6	PE, SEAMLESS
PIPE	2.0	2.0	XS	B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
PIPE	3.0	6.0	STD	B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
NIPPLE	0.5	1.5	M	B-36.10	ASTM A 333 GR.6	PBE, SEAMLESS
FLANGE GROUP						
FLNG.WN	0.5	6.0	M	B-16.5	ASTM A 350 GR.LF2	150, RF/125AARH
FLNG.BLIND	0.5	6.0		B-16.5	ASTM A 350 GR.LF2	150, RF/125AARH
FLNG.FIG.8	0.5	6.0		ASME B16.48	ASTM A 350 GR.LF2	150, FF/125AARH
FITTING GROUP						
ELBOW.90	0.5	0.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
ELBOW.90	1.0	1.5		B-16.11	ASTM A 350 GR.LF2	SW, 3000
ELBOW.90	2.0	6.0	M	B-16.9	ASTM A 420 GR.WPL6	BW, 1.5D
ELBOW.45	0.5	0.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
ELBOW.45	1.0	1.5		B-16.11	ASTM A 350 GR.LF2	SW, 3000
ELBOW.45	2.0	6.0	M	B-16.9	ASTM A 420 GR.WPL6	BW, 1.5D
T. EQUAL	0.5	0.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
T. EQUAL	1.0	1.5		B-16.11	ASTM A 350 GR.LF2	SW, 3000
T. EQUAL	2.0	6.0	M	B-16.9	ASTM A 420 GR.WPL6	BW
T.RED	0.5	0.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
T.RED	1.0	1.5		B-16.11	ASTM A 350 GR.LF2	SW, 3000
T.RED	2.0	6.0	M, M	B-16.9	ASTM A 420 GR.WPL6	BW
REDUC. CONC	2.0	6.0	M, M	B-16.9	ASTM A 420 GR.WPL6	BW
REDUC. ECC	2.0	6.0	M, M	B-16.9	ASTM A 420 GR.WPL6	BW
SWAGE. CONC	0.5	3.0	M, M	BS-3799	ASTM A 350 GR.LF2	PBE
SWAGE.ECC	0.5	3.0	M, M	BS-3799	ASTM A 350 GR.LF2	PBE
CAP	0.5	1.5		B-16.11	ASTM A 350 GR.LF2	SCRIF, 3000
CAP	2.0	6.0	M	B-16.9	ASTM A 420 GR.WPL6	BW
PLUG	0.5	1.5		B-16.11	ASTM A 350 GR.LF2	SCRM, 3000
COUPLING FULL	0.5	0.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
COUPLING FULL	1.0	1.5		B-16.11	ASTM A 350 GR.LF2	SW, 3000
COUPLING HALF	0.5	0.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
COUPLING HALF	1.0	1.5		B-16.11	ASTM A 350 GR.LF2	SW, 3000

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PIPING MATERIAL SPECIFICATION

Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
O'let						
WELDOLET	2.0	6.0	M, XXS	MSS-SP97	ASTM A 350 GR.LF2	BW
SOCKOLET	0.5	0.75		MSS-SP97	ASTM A 350 GR.LF2	SW, 6000
SOCKOLET	1.0	1.5		MSS-SP97	ASTM A 350 GR.LF2	SW, 3000
VALVES GROUP						
VLV.GLOBE	0.5	1.5		BS EN 15015761	BODY-ASTM A 350 GR.LF2, TRIMSTELLITED, STEMSS304	SW, 800, 3000, B-16.11
VLV.GLOBE	2.0	6.0		BS-1873	BODY-ASTM A 350 GR.LF2, / ASTM A 352 GR.LCB	FLGD, 150, B-16.5, RF/125AARH
VLV.CHECK	0.5	1.5		BS EN 15015761	BODY-ASTM A 350 GR.LF2,	SW, 800, 3000, B-16.11
VLV.CHECK	2.0	6.0		API-6D/BS-1868	BODY-ASTM A 350 GR.LF2, / ASTM A 352 GR.LCB TRIM-STELLITED	FLGD, 150, B-16.5, RF/125AARH
VLV.BALL	0.5	1.5		BS EN 15017292	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1, TRIM-BODY SEAT-RPTFE	SW, 800, 3000, B-16.11
VLV.BALL	2.0	6.0		API-6D	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1,	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	2.0	6.0		API-6D	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1,	BW, 150, B-16.25
BOLT GROUP						
BOLT.STUD	0.5	6.0		B-18.2	BOLT: A320 GR. L7, NUT: A194 GR.4	
GASKET GROUP						
GASKET	0.5	6.0		B-16.20-ANSI B16.5	SP.WND SS316+ GRAFOIL	SPIRAL, 150

Note: For all Valves, valve data sheets shall also be referred, stringent requirement among data sheet and above details shall be followed.

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PIPING MATERIAL SPECIFICATION

PIPE CLASS	30HC
DESIGN CODE	ASME B31.8
RATING	300#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Non-IBR
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	-29	38	93	149	204	260	316
Pressure	52.02	52.02	47.45	46.05	44.64	42.18	40.66

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. Corrosion allowance of 1.5 mm has been considered for terminal piping.
6. All branch connections including vent, drain, pressure, and temperature connection shall be as per branch connection table.
7. For valves, refer valve data sheets as enclosed.
8. Design Factor 0.5
9. 9. Ball Valve to be used in main pipeline shall have butt welded ends.

ITEM	SIZE	DESCRIPTION
Maintenance joints	ALL	Flanged, to be kept minimum

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Pipe joints	1.5" & BELOW	SW coupling
	2.0" & ABOVE	Butt welded
Drains	ON LINES <= 1.5"	Refer std. drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. drawing
Vents	ON LINES <= 1.5"	Refer std. drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. drawing
Temp. Connection	1.5"	Flanged, installation as per std. drawing, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std drawing

Branch Table

[illegible]

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0.5	0.75	1	1.5	2	3	4	6	8	10	12	14	16	18	20	24	30	32	36	42		
PIPE RUN SIZE (INCH)																					

CODES DESCRIPTION

T	Tees
W	Weldolet
S	Sockolet

Item	Lower Size (Inch)	Upper Size (Inch)	Sch./ Thk.	Dmn. STD	Material (Charpy)	Description
PIPE GROUP						
PIPE	0.5	0.75	S160	B-36.10	ASTM A 106 GR. B	PE, SEAMLESS
PIPE	1.0	1.5	XS	B-36.10	ASTM A 106 GR. B	PE, SEAMLESS
PIPE	2.0	2.0	XS	B-36.10	ASTM A 106 GR. B (CHARPY)	BE, SEAMLESS
PIPE	3.0	14.0	STD	B-36.10	ASTM A 106 GR. B (CHARPY)	BE, SEAMLESS
PIPE	16.0	20.0	XS	B-36.10	API 5L GR. X52 PSL- 2 (CHARPY)	BE, E.FS. W
PIPE	24.0	24.0	S30	B-36.10	API 5L GR. X52 PSL- 2 (CHARPY)	BE, E.FS. W
NIPPLE	0.5	1.5	M	B-36.10	ASTM A 106 GR. B	PBE, SEAMLESS
FLANGE GROUP						
FLNG.SW	0.5	1.5	M	B-16.5	ASTM A 105	300, RF/125AARH
FLNG.WN	2.0	14.0	M	B-16.5	ASTM A 105 (CHARPY)	300, RF/125AARH
FLNG. WN	16.0	24.0	M	B-16.5	ASTM A 105 (CHARPY)	300, RF/125AARH
FLNG.BLIND	0.5	1.5		B-16.5	ASTM A 105	300, RF/125AARH
FLNG.BLIND	2.0	24.0		B-16.5	ASTM A 105 (CHARPY)	300, RF/125AARH
FLNG.FIG.8	0.5	1.5		ASME- B 16.48	ASTM A 105	300, FF/125AARH
FLNG.FIG.8	2.0	8.0		ASME- B 16.48	ASTM A 105 (CHARPY)	300, FF/125AARH
SPCR&BLND	10.0	24.0		ASME- B 16.48	ASTM A 105 (CHARPY)	300, FF/125AARH

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FITTING GROUP						
ELBOW.90	0.5	0.75		B-16.11	ASTM A 105	SW, 6000
ELBOW.90	1.0	1.5		B-16.11	ASTM A 105	SW, 3000
ELBOW.90	2.0	24.0	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW, 1.5D
ELBOW.45	0.5	0.75		B-16.11	ASTM A 105	SW, 6000
ELBOW.45	1.0	1.5		B-16.11	ASTM A 105	SW, 3000
Item	Lower Size (Inch)	Upper Size (Inch)	Sch./ Thk.	Dmn. STD	Material (Charpy)	Description
ELBOW.45	2.0	24.0	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW, 1.5D
T. EQUAL	0.5	00.75		B-16.11	ASTM A 105	SW, 6000
T. EQUAL	1.0	1.5		B-16.11	ASTM A 105	SW, 3000
T. EQUAL	2.0	24.0	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
T.RED	0.5	0.75		B-16.11	ASTM A 105	SW, 6000
T.RED	1.0	1.5		B-16.11	ASTM A 105	SW, 3000
T.RED	2.0	24.0	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
REDUC. CONC	2.0	24.0	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
REDUC. ECC	2.0	24.0	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
SWAGE. CONC	0.5	3.0	M, M	BS-3799	ASTM A 105 (CHARPY)	PBE
SWAGE. ECC	0.5	3.0	M, M	BS-3799	ASTM A 105 (CHARPY)	PBE
CAP	0.5	0.75		B-16.11	ASTM A 105	SCRIF, 6000
CAP	1.0	1.5		B-16.11	ASTM A 105	SCRIF, 3000
CAP	2.0	24.0	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
PLUG	0.5	0.75		B-16.11	ASTM A 105	SCRM, 6000
PLUG	1.0	1.5		B-16.11	STM A 105	SCRM, 3000
CPLNG.FULL	0.5	0.75		B-16.11	ASTM A 105	SW, 6000

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CPLNG.FULL	1.0	1.5		B-16.11	ASTM A 105	SW, 3000
CPLNG.HALF	0.5	0.75		B-16.11	ASTM A 105	SW, 6000
CPLNG.HALF	1.0	1.5		B-16.11	ASTM A 105	SW, 3000
CPLNG.LH	0.5	0.75		B-16.11	ASTM A 105	SW, 6000
CPLNG.LH	1.0	1.5		B-16.11	ASTM A 105	SW, 3000
CPLNG.RED	0.5	0.75		B-16.11	ASTM A 105	SW, 6000
Item	Lower Size (Inch)	Upper Size (Inch)	Sch./ Thk.	Dmn. STD	Material (Charpy)	Description
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
SOCKOLET	01.000	01.500		MSS-SP97	ASTM A 105	SW, 3000
WELDOLET	02.000	08.000	M, XX	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%	SW, 800, 3000, B-16.11
VLV.GATE	02.000	24.000		API 600/ ISO 10434	BODY-ASTM A 105/ ASTM A 216 GR.WCB STELLITED, STEM- SS304	FLGD, 300, B-16.5, RF/125AARH
VLV.GLOBE	00.500	01.500		BS EN ISO 15761	BODY-ASTM A 105, TRIM- STELLITED, STEM- 13%	SW, 800, 3000, B-16.11
VLV.GLOBE	02.000	24.000		BS 1873	BODY-ASTM A 105 / ASTM A 216 GR.WCB , TRIM-13% CR. STEEL	FLGD, 300, B-16.5, RF/125AARH
VLV.CHECK	00.500	01.500		BS EN ISO 15761	BODY-ASTM A 105, TRIM- STELLITED	SW, 800, 3000, B-16.11
VLV.CHECK	02.000	24.000		API-6D/BS-1868	BODY-ASTM A 105 / ASTM A 216 GR.WCB	FLGD, 300, B-16.5, RF/125AARH

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VLV.BALL	0.5	1.5		BS EN ISO 17292	BODY-ASTM A 105,	SW, 800, B-16.11, RF/125AARH
VLV.BALL	2.0	24.0		API-6D	BODY-ASTM A 216 GR.WCB/ ASTM 105	FLGD, 300, B-16.5, RF/125AARH
Item	Lower Size (Inch)	Upper Size (Inch)	Sch./ Thk.	Dmn. STD	Material (Charpy)	Description
VLV.BALL	2.0	24.0	M	API-6D	BODY-ASTM A 216 GR.WCB/ASTM 105,	BW, 300, B- 16.25
VLV.PLUG	0.5	1.5		BS-5353	BODY-ASTM A 105, PLUG- A105 +0.003" ENP	SW, 800#, 3000, B-16.11
VLV.PLUG	2.0	24.0		API-6D	BODY- A 216GR. WCB, PLUG: A216 GR.WCB + 0.003" ENP	FLGD, 300, B-16.5, RF/125AARH
VLV.PLUG	2.0	24.0	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	0.5	30.0		B-18.2	BOLT: A193 GR.B7, NUT:A194	
GASKET						
GASKET	0.5	24.0		B-16.20- ANSI B16.5	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 300
GASKET	26.0	30.0		B-16.20- ANSI B16.47A	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 300

Note: For Valve Material, valve data sheet shall also be referred, stringent requirement among data sheet and above details shall be followed.

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PIPING MATERIAL SPECIFICATION

PIPE CLASS

30HLT

DESIGN CODE	ASME B31.8
RATING	300#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Low Temperature Service
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	-45	38	93	120	149	204
Pressure	48.86	48.86	46.05	45.54	44.99	43.59

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
- Flanged end shall be as per ASME B 16.5 for valve up to 24" (excluding 22"), for 22" as per MSS-SP-44.
- Charpy V notch test and hardness test shall be conducted for pipes, fittings and flanges at (-) 45°C.
- All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
- 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. drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. drawing
Vents	ON LINES <= 1.5"	Refer std. drawing

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	ON LINES $\geq 2.0"$	As per P&ID or 0.75". Refer std. drawing
Temp. Connection	1.5"	Flanged, installation as per std. drawing, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std. drawing

Branch Table

													T	16	BRANCH PIPE (INCH)									
													T	T		14								
													T	T		T	12							
													T	T		T	T	10						
													T	T		T	T	T	8					
													T	T		T	T	T	6					
													T	T		T	T	T	4					
													T	T		T	W	W	W	3				
													T	T		T	W	W	W	2				
													T	T		T	W	W	W	1.5				
													T	T	T	S	S	S	S	1				
													T	T	T	S	S	S	S	S	0.75			
													T	T	T	S	S	S	S	S	S	0.5		
													T	T	T	S	S	S	S	S	S	S	0.5	
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T	S	S	S	S	S	S	S	S	0.5
													T	T	T									

CODES

T
W
S

DESCRIPTION

Tees
Weldolet
Sockolet

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
PIPE GROUP						
PIPE	0.5	0.75	S160	B-36.10	ASTM A 333 GR.6	PE, SEAMLESS
PIPE	1.0	1.5	XS	B-36.10	ASTM A 333 GR.6	PE, SEAMLESS
PIPE	2.0	2.0	XS	B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
PIPE	3.0	14.0	STD	B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
NIPPLE	0.5	0.75	M	B-36.10	ASTM A 333 GR.6	PBE, SEAMLESS
NIPPLE	1.0	1.5	M	B-36.10	ASTM A 333 GR.6	PBE, SEAMLESS
FLANGE GROUP						
FLNG.SW	0.5	1.5	M	B-16.5	ASTM A 350 GR.LF2	300, RF/125AARH
FLNG.WN	2.0	14.0	M	B-16.5	ASTM A 350 GR.LF2	300, RF/125AARH
FLNG.BLIND	0.5	14.0		B-16.5	ASTM A 350 GR.LF2	300, RF/125AARH
FLNG.FIG.8	0.5	8.0		ASME- B 16.48	ASTM A 350 GR.LF2	300, FF/125AARH
SPCR&BLIND	10.0	14.0		ASME- B16.48	ASTM A 350 GR.LF2	300, FF/125AARH
FITTINGS						
ELBOW.90	0.5	0.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
ELBOW.90	1.0	1.5		B-16.11	ASTM A 350 GR.LF2	SW, 3000
ELBOW.90	2.0	14.0	M	B-16.9	ASTM A 420 GR.WPL6	BW, 1.5D
ELBOW.45	0.5	0.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
ELBOW.45	1.0	1.5		B-16.11	ASTM A 350 GR.LF2	SW, 3000
ELBOW.45	2.0	14.0	M	B-16.9	ASTM A 420 GR.WPL6	BW, 1.5D
T. EQUAL	0.5	0.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
T. EQUAL	1.0	1.5		B-16.11	ASTM A 350 GR.LF2	SW, 3000
Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description

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T. EQUAL	2.0	14.0	M	B-16.9	ASTM A 420 GR.WPL6	BW
VALVE GROUP						
VLV.BALL	0.5	1.5		BS EN ISO 17292	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1,	SW, 800, 3000, B-16.11
VLV.BALL	2.0	14.0		API-6D	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1,	FLGD, 300, B- 16.5, RF/125AARH
VLV.GATE	0.5	1.5		API-602	BODY-ASTM A 350 GR.LF2,TRIM- STELLITED,STEM- SS	SW, 800, 3000, B-16.11
VLV.GATE	2.0	14.0		API 600/ ISO 10434	BODY-ASTM A 350 GR.LF2,/ ASTM A 352 GR.LCB STELLITED,STEM- SS304	FLGD, 300, B-16.5, RF/125AARH
VLV.GLOBE	0.5	1.5		BS EN ISO 15761	BODY-ASTM A 350 GR.LF2,TRIM- STELLITED,STEM- SS304	SW, 800, 3000, B-16.11
VLV.GLOBE	2.0	14.0		BS-1873	BODY-ASTM A 350 GR.LF2,/ ASTM A 352 GR.LCB	FLGD, 300, B-16.5, RF/125AARH
VLV.CHECK	0.5	1.5		BS EN ISO 15761	BODY-ASTM A 350 GR.LF2,TRIM- STELLITED	SW, 800, 3000, B-16.11
VLV.CHECK	2.0	14.0		API-6D/BS- 1868	BODY-ASTM A 350 GR.LF2,/ ASTM A 352 GR.LCB TRIM- STELLITED	FLGD, 300, B-16.5, RF/125AARH
VLV.PLUG	0.5	1.5		BS-5353	BODY-ASTM A 350 GR.LF2, PLUG: A350 GR.LF2 + 0.003" ENP	SW, 800, 3000, B-16.11
VLV.PLUG	2.0	14.0		API-6D	BODY-ASTM A 352 GR.LCB / A350 GR.LF2,	FLGD, 300, B-16.5, RF/125AARH
VLV.PLUG	2.0	14.0		API-6D	BODY-ASTM A 352 GR.LCB/ ASTM A350GR.LF2,	BW, 300, B-16.25

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BOLT & GASKET						
BOLT.STUD	0.5	14.0		B-18.2	BOLT:A320 GR.L7, NUT:A194 GR.4	
GASKET	0.5	14.0		B-16.20- ANSI B16.5	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 300

Note: For all Valves, valve data sheets shall also be referred, stringent requirement among data sheet and above details shall be followed.

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PIPING MATERIAL SPECIFICATION

PIPE CLASS	60HC
DESIGN CODE	ASME B31.8
RATING	600#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Non-IBR
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	(-)29	38	93	149
Pressure	104.05	104.05	94.91	92.45

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
9. 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. drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. drawing

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Vents	ON LINES <= 1.5"	Refer std. drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. drawing
Temp. Connection	1.5"	Flanged, installation as per std. drawing, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std drawing

Branch Table

[illegible]

CODES	DESCRIPTION
T	Tees
W	Weldolet
S	Sockolet

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch/ Thk. (mm)	Dmn. STD	Material (Charpy)	Description
PIPE GROUP						
PIPE	0.5	0.75	S160	B-36.10	ASTM A 106 GR. B	PE, SEAMLESS
PIPE	1.0	1.5	XS	B-36.10	ASTM A 106 GR. B	PE, SEAMLESS
PIPE	2.0	8.0	XS	B-36.10	ASTM A 106 GR. B (CHARPY)	BE, SEAMLESS
PIPE	10.0		XS	B-36.10	API 5L GR. X-52 PSL2	BE, SEAMLESS
PIPE	12.0		S60	B-36.10	API 5L GR. X-52 PSL2	BE, SEAMLESS
PIPE	16.0		17.5	B-36.10	API 5L GR. X-52 PSL2	BE, SEAMLESS
PIPE	18.0		12.7	B-36.10	API 5L GR. X-70 PSL2	BE, HSAW/LSAW
NIPPLE	0.5	1.5	M	B-36.10	ASTM A 106 GR. B	PBE, SEAMLESS
FLANGE GROUP						
FLNG. SW	0.5	1.5	M	B-16.5	ASTM A 105	600, RF/125AARH
FLNG. WN	2.0	8.0	M	B-16.5	ASTM A 105 (CHARPY)	600, RF/125AARH
FLNG. WN	10.0	16.0	M	B-16.5	ASTM A 694 GR. F52	600, RF/125AARH
FLNG. WN	18.0		M	B-16.5	ASTM A 694 GR. F70	600, RF/125AARH
FLNG. BLIND	0.5	1.5		B-16.5	ASTM A 105	600, RF/125AARH
FLNG. BLIND	2.0	24.0		B-16.5	ASTM A 105 (CHARPY)	600, RF/125AARH
FLNG. FIG.8	0.5	1.5		ASME- B 16.48	ASTM A 105	600, FF/125AARH

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch/ Thk (mm)	Dmn. STD	Material (Charpy)	Description
FLNG. FIG.8	2.0	8.0		ASME- B 16.48	ASTM A 105 (CHARPY)	600, FF/125AARH
SPCR& BLND	10.0	24.0		ASME- B 16.48	ASTM A 105 (CHARPY)	600, FF/125AARH
FITTING GROUP						
ELBOW.90	0.5	0.75		B-16.11	ASTM A 105	SW, 6000
ELBOW.90	1.0	1.5		B-16.11	ASTM A 105	SW, 3000
ELBOW.90	2.0	8.0	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW, 1.5D
ELBOW.90	10.0	18.0	M	MSS-SP-75	ASTM A 860 GR. WPHY 52 (CHARPY)	BW, 1.5D
ELBOW.45	0.5	0.75		B-16.11	ASTM A 105	SW, 6000
ELBOW.45	1.0	1.5		B-16.11	ASTM A 105	SW, 3000
ELBOW.45	2.0	8.0	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW, 1.5D
ELBOW.45	10.0	18.0	M	MSS-SP-75	ASTM A 860 GR. WPHY 52 (CHARPY)	BW, 1.5D
T. EQUAL	0.5	0.75		B-16.11	ASTM A 105	SW, 6000
T. EQUAL	1.0	1.5		B-16.11	ASTM A 105	SW, 3000
T. EQUAL	2.0	8.0	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
T. EQUAL	10.0	16.0	M	MSS-SP-75	ASTM A 860 GR. WPHY 52 (CHARPY)	BW
T.RED	0.5	0.75		B-16.11	ASTM A 105	SW, 6000
T.RED	1.0	1.5		B-16.11	ASTM A 105	SW, 3000
T.RED	2.0	8.0	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
T.RED	10.0	16.0	M, M	MSS-SP-75	ASTM A 860 GR. WPHY 52 (CHARPY)	BW

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch/ Thk (mm)	Dmn. STD	Material (Charpy)	Description
REDUC. CONC	2.0	6.0	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
REDUC. CONC	8.0	18.0	M, M	MSS-SP-75	ASTM A 860 GR. WPHY 52 (CHARPY)	BW
REDUC. ECC	2.0	18.0	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
SWAGE. CONC	0.5	3.0	M, M	BS-3799	ASTM A 105 (CHARPY)	PBE
SWAGE. ECC	0.5	3.0	M, M	BS-3799	ASTM A 105 (CHARPY)	PBE
CAP	0.5	0.75		B-16.11	ASTM A 105	SCRF, 6000
CAP	1.0	1.5		B-16.11	ASTM A 105	SCRF, 3000
CAP	2.0	18.0	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
PLUG	0.5	0.75		B-16.11	ASTM A 105	SCRM, 6000
PLUG	1.0	1.5		B-16.11	STM A 105	SCRM, 3000
CPLNG. FULL	0.5	0.75		B-16.11	ASTM A 105	SW, 6000
CPLNG. FULL	1.0	1.5		B-16.11	ASTM A 105	SW, 3000
CPLNG. HALF	0.5	0.75		B-16.11	ASTM A 105	SW, 6000
CPLNG. HALF	1.0	1.5		B-16.11	ASTM A 105	SW, 3000
CPLNG. LH	0.5	0.75		B-16.11	ASTM A 105	SW, 6000
CPLNG. LH	1.0	1.5		B-16.11	ASTM A 105	SW, 3000
CPLNG. RED	0.5	0.75		B-16.11	ASTM A 105	SW, 6000
CPLNG. RED	1.0	1.5		B-16.11	ASTM A 105	SW, 3000
O'let						
SOCKOLET	0.5	0.75		MSS- SP97	ASTM A 105	SW, 6000
SOCKOLET	1.0	1.5		MSS- SP97	ASTM A 105	SW, 3000
WELDOLET	2.0	8.0	M, XX	MSS- SP97	ASTM A 105 (CHARPY)	BW

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch ./Thk	Dmn. STD	Material (Charpy)	Description
VALVE GROUP						
VLV.GATE	0.5	1.5		API-602	BODY-ASTM A 105,TRIM-STELLITED,STEM 13%	SW, 800, 3000, B-16.11
VLV.GATE	2.0	24.0		API 600/ ISO 10434	BODY-ASTM A 105/ ASTM A 216 GR.WCB STELLITED, STEM-SS304	FLGD, 600, B-16.5, RF/125AARH
VLV. GLOBE	0.5	1.5		BS EN ISO 15761	BODY-ASTM A 105,TRIM-STELLITED,STEM-13%	SW, 800, 3000, B-16.11
VLV. GLOBE	2.0	24.0		BS 1873	BODY-ASTM A 105 / ASTM A 216 GR.WCB , TRIM-13% CR.STEEL	FLGD, 600, B-16.5, RF/125AARH
VLV. CHECK	0.5	1.5		BS EN ISO 15761	BODY-ASTM A 105, TRIM- STELLITED	SW, 800, 3000, B-16.11
VLV. CHECK	2.0	24.0		API-6D/ BS-1868	BODY-ASTM A 105 / ASTM A 216 GR.WCB	FLGD, 600, B-16.5, RF/125AARH
VLV.BALL	0.5	1.5		BS EN ISO17292	BODY-ASTM A 105,	SW, 800, B-16.11, RF/125AARH
VLV.BALL	2.0	24.0		API-6D	BODY-ASTM A 216 GR.WCB/ ASTM 105	FLGD, 600, B-16.5, RF/125AARH
VLV.BALL	2.0	24.0	M	API-6D	BODY-ASTM A 216 GR.WCB/ASTM 105,	BW, 600, B-16.25
VLV.PLUG	0.5	1.5		BS-5353	BODY-ASTM A 105, PLUG- A105 +0.003" ENP	SW, 800#, 3000, B-16.11

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch ./Thk	Dmn. STD	Material (Charpy)	Description
VLV.PLUG	2.0	24.0		API-6D	BODY- A 216GR. WCB, PLUG: A216 GR.WCB + 0.003" ENP	FLGD, 600, B-16.5, RF/125AARH
VLV.PLUG	2.0	24.0	M	API-6D	BODY-ASTM A 216 GR.WCB, PLUG: A216 GR.WCB +	BW, 600, B-16.25
BOLT GROUP						
BOLT. STUD	0.5	30.0		B-18.2	BOLT: A193 GR.B7, NUT:A194	
GASKET						
GASKET	0.5	24.0		B-16.20- ANSI B16.5	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 600
GASKET	26.0	30.0		B-16.20- ANSI B16.47A	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 600

Note: For Valve Material, valve data sheet shall also be referred, stringent requirement among data sheet and above details shall be followed.

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PIPING MATERIAL SPECIFICATION

PIPE CLASS	60HLT
DESIGN CODE	ASME B31.8
RATING	600#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Low Temperature Service
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	-45	38	93	120
Pressure	98.07	98.07	92.79	91.27

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
- Flanged end shall be as per ASME B 16.5 for valve up to 24" (excluding 22"), for 22" as per MSS-SP-44.
- Charpy V notch test and hardness test shall be conducted for pipes, fittings and flanges at (-) 45°C.
- All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
- 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. drawing

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	ON LINES $\geq 2.0"$	As per P&ID or 0.75". Refer std. drawing
Vents	ON LINES $\leq 1.5"$	Refer std. drawing
	ON LINES $\geq 2.0"$	As per P&ID or 0.75". Refer std. drawing
Temp. Connection	1.5"	Flanged, installation as per std. drawing, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std. drawing

Branch Table

													T	16	BRANCH PIPE (INCH)
												T	T	14	
											T	T	T	12	
										T	T	T	T	10	
									T	T	T	T	T	8	
								T	T	T	T	T	T	6	
							T	T	T	T	W	W	W	4	
						T	T	T	W	W	W	W	W	3	
					T	T	T	W	W	W	W	W	W	2	
				T	T	T	T	S	S	S	S	S	S	1.5	
			T	T	T	S	S	S	S	S	S	S	S	1	
		T	T	T	T	S	S	S	S	S	S	S	S	0.75	
T	T	T	T	S	S	S	S	S	S	S	S	S	S	0.05	
0.05	0.75	1	1.5	2	3	4	6	8	10	12	14	16			
PIPE RUN Size (INCH)															

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PIPING MATERIAL SPECIFICATION

CODES	DESCRIPTION
T	Tees
W	Weldolet
S	Sockolet

Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
PIPE GROUP						
PIPE	0.5	0.75	S16	B-36.10	ASTM A 333 GR.6	PE, SEAMLESS
PIPE	1.0	1.5	XS	B-36.10	ASTM A 333 GR.6	PE, SEAMLESS
PIPE	2.0	8.0	XS	B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
PIPE	10.0			B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
PIPE	12.0		17.48	B-36.10	ASTM A 333 GR.6	PBE, SEAMLESS
NIPPLE	0.5	0.75	M	B-36.10	ASTM A 333 GR.6	PBE, SEAMLESS
NIPPLE	1.0	1.5	M	B-36.10	ASTM A 333 GR.6	PBE, SEAMLESS
FLANGE GROUP						
FLNG.SW	0.5	1.5	M	B-16.5	ASTM A 350 GR.LF2	600, RF/125AARH
FLNG.WN	2.0	14.0	M	B-16.5	ASTM A 350 GR.LF2	600, RF/125AARH
FLNG.BLIND	0.5	14.0		B-16.5	ASTM A 350 GR.LF2	600, RF/125AARH
FLNG.FIG.8	0.5	8.0		ASME- B 16.48	ASTM A 350 GR.LF2	600, FF/125AARH
SPCR&BLIND	10.0	14.0		ASME- B16.48	ASTM A 350 GR.LF2	600, FF/125AARH
FITTINGS						
ELBOW.90	0.5	0.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
ELBOW.90	1.0	1.5		B-16.11	ASTM A 350 GR.LF2	SW, 3000
ELBOW.90	2.0	14.0	M	B-16.9	ASTM A 420 GR.WPL6	BW, 1.5D
ELBOW.45	0.5	0.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
ELBOW.45	1.0	1.5		B-16.11	ASTM A 350 GR.LF2	SW, 3000
ELBOW.45	2.0	14.0	M	B-16.9	ASTM A 420 GR.WPL6	BW, 1.5D

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T. EQUAL	0.5	0.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
T. EQUAL	1.0	1.5		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	2.0	14.0	M	B-16.9	ASTM A 420 GR.WPL6	BW
VALVE GROUP						
VLV.BALL	0.5	1.5		BS EN ISO 17292	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1,	SW, 800, 3000, B-16.11
VLV.BALL	2.0	14.0		API-6D	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1,	FLGD, 600, B-16.5, RF/125AARH
VLV.GATE	0.5	1.5		API-602	BODY-ASTM A 350 GR.LF2, TRIM-STELLITED, STEM- SS	SW, 800, 3000, B-16.11
VLV.GATE	2.0	14.0		API 600/ ISO 10434	BODY-ASTM A 350 GR.LF2/ ASTM A 352 GR.LCB STELLITED, STEM- SS304	FLGD, 600, B-16.5, RF/125AARH
VLV.GLOBE	0.5	1.5		BS EN ISO 15761	BODY-ASTM A 350 GR.LF2, TRIM-STELLITED, STEM- SS304	SW, 800, 3000, B-16.11
VLV.GLOBE	2.0	14.0		BS-1873	BODY-ASTM A 350 GR.LF2/ ASTM A 352 GR.LCB	FLGD, 600, B-16.5, RF/125AARH
VLV.CHECK	0.5	1.5		BS EN ISO 15761	BODY-ASTM A 350 GR.LF2, TRIM-STELLITED	SW, 800, 3000, B-16.11
VLV.CHECK	2.0	14.0		API-6D/BS-1868	BODY-ASTM A 350 GR.LF2/ ASTM A 352 GR.LCB TRIM-STELLITED	FLGD, 600, B-16.5, RF/125AARH
VLV.PLUG	0.5	1.5		BS-5353	BODY-ASTM A 350 GR.LF2, PLUG: A350 GR.LF2 + 0.003" ENP	SW, 800, 3000, B-16.11
VLV.PLUG	2.0	14.0		API-6D	BODY-ASTM A 352 GR.LCB / A350 GR.LF2,	FLGD, 600, B-16.5, RF/125AARH

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VLV.PLUG	2.0	14.0		API-6D	BODY-ASTM A 352 GR.LCB/ ASTM A350GR.LF2,	BW, 600, B-16.25
BOLT & GASKET						
BOLT.STUD	0.5	14.0		B-18.2	BOLT: A320 GR. L7, NUT: A194 GR.4	
GASKET	0.5	14.0		B-16.20- ANSI B16.5	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 600

Note: For all Valves, valve data sheets shall also be referred, stringent requirement among data sheet and above details shall be followed.

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VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION FOR ASSORTED PIPES

VCS – SS – PP - 2503

					
01	30.06.2022	RP	MC	HK	GW
00	28.01.2020	MB	AK	AD	SK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

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CONTROLLED COPY	: If in soft and signed

REVISION RECORD

Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	12.10.2019					
		MB	AK	AD	SK	
01	30.06.2022					VCS QMS Integration
		RP	MC	HK	GW	

ABBREVIATIONS:

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
BIS	Bureau of Indian Standards
E.FS.W	Electric Fusion Weld
E.R.W	Electric Resistance Weld
HAZ	Heat Affected Zone
HIC	Hydrogen Induced Cracking
IBR	Indian Boiler Regulations
IGC	Inter Granular Corrosion
IS	Indian Standard
LT	Low Temperature
MR	Material Requisition
NACE MR	National Association of Corrosion Engineers : Material Requirement
NB	Nominal Bore
NPT	Nominal Pipe Thread
PMI	Positive Material Identification
PR	Purchase Requisition
SMYS	Specified Minimum Yield Strength
SS	Stainless Steel

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3.0 ACCEPTABLE DEVIATION.....	8
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5.0 MARKING AND DESPATCH.....	11

1. 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 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 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. PMI shall be performed as per the scope and procedures at supplier's work.

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.F.S.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.F.S.W pipes < 36" shall not have more than one longitudinal seam joint and E.F.S.W pipes ≥ 36" shall not have more than two longitudinal seam joints.

1.6. Pipe with screwed ends shall have NPT external taper pipe threads conforming to ASME/ANSI B1.20.1 up to 1.5" NB & IS 554 for 2" to 6" NB.

1.7. Pipe with beveled 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	Up to 22 mm	Figure 2 Type A
	> 22 mm	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
	> 25 mm	Figure 6 Type A

- 1.8. Galvanized pipes shall be coated with zinc by hot dip process conforming to IS 4736 / ASTM A 153.
- 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. (Inter Granular Corrosion) 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 with acceptance criteria of no cracks at 20X magnification and microstructure to be observed at 250X magnification shall ensure the absence of any cracks/ fissures. When testing is conducted as per practice 'E' photograph of microstructure shall be submitted for record.
- 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 'CRYO' & '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 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 "HIC1" shall meet the requirements given in NACE MR-0103 unless mentioned otherwise.
- 1.12.2. Pipes made from plates and designated as "HIC1" shall meet the HIC requirements of specification 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 1Cr-1/2Mo and 1 ¼ Cr-1/2Mo seamless pipes shall be normalized 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 normalized. Cold drawn pipes shall be normalized after the final cold draw pass for all thicknesses.
 - 1.17.2. All alloy steel (Cr-Mo) pipes shall be normalized and tempered. The normalizing 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 psig.
 - 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 austenitic stainless steels, the weld deposit shall be checked for ferrite content. A Ferrite No.(FN) not less than 3% and not more than 10% is required to avoid sigma phase embrittlement during heat treatment. FN shall be determined by Ferrite scope prior to post weld heat treatment.
 - 1.17.5. 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. Impact energies at 0°Celsius shall average greater than 27J (20 ft-lb) per set of three specimens, with a minimum of 19J (15 ft-lb).
- 1.18. For dual grades of SS where specified, chemical composition and mechanical

properties of both grades specified shall be ensured.

2. IBR PIPES

2.1. IBR Documentation

- 2.1.1. Pipes under purview of IBR shall be accompanied with IBR certificate original in Form III-A duly approved and countersigned by IBR authority/local authority empowered by the Central Boiler Board of India (Photocopy of the original certificate duly attested by the local boiler inspector where the supplier is located is the minimum requirement for acceptance) or Form III-D [for well-known pipe manufacturers as per IBR] signed by Manufacturer's authorized representative. Well known pipe manufacturers, as recognized by IBR, shall submit a duly attested copy of Form XVI-G along with Form III-D.
- 2.1.2. For materials 1¼ Cr - ½ Mo (ASTM A335 Gr.P11 / A691 Gr. 1¼Cr), 2¼Cr - 1Mo (ASTM A335 Gr.P22 / A691 Gr. 2¼Cr) & 9Cr -1Mo-V (A335 Gr.P91/A691 Gr.91), Form III-A approved by IBR shall include the tabulation of Et, Sc & Sr values for the entire temperature range given below. Et, Sc & Sr values shall be such that throughout the temperature range

$$\begin{array}{lcl} E_t/1.5 & \geq & \\ S_r/1.5 & \geq & S_A \\ S_c & \geq & \end{array}$$

where,

- S_A Allowable stress at the working metal temperature.
- E_t Yield point (0.2% proof stress at the working metal temperature)
- S_c The average stress to produce elongation of 1%(creep) in 100000 hrs at the working metal temperature.
- S_r The average stress to produce rupture in 100000 hrs at the working metal temperature and in no case more than 1.33 times the lowest stress to produce rupture at this temperature

Temp (°F) Material	SA (psi)											
	500	600	650	700	750	800	850	900	950	1000	1050	1100
A335 Gr.P11	17200	16700	16200	15600	15200	15000	14500	12800	9300	6300	4200	2800
A691	18900	18300	18000	17600	17300	16800	16300	15000	9900	6300	4200	2800

Temp (°F) Material	SA (psi)											
	500	600	650	700	750	800	850	900	950	1000	1050	1100
Gr. 1½ Cr												
A335 Gr.P22 / A691 Gr. 2½ Cr	17900	17900	17900	17900	17900	17800	14500	12800	10800	7800	5100	3200
A335 Gr.P91/ A691 Gr.91	28100	27700	27300	26700	25900	24900	23700	22300	20700	18000	14000	10300

Note : S_A values shall be as per the latest edition prevailing.

2.2. For carbon steel pipes under IBR the chemical composition shall conform to the following:

Carbon (max) : 0.25%

Others (S, P, Mn) : As prescribed in IBR.

The chemical composition as indicated in this clause is not applicable for pipes other than IBR services.

3. ACCEPTABLE DEVIATIONS

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

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

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

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

4. HYDROSTATIC TEST

4.1. All pipes shall be hydrostatically tested.

4.2. The mill test pressure shall be as follows:

4.2.1. 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.	ASTM A530

b) Seamless 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 No. 2200	ASTM B161
ASTM B165 UNS No. 4400	ASTM B165
ASTM B167 UNS No. 6600	ASTM B167
ASTM B407 UNS No. 8800	ASTM B407

e) Welded Nickel Alloy

Material Std.	Test Pressure Std.
ASTM B725 UNS No. 2200,4400	ASTM B725
ASTM B517 UNS No. 6600	ASTM B517

ASTM B514 UNS No. 8800	ASTM B514

4.2.2. Electric Fusion Weld

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 A691 Gr. ½ Cr, 1Cr, 1¼ Cr, 2¼ Cr, 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 : 10S		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 Pipe to BIS Standards

Material Std	Test Pressure Std.
IS 1239	IS 1239
IS 3589	IS 3589

- 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. 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 "IBR", "CRYO", "NACE", "H2" etc. shall also be marked.
- 5.2. Pipes under "IBR", "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.



STANDARD SPECIFICATION FOR WELDING OF ONSHORE HYDROCARBON PIPELINE

					
04	29.04.2022	RP	MC	HK	GW
03	04.01.2022	SR	MC	HK	HK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By
UNCONTROLLED COPY : If printed					
CONTROLLED COPY : If in soft and signed					

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	27.08.2018					Issued as Standard Specification.
		PK	MD	AD	SK	
01	19.09.2019					Re-issued as Standard Specification
		SS	MC	AD	SK	
02	28.01.2020					Document numbering updated from VPC-SS-PL-0045 to VPC-SS-PP-2019.
		MB	MC	AD	SK	
03	04.01.2022					Revised as marked
		SR	MC	HK	HK	
04						VCS QMS Integration
	29.04.2022	RP	MC	HK	GW	

ABBREVIATIONS:

ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
BS	British Standard
CRT	Cathode Ray Tube
CTOD	Crack Tip Opening Displacement
GMAW	Gas Metal Arc Welding
GTAW	Gas Tungsten Arc Welding
HAZ	Heat Affected Zone
HV	Vickers Hardness
IIW	International Institute of Welding
IQI	Image Quality Indicator
ISO	International Organization for Standardization
MPI	Magnetic Particle Inspection
PQR	Procedure Qualification Record
SMAW	Shielded Metal Arc Welding
UT	Ultrasonic Testing
UTS	Ultimate Tensile Strength
WPS	Welding Procedure Specification

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1.0 SCOPE

This specification covers the welding of carbon and low-alloy steel pipeline used in the transmission of hydrocarbons, covers welding of distribution systems. This specification applies to new construction of pipeline projects. The welding may be done by a shielded metal arc welding, submerged arc welding, gas tungsten arc welding, gas metal arc welding, flux cored arc welding, plasma arc welding or oxyacetylene welding process or by a combination of these processes using a manual, semiautomatic or mechanized welding technique or a combination of these techniques. The welds may be produced by position or roll welding or by a combination position and roll welding.

This specification also covers the procedures for radiographic, magnetic particle, liquid penetrant and ultrasonic testing as well as the acceptance standards for destructive testing in Procedure Qualification and Non-Destructive testing methods viz. Radiographic, Magnetic Particle, Liquid Penetrant, Ultrasonic and visual.

It is intended that all work performed in accordance with this specification meets or exceeds the requirements of this specification

Any approval granted by the COMPANY shall not relieve the CONTRACTOR of his Responsibilities and guarantees.

2.0 APPLICABLE CODE AND STANDARDS

All welding work, equipment for welding, heat treatment, other auxiliary functions and the welding personnel shall meet the requirements of the latest editions (editions in force at the time of floating the enquiry) of the codes, standards and specifications listed below:

- a) Code for Gas Transmission and Distribution Piping Systems, ASME B 31.8
- b) Standard for welding of Pipelines and Related Facilities, API 1104
- c) Specification for welding Electrodes and Filler Materials ASME Sec. II C
- d) Non-Destructive examination, ASME Sec. V

3.0 BASE MATERIAL

In general carbon steel is used in this specification. The details of material specifications are given in the welding Specification Chart attached along with

other project data sheets. The CONTRACTOR will arrange and maintain the record of test certificates of all the materials for the reference of the welding engineer.

4.0 WELDING CONSUMABLES

- a) The CONTRACTOR shall provide at his own expense all the welding consumables necessary for the execution of the job such as electrodes, oxygen, acetylene etc. and These shall bear the approval of the COMPANY.
- b) The welding electrodes / filler wires supplied by the CONTRACTOR shall conform to the class specified in the welding specification chart attached along with other project data sheets. The materials shall be of the make approved by the COMPANY.
- c) The electrode shall be suitable for the welding process recommended and the base metal used. Physical properties of the welds produced by an electrode recommended for the welding of a particular base metal shall not be lower than the minimum values specified for the base metal unless otherwise specified in the Welding Specification Chart and shall correspond to the physical properties of the class of electrode adopted. The choice of electrode shall be made after conducting the required tests on the electrodes as per relevant standards, and shall be the sole prerogative of the COMPANY.
- d) The CONTRACTOR shall submit batch test certificates from each electrode manufacturers giving details of physical and chemical tests carried out by them for each batch of electrodes to be used.
- e) Electrode Qualification test records shall be submitted as per the Exhibit-A (attached) in respect of the electrodes tested by the CONTRACTOR for obtaining the approval of the COMPANY.
- f) All electrodes shall be purchased in sealed containers and stored properly to prevent deterioration. The electrodes removed from the containers (except cellulosic coated electrodes) shall be kept in the holding ovens, at the temperature recommended by the electrode manufacturer. Ovens shall be used for the low hydrogen electrodes only. Out-of-the oven time of electrodes before they are consumed shall not exceed the limits recommended by the electrode manufacturer. The electrodes shall be handled with care to avoid any damage to the flux covering. Different grades of electrodes shall be stored separately. Cellulosic electrodes used shall however be used as per the specific recommendations of manufacturer.

- g) The electrodes used shall be free from rust, oil, grease, earth and other foreign matter, which affect the quality of welding.
- h) **Shielding Gas**: The composition and the purity of shielding gas when required by the welding
Processes other than shielded metal arc welding, when permitted by the COMPANY shall bear the approval of the COMPANY. Where appropriate, gases or gas mixture of the following quality shall be used.
- I. Argon gas complying with BS 4365.
 2. Carbon dioxide gas complying with type 1 specified in BS 4105
 3. Gas mixtures that have been proved to be satisfactory as a result of procedure approval tests.
- When a gas mixture is used, which has specified additions, e.g. 2% O₂, 5% CO₂ the variation of such addition shall not exceed $\pm 10\%$ of that stated. Moisture content shall correspond to a dew point of -30°C or lower.

5.0 EQUIPMENT & ACCESSORIES

The CONTRACTOR shall have sufficient number of welding and cutting equipment, Auxiliaries and accessories of sufficient capacities to meet the target schedules.

- 5.1 All the equipment for performing the heat treatment, including transformers, thermocouples, pyro-meters, automatic temperature recorders with suitable calibration arrangements, etc. shall be provided by the CONTRACTOR, at his own expense and these shall bear the approval of the COMPANY. Adequate means of measuring current and voltage shall be available.
- 5.2 Redoing of any work necessitated by faulty equipment or operation used by the CONTRACTOR, will be done at his own expense.

6.0 WELDING PROCESSES

- 6.1 Welding of various materials under this specification shall be carried out using Shielded Metal Arc Welding process (SMAW) with the approval of the COMPANY.
- 6.2 The welding processes to be employed are given in the welding specification chart attached along with other project data sheets. Any deviation desired by the CONTRACTOR shall be obtained through the express consent of the COMPANY.
- 6.3 Automatic process shall be employed only with the express approval of the COMPANY. The welding procedure adopted and the consumables used shall be specifically approved.
- 6.4 A combination of different welding processes or a combination of electrodes of different classes / makes could be employed for a particular joint only after duly

qualifying the welding procedures to be adopted and obtaining the approval of the COMPANY.

7.0 BEVEL CLEANING / BEVEL INSPECTION

The Line Pipe supplied by COMPANY shall have bevel ends as specified in the applicable specification for the Line Pipe attached with the Bid Package. Any modification thereto, if required by the CONTRACTOR due to his special welding technique, shall be carried out by the CONTRACTOR at his own cost. Before welding, all the rust and the foreign matter shall be removed from the beveled ends by power operated tools. This shall be affected inside and outside and for a minimum distance of 25 mm from the edge of the weld bevel. The bevels shall be thoroughly inspected at this stage. If any of the ends of the pipe joints are damaged to the extent that, in the opinion of the COMPANY, satisfactory weld spacing cannot be obtained and local repair by grinding cannot be successfully done, the damaged ends shall be cut and beveled to the satisfaction of the COMPANY, with an approved beveling machine. Manual cutting and weld repairs of bevels is not allowed. Should laminations, split ends or inherent manufacturing defects in the pipe be discovered, the lengths of pipe containing such defects shall be removed from the line to the satisfaction of COMPANY. On pipes, which have been cut back, a zone extending 25 mm back from the new field bevel, shall be ultrasonically tested to the requirement of the line pipe specification to ensure freedom from laminations. The new bevel shall be 100% visual and 100% dye penetrant/MPI tested. A report shall be written for all the testing and records kept.

8.0 ALIGNMENT AND SPACING

Immediately prior to line-up CONTRACTOR shall inspect the pipe ends inside and outside for damage, dents, laminations etc. Pipe for welding shall be set up, correctly spaced, allowing for the temperature changes during welding. In correct alignment shall in no circumstances be sprung into position. Temporary attachments of any kind shall not be welded to the pipe. Welds joining the sections of the pipeline, valve installation or similar welds classified as tie in welds shall be made in the trench. Otherwise, the alignment and welding shall be made alongside the ditch with the pipe supported on skids and pack pads or other suitable means approved by COMPANY, at least 500 mm above the ground unless approved by the COMPANY in specific cases.

Seam orientation of welded pipe shall be selected to ensure that at the circumferential welds, the longitudinal welds shall be staggered in the top 90° of the pipelines, or 250 mm whichever is the lesser. A longitudinal joint shall pass an appurtenance of a structural element at a minimum distance of 50 mm. Should a section of the line containing uncompleted welds fall from the skids, the CONTRACTOR shall immediately inform the COMPANY.

Every effort shall be made to reduce misalignment by the use of the clamp and rotation of the pipes to the best fit. For pipe of same nominal wall thickness the offset shall not exceed 1.6 mm. The offset may be checked from outside using dial gauges. Any branch connection sleeve, etc. shall be at least 150 mm from any other weld. The welds for fittings shall be so located that the toe of the weld shall not come within 50 mm of any other weld. Cold dressing is permissible only in cases of slight misalignment and may only be carried out with a bronze headed hammer. Hot dressing shall not be permitted. When welding pipes of different wall thickness (as directed by COMPANY) a special transition piece shall be used. This shall have a minimum of 1:4 taper. The welds shall be subject to both ultrasonic and radiographic inspection.

The root gap shall be accurately checked and shall conform to the qualified welding procedure. The use of internal Line-up Clamps is mandatory for pipe diameters 10" and above. However, in some cases (tie-in welds, flanges, fittings, diameter of pipe 10" etc.) where it is impossible to use internal clamps, an external line-up clamp may be used.

The internal line-up clamp shall not be released before the entire first pass has been completed.

When an external line-up clamp is used, all the spaces between the bars or at least 60% of the first pass shall be welded before the clamp is released and the pipe remaining adequately supported on each side of the joint.

Segments thus welded shall be equally spaced around the circumference of the pipe. Slag, etc. shall be cleaned off and the ends of the segments shall be prepared by grinding, so as to ensure continuity of the weld bead.

9.0 WEATHER CONDITIONS

The parts being welded and the welding personnel shall be adequately protected from rain and strong winds. In the absence of such a protection no welding shall be

carried out. The completed welds shall be suitably protected in case of bad weather conditions.

10.0 WELDING

10.1 Root Pass

- a) The root pass shall be made with the electrodes/filler wires recommended in the welding specification chart attached along with the other project data sheets. The size of the electrodes used shall be as per the approved welding procedure.
- b) Position or roll welding may be permitted. The vertical up method of welding shall be used for the root pass of the tie-ins, special crossings, fittings and special parts, fillet welds, repairs and when an external line up clamp is used. The downhill welding may be used for the root run welding of tie-ins and special crossings when (a) the edges are machined or have equivalent preparation (b) line up clamps are used and the fit up is geometrically and mechanically similar to one of the ordinary line welding without misalignment or unevenness.
- c) The root pass of butt joints shall be executed properly so as to achieve full penetration with complete fusion of the root edges. Weld projection inside the pipe shall not exceed 3 mm wherever not specified by the applicable code.
- d) Any deviations desired from the recommended welding technique and electrodes indicated in the welding specification chart shall be adopted only after obtaining express approval of the COMPANY.
- e) Welding shall be continuous and uninterrupted during a pass.
- f) On completion of each run, craters, welding irregularities, slag etc., shall be removed by grinding and chiseling.
- g) While the welding is in progress care shall be taken to avoid any kind of movement of the components, shocks, vibration and stresses to prevent occurrence of weld cracks.
- h) Fillet welds shall be made by shielded metal arc welding process irrespective of the thickness and class of piping. Electrode size shall not exceed 3.25 mm diameter for the socket joints. At least two passes shall be made on the socket weld joints.
- i) Peening shall not be used.

10.2 Joint Completion

In case of manual welding, for sizes 12" and above, the first pass shall be carried out by a minimum of two welders, working simultaneously and so placed as to cause minimum distortion of the pipe.

The number of welders and the allowable welding sequences shall be as those laid down in the qualified welding procedure specification. Once the deposit of the first pass has been started, it must be completed as rapidly as possible, reducing interruptions to the minimum. The welding and wire speed shall be approximately same as that established in the qualified welding procedure specification.

The pipe shall always be adequately supported and must not be bumped or shaken during welding. The clamp shall be removed, as indicated in clause 8.0 above. Before starting the second pass, the first pass shall be cleaned and flattened with rotating grinders.

The interruption between completion of the first pass and starting the second pass shall be as stated in the procedure specification, normally not exceeding four minutes.

For crack prevention a top and bottom reinforcement of at least one electrode shall be applied before lowering the pipe on the skid.

The welding speed selected shall enable production of a bead which is sufficiently thick and which shows no under cutting.

The time lapse between the second and the third pass shall be as stated in the procedure specification, normally not exceeding five minutes. After completion of the third or following passes, welding operations may be suspended, so allowing the joint to cool down, provided that the thickness of the weld metal deposited is equal to at least 50% of the pipe thickness. Upon restarting, depending on the materials, wall thickness and welding process, a preheating of at least 100°C shall be applied. Subsequent passes up to weld completion shall be protected to avoid rapid cooling, if meteorological conditions so dictate. Cleaning between the passes shall be done carefully so as to reduce the possibility of inclusions.

The electrode starting and finishing points shall be staggered from pass to pass. Arc-strikes outside the bevel on the pipe surface are not permitted. Arc-strike or arc-burn on the pipe surface outside the weld, which are caused accidentally by electrical arcs between the electrode, electrode holder, welding cable or welding cable round and the pipe shall be removed by grinding in accordance with a procedure approved by the COMPANY and the repair checked by ultrasonic, radiographic, magnetic particle or dye penetrant tests which the COMPANY feels

necessary. The pipe wall thickness after grinding shall not be less than the minimum thickness limit permitted for the pipe. Repair of arc strikes by welding is prohibited.

The completed weld shall be carefully brushed and cleaned and shall appear free from spatters, scales, etc.

These requirements apply not only to completed welds but also to the bare strip at least so wide as to allow full skid examination at both ends of the pipe to allow a good ultrasonic inspection when it is required.

11.0 HEAT TREATMENT

11.1 Preheating

- a) Preheating requirements for the various materials shall be as per the welding Specification chart attached along with other project data sheets.
- b) Preheating shall be performed using resistance or induction heating methods. Pre-heating for tie-in welds, repair welds or welds at point spreads may be done using a propane gas burner ring with prior approval from PMC/owner. The contractor may be asked to demonstrate the effectiveness of the arrangement.
- c) Preheating shall extend uniformly to at least three times the thickness of the joint, but not less than 50 mm, on both sides of the weld.
- d) Preheating temperature shall be maintained over the whole length of the joint during welding. Temperature indicating crayons or other temperature indicating devices shall be provided by the CONTRACTOR to check the temperature.

11.2 Post Weld Heat Treatment

- a) Post weld heat treatment, wherever required for joints between pipes and fittings, pipe body and supports shall be carried out by the CONTRACTOR at his expense as per the relevant specifications, applicable standards and the instructions of the COMPANY.
- b) The heat treatment of welded joints shall be carried out as per the requirements laid down in ASME B31.8 and other special requirements mentioned in welding Specification chart.
- c) The CONTRACTOR shall submit for the approval of the COMPANY, well before Carrying out actual heat treatments the details of the post weld heat treatment Procedure, as per Exhibit 'B' attached, that he proposes to adopt for each of the Materials/assembly/part involved.
- d) Post weld heat treatment shall be done in a furnace or by using an electric resistance or induction heating equipment, as decided by the COMPANY.

- e) While carrying out local post weld heat treatment, technique of application of heat must ensure uniform temperature attainment at all points of the portion being heat- treated. Care shall be taken to ensure that width of heated band over which specified post weld heat treatment temperature is attained is at least as that specified in the relevant applicable standards/codes.
- f) The width of the heated band centered on the weld shall at least be equal to the width of weld plus 2" (50 mm). The temperature gradient shall be such that the length of the material on each side of the weld, at a temperature exceeding half the heat treatment temperature, is at least $2.5 \sqrt{rt}$ where r is the bore radius and t is the pipe thickness at the weld.
- g) Throughout the cycle of heat treatment, the portion outside the heat band shall be suitably wrapped under insulation so as to avoid any harmful temperature gradient at the exposed surface of pipe. For this purpose, temperature at the exposed surface of the pipe shall not be allowed to exceed 400°C.
- h) The temperature attained by the portion under heat treatment shall be recorded by means of thermocouple pyrometers. Adequate number of thermocouples shall be attached to the pipe directly at equally spaced locations along the periphery of the pipe joint. The minimum number of thermocouples attached per joint shall be 2 up to 10" dia and 3 for 12" dia and above. However, the COMPANY can increase the required minimum number of thermocouples to be attached if found necessary.
- i) Automatic temperature recorders, which have been suitably calibrated, shall be Employed. The calibration chart of each recorder shall be submitted to the COMPANY prior to starting the heat treatment operation and its approval shall be Obtained.
- j) Immediately on completion of the heat treatment, the post weld heat treatment charts/records along with the hardness test results on the weld joints (whenever required as per the welding specification chart) shall be submitted to COMPANY for its approval.
- k) Each joint shall bear an identification number, which shall be maintained in the piping sketch to be prepared by the CONTRACTOR. The joint identification number shall appear on the corresponding post weld heat treatment charts. The same identification numbers shall also be followed for identification of corresponding radiographic films. The chart containing the identification number and the piping sketch shall be submitted to the COMPANY in suitable folders.
- l) Vickers hardness/Brinell hardness of the heat affected zone as well as of the weld metal, after heat treatment shall be measured using a suitable hardness tester and shall not exceed the maximum hardness specified in the welding

specification chart. The weld joint shall be subjected to reheat treatment, when hardness measured exceeds the specified limit, at the CONTRACTOR'S own expense.

- m) The CONTRACTOR shall arrange for the hardness testing and shall maintain the Records of all the joints tested. These records shall be checked by the plant COMPANY'S inspector.

12.0 INSPECTION & TESTING

12.1 General

- a) The COMPANY'S Inspector shall have free access to all the concerned areas, where the actual work is being performed. The CONTRACTOR shall also afford the COMPANY'S inspector all means and facilities necessary to carry out inspection.
- b) The COMPANY is entitled to depute its own inspector to the shop or field where prefabrication and erection of pipelines are being done, with (but not limited to) the following objectives:
- i) To check the conformance to relevant standards and suitability of various Welding equipment and the welding performance.
 - ii) To supervise the welding procedure qualification.
 - iii) To supervise the welders' performance qualification.
 - iv) To check whether shop/field welding being executed is in conformity with the relevant specifications and codes of practice followed in pipe construction.
- c) CONTRACTOR shall intimate sufficiently in advance the commencement of the Qualification tests, welding works and acceptance tests, to enable the COMPANY'S inspector to be present to supervise them.

12.2 Welding Procedure Qualification

- a) Welding procedure qualification shall be carried out in accordance with the relevant requirements of API 1104 latest edition (edition in force at the time of floating the enquiry) or other applicable codes and other job requirements by the CONTRACTOR at his expense. The CONTRACTOR shall submit the welding procedure specifications in format as per Exhibit-C (attached) immediately after the receipt of the order.
- b) COMPANY'S inspector will review, check and approve the welding procedure submitted and shall release the procedure for procedure qualification tests. The Procedure qualification test shall be carried out by the CONTRACTOR under field conditions at his own expense. A complete set of the test results in format as per Exhibit-C (attached) shall be submitted to the COMPANY'S Inspector for approval immediately after completing the procedure qualification test and at least 2 weeks before the commencement of actual work. Standard tests as

specified in the code shall be carried out in all cases. In addition to these tests, other tests like radiography, macro/micro examination, hardness tests, dye penetrant examination, Charpy v-notch etc. shall be carried out on the specimens. It shall be the responsibility of the CONTRACTOR to carry out all the tests required to the satisfaction of the COMPANY'S Inspector. The destructive testing of welded joints shall be as per Annexure - 1.

12.3 Welder's Qualification

- a) Welders shall be qualified in accordance with the API 1104 and other applicable specifications by the CONTRACTOR at his expense. The butt weld test pieces of the qualification test shall meet the radiographic test requirements specified in Clause 12.5 and Annexure-3 of this specification. The COMPANY'S inspector shall witness the test and certify the qualification of each welder separately. Only those welders who have been approved by the COMPANY'S inspector shall be employed for welding. CONTRACTOR shall submit the welder qualification test reports in the standard format as shown in Exhibit - D and obtain express approval, before commencement of the work. It shall be the responsibility of CONTRACTOR to carry out qualification tests of welders.
- b) The welders shall always have in their possession the identification card as shown in Exhibit-E and shall produce it on demand by the COMPANY'S Inspector. It shall be the responsibility of the CONTRACTOR to issue the identity cards after the COMPANY has duly certified it.
- c) No welder shall be permitted to work without the possession of identity card.
- d) If a welder is found to perform a type of welding or in a position for which he is not qualified, he shall be debarred from doing any further work. All welds performed by an unqualified welder shall be cut and redone by a qualified welder at the expense of the CONTRACTOR.

12.4 Visual Inspection

COMP ANY shall carry out inspection of all welds as per the latest editions of the applicable codes and specifications. All finished welds shall be visually inspected for parallel and axial alignment of the work, excessive reinforcement, concavity, shrinkage, cracks, under-cuts, dimensions, surface porosity and other surface defects. Undercutting adjacent to the completed weld shall not exceed the limits specified in the applicable standard I code.

12.5 Non Destructive Examination

The non-destructive examination shall mainly consist of examination using x-ray radiography as detailed in Annexure 3.

Radiographic examination of one hundred percent (100%) girth welds will be required by the COMPANY. Welds shall meet the standards of acceptability as set forth in API 1104 and as well as the requirements laid in subsequent paragraphs.

The CONTRACTOR shall make all the arrangements for the radiographic examination of work covered by the specification at his expense.

The COMPANY will review all the radiographs of welds and inform the CONTRACTOR regarding unacceptable welds. The decision of the COMPANY shall be final and binding in this regard.

All the requirements mentioned in the specification shall be arranged and executed by the CONTRACTOR through his own resources. In addition, ultrasonic inspection is required in the following cases as per Annexure - 2 of this Specification.

- a) When 20 mm or more are cut from the pipe end as supplied, the ends shall be ultrasonically inspected for an additional length of 20 mm to assure no laminations exist.
- b) When in the opinion of COMPANY, ultrasonic inspection is required to confirm or clarify defects indicated by radiography.
- c) When automatic procedure is used at least 10 cm on each weld shall be ultrasonically inspected at COMPANY's discretion.
- d) UT on Golden Joints.

All fillet and groove welds other than those radiographed shall be subjected to dye penetrant! MP inspection. The non- destructive test system used for inspecting welds must be approved by the COMPANY.

12.5.1 Acceptance Criteria

Weld quality as judged on the basis of the acceptability criteria mentioned below:

- i) Any weld, which as a result of radiographic and/or ultrasonic examination in the opinion of COMPANY exhibits imperfections greater than the limits, stated in API 1104 latest edition or as superseded in this article shall be considered defective and shall so be marked with an identification point marker.
- ii) In addition to the API 1104 requirements, the welds containing cracks including crater cracks regardless of size or location are unacceptable.

Lack of fusion and lack of root penetration may be permitted only up to a maximum individual length of 25mm. Cumulative length of the defect shall not exceed 25 mm in any 300 mm length of weld. For welds less than 300 mm length, the aggregate length shall not exceed 8 percent of the weld length. Defects situated in line and separated by less than the length of the shortest defect shall be considered as one defect. However, no Lack of fusion or lack of root penetration is permitted at any intersections of welds.

Suitable records shall be maintained by the CONTRACTOR as desired by the COMPANY on the day-to-day work done on welding radiography, ultrasonic testing. The CONTRACTOR shall present the records to the COMPANY on day-to-day basis and whenever demanded, for approval.

12.6 Destructive Testing

The COMPANY has the authority to order the cutting of up to 0.1 % of the total number of welds completed for subjecting to destructive tests at no extra cost to

COMPANY. The destructive testing of weld joints shall be made as per Annexure - 1. In addition, welds already cut out for defects for any reason may also be subjected to destructive testing. The sampling and the re-execution of welds shall be carried out by the CONTRACTOR at his own expense. If the results are unsatisfactory, welding operations shall be suspended and may not be restarted until the causes have been identified and the CONTRACTOR has adopted measures, which guarantee acceptable results. If it is necessary in the COMPANY's opinion the procedure shall be requalified. The weld joint represented by unsatisfactory welds shall stand rejected unless investigation proves otherwise.

13.0 REPAIRS OF WELDS

13.1 With the prior permission of COMPANY welds, which do not comply with the standards of acceptability, shall be repaired or the joint cut out and re-welded. A separate welding procedure specification sheet shall be formulated and qualified by CONTRACTOR for repair welds simulating the proposed repair to be carried out. Separate procedures are required to be qualified for (a) through thickness repair (b) partial thickness repair (c) cover pass repair and (d) Double repair. Welders shall be qualified in advance for repairs. The root pass, for repairs opening the root, shall be replaced by the vertical uphill technique. The procedure shall be proven by satisfactory procedure test to API-1104 including the special requirements of the specification, and shall also be subjected to metallographic examination, hardness surveys and Charpy tests to determine the effects of repair welding on the associated structure.

Root sealing or single pass repair deposit shall not be allowed. Internal root defects shall be ground thoroughly and welded with a minimum of two passes. However, while grinding for repairs, care shall be taken to ensure that no grinding marks are made on the pipe surface anywhere.

The repair shall be subjected, as a minimum requirement to the same testing and inspection requirements as the original weld. After the repair of the circumferential weld, re-radiography of the full joint shall be carried out. Any repaired area that is wide, irregular or rough shall be rejected and a full cut out shall be done.

Repairs are limited to a maximum of 30% of the weld length. Not more than two repairs are permitted on the same location. All repairs shall be carried out the day after initial radiography or earlier. A full report of all repairs made shall be submitted every day to the COMPANY.

13.2 Weld Rejected by Accumulation of Defects

Where a weld is rejected by the accumulation of defect clause, as defined by API-1104 and this specification, repairs within these limitations are permitted. Defects in the filling and capping passes shall be repaired preferentially.

ANNEXURE-I

1.0 DESTRUCTIVE TESTING OF WELDED JOINT - BUTT WELDS

1.1 Preparation

Having passed the visual and the non-destructive inspection, the test weld shall be subjected to mechanical test.

After satisfactory completion of all visual and non-destructive testing the procedure test weld shall be set-aside for a period not less than 24 hours. No further work on the test weld and no cutting of test specimens from the weld shall be performed until a period of at least 24 hours has expired.

Weld specimens shall be taken from the positions indicated in fig.1, 2, 3 & 4 of this specification from areas as free from defects as possible; for this reason, it is necessary to take the previous non-destructive tests into account. The minimum number of tests to be carried out is given in Table - 1 of this specification.

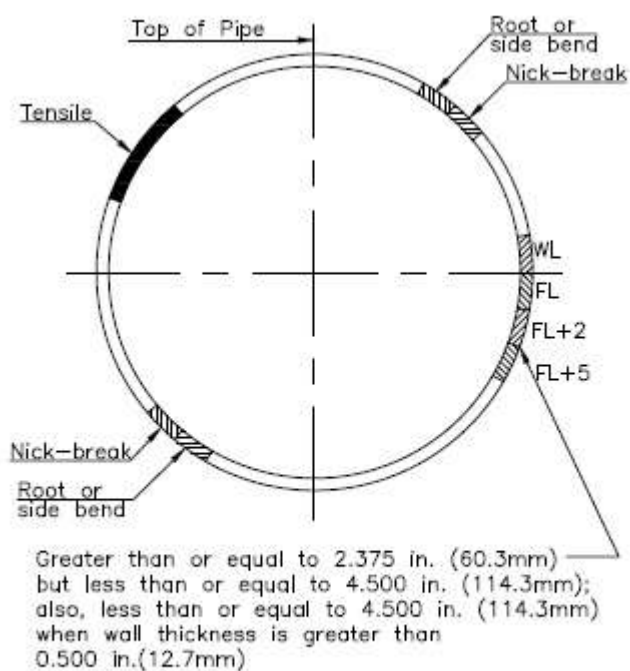
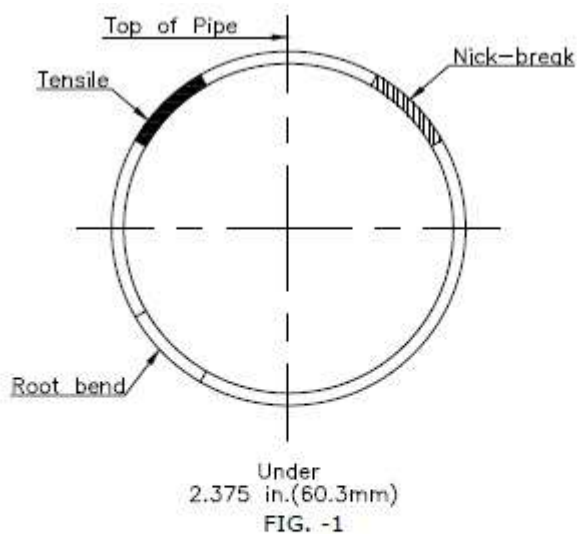
The test shall be carried out at laboratories approved by the COMPANY. The specimens shall be prepared in accordance with the figures given in the paragraphs that refer to the individual test.

1.2 Tensile Strength

Specimens shall be taken from the position indicated in fig.1, 2, 3 & 4 of this specification and Table-1 of this specification.

1.2.1 Method

The test shall be carried out in accordance with API 1104.



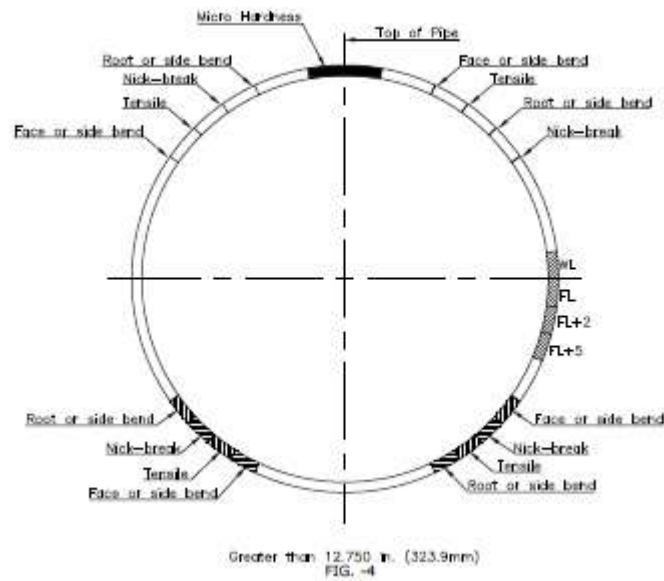
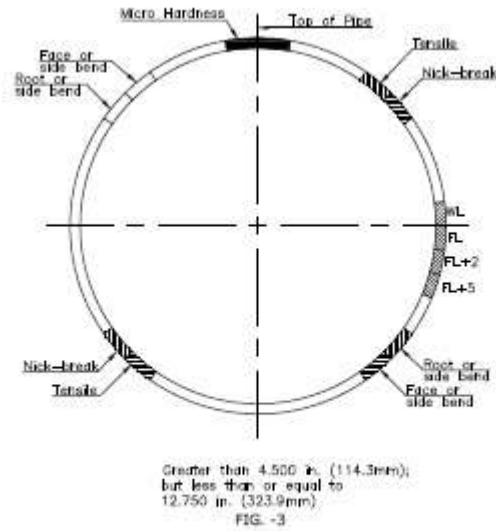


TABLE 1

OUTSIDE DIAMETER OF PIPE (mm)	NUMBER OF SPECIMENS							
	TENSILE STRENGTH	NICK BREAK	ROOT BEND	FACE BEND	SIDE BEND	MACRO & HARDNESS	IMPACT	TOTAL
	WALL THICKNESS $\leq$ (12.7 mm)							
<60.3	1	2	2	0	0	0	0	5
60.3 to 114.3	1	2	2	0	0	0	12	17
>114.3 to 323.9	2	2	2	2	0	2	12	22
>323.9	4	4	4	4	0	2	12	30
	WALL THICKNESS > (12.7 mm)							
$\leq$ 114.3	1	2	0	0	2	0	12	17
>114.3 to 323.9	2	2	0	0	4	2	12	20
>323.9	4	4	0	0	8	2	12	30

1.3 Nick-Break Test

1.3.1 Preparation

Specification for nick-break test with notches thus worked can break in the base metal, instead of in the fusion zone; therefore, an alternative test piece may be used after authorization by the COMPANY with a notch cut in the reinforcement of outside weld bead to a maximum depth of 1.5mm, measured from the surface of the weld bead.

1.4 Macroscopic Inspection

1.4.1 Preparation

Specimens shall be taken from the positions indicated in Fig. 1 of this specification and shall be prepared in accordance with ASTM E2 and E3. The width of the macro section has to be at least three times the width of the weld. The section is to be prepared by grinding and polishing and etched to clearly reveal the weld metal and heat affected zone.

1.4.2 Method

Specimens shall be carefully examined under the microscope, with a magnification of at least 25 times (25:1). The COMPANY may ask for a macrograph with 5 times (5:1) magnification, for DOCUMENTATION purposes.

1.4.3 Requirements

Under macroscopic examination, the welded joints shall show good penetration and fusion, without any defect exceeding the limits stated in the evaluation criteria of the nick bream test

1.5 Hardness Test

1.5.1 Preparation

The prepared macro section is to be used for hardness testing using the vickers method with 10 kg load indentations are to be made along traverses each approximately 1 mm below the surface at both side of the weld.

In the weld metal a minimum of 6 indentations equally spaced along the traverses are to be made. The HAZ indentations are to be made along the traverses for approximately 0.5 mm each into unaffected material, and starting as close to the fusion line as possible.

One indentation at each side of the weld along each traverse has to be made on parent metal. Reference is made to Fig. 3 of this specification. The indentations are to be made in the adjacent region as well as on the opposite side of the macro section along the specified traverses.

1.5.2 Method

The test shall be carried out in accordance with recommendation ISO R81, Vickers hardness, using a laboratory type machine controlled as pre-recommendation ISO R 146 and using a diamond pyramid penetrator set at 2.37 rad (136") with a load of 10 kg.

1.5.3 Requirements

Hardness value shall not exceed the limit specified in welding specification chart. In case of a single reading strictly (+ IOHV) higher than the specified limit, further indentations shall be made to check if the high value was an isolated case.

All the hardness values contained from the heat-affected zone shall not exceed 100 HV with respect to the average hardness of the values obtained for the base metal. If these additional tests give hardness within the specification limit the slightly higher value may be accepted.

1.6 Charpy V-Notch Impact Test

1.6.1 Specimens shall be taken from the position indicated in Fig. 2, 3 & 4 of this specification. The test specimens will be prepared in accordance with API 1104. Charpy V-Notch specimens shall have dimensions as given in Fig. 6 of the specification. Three test specimens shall be taken from each sample and they shall be cut and worked so that their length is transversal and perpendicular to the weld bead with the notch position as shown in Fig. 6 of this specification. The notch shall be to the roller surface perpendicular to the roller surface. The test shall be conducted at -29 deg C and as per ASTM A370.

1.6.2 Requirements (Note 1)

The impact energy shall be:

Test specimen in (mm)	Average of three specimen (Note 2) joule (Min.)	Minimum single value (Note 1)
10.0	27.0	22.0
7.5	21.5	17.5
5.0	18.5	15.0
2.5	10.0	8.0

Note:

- (1) These values are specified for resistance to brittle fracture only. Where additional requirements are specified in project data sheet (Ex. pipeline materials with arrest properties i.e., a higher upper shelf Charpy V energy for resistance against propagating ductile fractures) the same shall be followed.
- (2) Only one value is permitted to be lower than average value up to the value specified.

1.7 Bend Test Requirements

The Bend test Specimens shall be made and tested as per the requirements of API 1104 Latest edition (edition in force at the time of floating enquiry). The acceptance criteria shall be as per API 1104.

ANNEXURE-2

1.0 ULTRASONIC INSPECTION

In addition, the radiographic inspection, ultrasonic inspection is required as per conditions listed in paragraph 12.5 of this specification. This section concerns manual ultrasonic inspection. However ultrasonic inspection by automatic equipment may be used if approved by the COMPANY.

1.1 General:

The CONTRACTOR who carries out the ultrasonic inspections shall have sufficient no. of qualified personnel, equipment and instruments at his disposal to be able to affect the tests without hindering or delaying the pipeline assembly operations. The CONTRACTOR appointed to carry out ultrasonic inspections shall supply all the instruments necessary for their execution on site.

1.2 Specification for Ultrasonic Testing Procedure Qualification

Before work begins, the CONTRACTOR shall present a specification describing the proposed U.T. procedure qualification. This specification shall state, all the parameters described in API 1104 and the following information:

- a) Type of U.T. Equipment used;
- b) Type and dimensions of transducers
- c) Frequency range
- d) Details for calibration
- e) Coupling medium
- f) Inspection technique
- g) Record details
- h) Reference to the welding procedure where it is intended to adopt the specification
- I) Temperature range of the joints to be inspected.

1.3 Qualification of Ultrasonic Inspection Procedure

The ultrasonic inspection procedure shall be approved by the COMPANY. Before inspection begins, the COMPANY may require the qualification test of the ultrasonic inspection procedure. This specification test consists in testing (under normal operating conditions) some CONTRACTOR welds made according to the same production procedure, where there are typical defects the test intends to detect.

This test shall be conducted in the presence of the COMPANY.

1.4 Test Procedure

Circumferential welds shall be inspected from both sides using angle probes. The surface with which the probe comes into contact shall be free of metal spatter, dirt, iron oxide, and scales of any type; therefore, it shall be necessary to clean a strip at least 50 mm wide on both sides of the weld with steel-wire brushes and anyhow the cleaned strip must be at least wide enough to allow one and a half skip examination.

If, during the test, echoes of doubtful origin appear, it shall be necessary to inspect a convenient area on the pipe surface, close to the weld, with a straight beam transducer in order to check whether any manufacturing defects are present which could have interfered with the ultrasonic beam.

By way of an example, the equipment shall include but not be limited to the following:

- a) Ultrasonic equipment and coupling medium
- b) Sample sections for calibration of instruments
- c) Equipment for cleaning of surface to be examined
- d) Rules calibrated in centimeters for exact location of the position of defects.

The characteristics of the above listed instruments and equipment shall guarantee:

- a) That the required standards of the inspection procedure, as previously established and approved by the COMPANY, are satisfied.
- b) Continuous operation

All the instruments and equipment shall be approved by the COMPANY before being used. The COMPANY has the authority to reject any item that is considered unsuitable. The decision of the COMPANY is final. The CONTRACTOR appointed to carry out ultrasonic inspections shall also ensure the operational efficiency and maintenance of the instruments and equipment, and shall immediately substitute any item rejected by the COMPANY.

All the instruments and equipment necessary for carrying out ultrasonic inspection on site shall satisfy the requirements laid down by the public boards of institutions that regulate 'safety at work'.

1.5 Ultrasonic Instruments

The ultrasonic instrument:

- a) Shall be pulse echo type, able to generate, receive and display, on the screen a Cathode Ray Tube (CRT), pulse at frequencies between 1 and 6 MHz. The useful part of the CRT screen shall be at least 70mm wide and at least 50mm high shall have variable amplification, with steps of 1 or 2 dB over a range of at least 60 dB.

- b) the regulation control shall be accurate to within ± 1 dB and this accuracy shall be certified by the instrument manufacturer.
- c) may be powered by a battery or an electric generator. In the first case, the autonomy of operation (endurance) of the instrument shall be sufficient to carry on working without frequent interruptions, and the instrument shall be equipped with an automatic switch which switches it off when the battery runs down; in the second case, there must be a voltage stabilizing device with a tolerance of ± 2 Volts.

1.6 Probes

The probes used shall have dimensions, frequencies, and a refraction angle suited to the type of steel, the diameter, and the thickness of the pipeline and to the joint design.

1.7 Reference Sample Pieces

The efficiency of the equipment used, the effective refraction angle of the probe, and the beam output point, shall be checked using a VI and V2 sample block, IIW type or the calibration block ASTM E-428.

For manual ultrasonic testing and automated ultrasonic testing, the reference sample pieces shall be as described in API 1104, Nineteenth Edition, para 11.4.5.

1.8 Calibration

The calibration, qualification of the testing procedure shall be done as provided in API 1104.

1.9 Regulation of Amplification during Production Testing

Scanning sensitivity shall be as provided in API 1104 para 11.4.7.2 & 11.4.7.3.

1.10 Qualification of Ultrasonic Testing Operators for Automatic UT. Before the inspection begins or during the same inspection, the COMPANY may require a qualification test for the ultrasonic equipment operators.

The operators shall be fully qualified as per a recognized standard (ASME Sec V or equivalent) and they shall have as minimum level II as described in API 1104. The operators shall be able to:

- a) calibrate the equipment;
- b) perform an operational test under production conditions;
- c) interpret the screen picture;
- d) evaluate the size and location of reflectors
- e) interpret the type of defects detected

The COMPANY has the option of checking the ability of personnel employed for ultrasonic

Testing by means of qualification tests.

1.11 Evaluation of Indications given by Ultrasonic Tests

Each time that echoes from the weld bead appear during production testing, the instrument amplification shall be altered to coincide with the reference amplifications and the probe shall be moved until maximum response is obtained, paying attention all the time to the probe-tube coupling.

If, under these conditions, the height of the defect echo is equal to or greater than that of the reference echo, the defect shall be evaluated according to clause 12.5 of this specification. If the defect has also been detected by the radiographic and/or visual examination, the dimensions shall be judged according to the type of examination which detects the greater defect. Returns that are less than 50% of the reference echo will not be considered. If returns are above 50% but lower than 100% of the reference echo, and if the operator has good reasons to suspect that the returns are caused by unfavorably oriented cracks, he shall inform the COMPANY. Moreover, when there is a defect to be repaired, such defect shall be removed for a length corresponding to the one where no more return echo is given.

1.12 Other Equipment

The use of rules calibrated in centimeters, attached if possible, to the probe, for the precise location of the position of welding defects, is recommended. Defect location is affected by measuring the projection distance between the probe output and the reflecting surface.

The operators carrying out the tests shall have, besides the probing instrument, tools for cleaning the pipe surface (files, brushes, etc.) as well as the coupling liquid or paste appropriate for the temperature of the section to be examined.

ANNEXURE-3

RADIOGRAPHY

1.0 SCOPE

This annexure covers the radiographic inspection of all types of welded joints of the main pipeline.

The welded joints shall include the following:

- i) Full girth welds on the mainline construction including double jointing of pipe, if adopted.
- ii) Welds for installation of block valves, insulating joints and other appurtenances and tie-ins.
- iii) Welds at scraper launching and receiving barrels.
- iv) Terminal Piping

2.0 APPLICABLE STANDARDS

This specification shall apply in conjunction with the following (all latest editions):

- i) API 1104, Standard for welding Pipelines and Related Facilities
- ii) ANSI B 31.8, Code for Gas Transmission and Distribution Piping Systems.
- iii) ANSI B 31.4, Code for Transportation System for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia and Alcohols.
- iv) ASTM E 94, Recommended practice for Radiographic Testing
- v) ASTM E 142, Standard Method for Controlling Quality of Radiographic Testing
- vi) The American Society for Nondestructive Testing. Recommended Practice no. SNT-TC-IA Supplement A.

3.0 PROCEDURE

3.1 The radiographic examination procedure to be adopted shall be submitted by the CONTRACTOR as per Exhibit-F.

3.2 The procedure of radiographic examination shall be qualified to the entire satisfaction of COMP ANY prior to use. It shall include but not be limited to the following requirements:

- i) Lead foil intensifying screens, at the rear of the film shall be used for all exposures.
- ii) Type 2 and 3 films as per ASTM E-94 shall be used.

- iii) A densitometer shall be used to determine film density. The transmitted film density shall be between 2.0 and 3.5 throughout the weld. The unexposed base density of the film shall not exceed 0.30.
 - iv) Radiographic identification system and documentation for radiographic interpretation reports and their recording system.
- 3.3 The CONTRACTOR shall qualify each procedure in the presence of the COMPANY prior to use.
- 3.4 The procedure of radiographic examination shall produce radiographs of sufficient density, clarity and contrast so that defects in the weld or in the pipe adjacent to the weld are clearly discernible.
- 3.5 One Check shot of the full joint on main line welds shall be taken per 100 circumferential welds or one per day of the production whichever is more for cross checking the correctness of the radiographs of weld joints executed by the contractors. For taking check shots on completed/accepted sections, contractor has to separately mobilize either internal crawler/external X-ray unit, as appropriate.
- 3.6 All the girth welds of mainline shall be subjected to 100% radiographic examination. The CONTRACTOR shall furnish all the radiographs to the COMPANY, immediately after processing them, together with the corresponding interpretation reports on approved format. The details of the radiographs along with the joint identification number shall be duly entered in a register and signed by the CONTRACTOR and submitted to the COMPANY for approval.
- 3.7 When the radiation source and the film are both on the outside of the weld and located diametrically opposite each other, the maximum acceptable length of film for each exposure shall not exceed the values given. The minimum film overlap, in such cases, shall be 40mm. The ellipse exposure technique may be used on nominal pipe sizes of 2 inch and smaller provided that the source of film distance used is a minimum of 12 inch.
- 3.8 Three copies of each acceptable radiographic procedure (as per Exhibit-F) and three copies of radiographic qualification records shall be supplied to COMPANY. One set of the qualifying radiographs on the job shall be kept by the CONTRACTOR's authorized representative to be used as a standard for the quality of production radiographic during the job. The other two sets shall be retained by COMPANY for its permanent record.
- 3.9 Three copies of the exposure charts relating to material thickness, kilo voltage, source of film distance and exposure time shall also be made available to COMPANY by the CONTRACTOR.
- 3.10 The CONTRACTOR shall, on a daily basis, record for each radiograph (1) radiograph's number, (2) approximate chainage of weld location, (3) whether or not the welds meet the specified acceptance standards and (4) the nature and approximate location of unacceptable defects observed. It must be possible to relate back to a particular butt weld and welder on piping drawing and pipeline alignment drawing.

- 3.11 Each day's production of processed radiographs shall be properly packaged separately, identified by at least the (1) date, (2) radiographic unit, (3) job locations, (4) starting and ending progress survey stations and (5) shall include original and three copies of the daily radiographic record. The package shall be submitted to the COMPANY daily when possible, but in no event later than noon of the following day.
- 3.12 The CONTRACTOR shall provide all the necessary facilities at site, such as a dark room with controlled temperature, film viewer etc. to enable the COMPANY to examine the radiographs.
- 3.13 The CONTRACTOR, if found necessary, may modify the procedure of radiographic examination suiting to the local conditions prevailing. This shall, however, be subject to the approval of the Company.
- 3.14 COMPANY shall have free access to all the CONTRACTOR's work facilities in the field.
- 3.15 Any approval granted by the COMPANY shall not relieve the CONTRACTOR of his responsibilities and guarantees.

4.0 RADIATION SOURCE

- 4.1 Radiographic examination shall be carried out using X-radiations; radiographic examination by Gamma rays using slow speed films may be allowed, at the discretion of the COMPANY, in case of inaccessible joints. Radiography by Gamma ray for tie-in-joints shall be acceptable provided D4 AGF A film or equivalent is used and the required sensitivity obtained.
- 4.2 Whenever possible, pipeline welds will be inspected by placing the radiation source inside the pipe. on the pipeline axis. with a radiation of 6.28 red. (360).

5.0 LEVEL OF QUALITY

The quality level of Radiographic sensitivity required for radiographic inspection shall be at least equivalent to the values in Figure-7.

6.0 PENETRAMETERS

The Image Quality Indicator (abbreviation: IQI) shall be used for the qualification of the welding procedure and during normal line production. Radiographic sensitivity shall be measured with the wire image quality indicator (Penetrameter). The Penetrameter shall be selected according to DIN-54109 or ISO-I 027. For radiographs made with the source on the outside, a Penetrameter shall be placed on each side of the film with the smaller wire of the Penetrameter turned towards the end of the film itself. When a complete weld is radiographed in a single exposure using a source inside the piping, four penetrameters approximately equally spaced around the circumference shall be used. During the procedure qualification, IQI shall be placed both on the source side and on the film side.

The sensitivity obtained with IQI on the source side shall not be less than the values shown in Fig. 7 of this specification. The sensitivity limit may be considered to have

been reached when the outline of the IQI, its identification number and the wire of the required diameter show up clearly on the radiograph.

The COMPANY may authorize use of types of IQI other than those planned, provided that they conform with recognized standards and only if the CONTRACTOR is able to demonstrate that the minimum sensitivity level required is obtained. For this demonstration, a test shall be carried out comparing the IQI specified and the CONTRACTORS to show up the identification number and other details of the proposed IQI, which must be visible in the test radiograph.

7.0 FILM IDENTIFICATION MARKERS

All films shall be clearly identified by lead numbers, letters, and/or markers. The image of the markers shall appear on the films, without interfering with the interpretation. These markers positions shall also be marked on the part to be radiographed and shall be maintained during radiography.

8.0 PROTECTION AND CARE OF FILM

- 8.1 All unexposed films shall be protected and stored properly as per the requirements of API1104 standard and ASTM E.94.
- 8.2 The exposed and unexposed film shall be protected from heat, light, dust and moisture. Sufficient shielding shall be supplied to prevent exposure of film to damaging radiation prior to and following the use of the film for radiographic exposure.

9.0 RE-RADIOGRAPHY

- 9.1 The weld joints shall be re-radiographed in case of unsatisfactory quality of the radiographs, at the expense of the CONTRACTOR.
- 9.2 All the repaired weld joints shall be re-radiographed at no extra cost to the COMPANY in the same manner as that followed for the original welds. In addition, the repaired weld areas shall be identified with the original identification number plus the letter R to indicate the repair.
- 9.3 When evaluating repair film, radiographers shall compare each section (exposure) of the weld with the original film to assure repair was correctly marked and original defect removed.
- 9.4 The COMPANY will review prior to any repair of welds, all the radiographs of welds that contain, according to the CONTRACTOR's interpretation, unacceptable defects. The final disposition of all unacceptable welds shall be decided by the COMPANY.

10.0 QUALIFICATION OF RADIOGRAPHERS

- 10.1 Pipeline radiographers shall be qualified in accordance with the requirement of API 1104 and to the full satisfaction of COMPANY.
- 10.2 Certification of all the radiographers, qualified as per 10.1 above, shall be furnished by the CONTRACTOR to the COMPANY before a radiographer will be

permitted to perform production radiography. The certificate record shall include:

- i) Background and Experience Record
- ii) Training Course Record
- iii) Technical Examination Record
- iv) Doctor's report on radiographer's Jacque 0-1 acuity eye test
- v) Date of qualification

- 10.3 The radiographers shall be required to qualify with each radiographic procedure they use, prior to performing the work assigned to him in accordance with the specification.

11.0 PRESERVATION OF RADIOGRAPHS

- 11.1 The radiographs shall be processed to allow storage of films without any discoloration for at least three years. All the radiographs shall be presented in suitable folders for preservation along with necessary documentation.
- 11.2 All radiographs shall become property of the COMPANY.

12.0 EQUIPMENT AND ACCESSORIES

- 12.1 CONTRACTOR shall make necessary arrangements at his own expense, for providing the radiographic equipment, radiographic films and all the accessories for carrying out the radiographic examination for satisfactory and timely completion of the job.
- 12.2 For carrying out the mainline radiographic examination the CONTRACTOR shall be equipped with suitable mobile/stationary type dark rooms. These shall have all the required facilities for film processing. Film viewer used shall be equipped with the film illuminator that has a light source of sufficient intensity and suitably controlled to allow viewing film densities up to 4.0 without damaging the film.

13.0 RADIATION PROTECTION

- 13.1 CONTRACTOR shall be responsible for the protection and personnel monitoring of every man with or near radiation sources.
- 13.2 The protection and monitoring shall comply with local regulations.
- 13.3 In view of visual hazards in the handling of Radioactive source of material, CONTRACTOR shall be solely responsible for complying with all rules and regulations set forth by Atomic Energy Commission or any other Government agencies of India in this regard and COMPANY shall not be responsible and shall be kept indemnified by the CONTRACTOR for default (s) of whatever nature by the CONTRACTOR. Safety equipment as considered adequate by the COMPANY

for all necessary personnel shall be made available for use and maintained for immediate and proper use by the CONTRACTOR.

14.0 DISPLAY OF SAFETY INSTRUCTIONS

The safety provisions shall be brought to the notice of all concerned by display on a notice board at prominent place at the work spot. The person responsible for the "Safety" shall be named by the CONTRACTOR.

15.0 ENFORCEMENT OF SAFETY REGULATIONS

To ensure effective enforcement of the rules and regulations relating to safety precautions, the arrangement made by the CONTRACTOR shall be open to inspection by COMPANY or its representatives.

16.0 FIRST AID AND INDUSTRIAL INJURIES

- 16.1 CONTRACTOR shall maintain first aid facilities for its employees and those of sub-Contractors.
- 16.2 CONTRACTOR shall make outside arrangements for ambulance service and for treatment of industrial injuries. Names of those providing these services shall be furnished to COMPANY prior to start of work and their telephone no. Shall be posted prominently in CONTRACTOR'S field office.
- 16.3 All critical industrial injuries shall be reported promptly to the COMPANY and a copy of CONTRACTOR's report covering each personal injury requiring the attention of physician shall be furnished to the COMPANY.

17.0 NO EXEMPTION

Notwithstanding the above there is nothing in these to exempt the CONTRACTOR from the operation of any other act or rules in force.

EXHIBIT- A

ELECTRODE QUALIFICATION TEST RECORD

- A.** Tested at (Site name) : Date:
- Manufacturer's Name :
- Brand Name: :
- Batch Number & Size tested :
- Classification & Code :
- Intended for welding in position: :
- In combination with (if any) :
- Code of Reference (used for testing) :
- Special Requirements (if any) :
- B.** All-weld Tensile Test :
- Base Material used :
- Pre-heat temperature :
- Post weld heat treatment details: :
- Visual examination :
- Radiographic examination results :
- Tensile test results :

Identification No.	U.T.S.	Yield Point	Elongation	Remarks
1.				
2.				

C. Impact Test Results

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

Specimen No.	Impact Value	Average
1		
2		
3		
4		
5		

D. Chemical Analysis Results

Electrode Size Result :

Batch No. :

%C	%S	%P	%Si	%Mn	%Cr	%Ni	%Mo	Other

PREPARED BY
(CONTRACTOR)

REVIEWED BY
(CONTRACTOR)

APPROVED
(PMC/OWNER)

EXHIBIT- B

STRESS RELIEF HEAT TREATMENT PROCEDURE SPECIFICATION

Name of the Heat-treater :
Name of the Project : Specification Reference No.

1. General Detail:
Name of the Equipment:
Name of the Assembly/Part:
Drawing No:
Material:
2. Furnace Details
Type of Heating : Gas/Oil/Elect.
Res/ induction Type of Heating
Capacity (Size)
Maximum Temp. (C) :
Method of temp. Measurement
Atmosphere Control :
3. Heat Treatment Cycle Details
Charging Temp. C
Rate of heating, C/Hr.
Soaking Temp. C
Soaking Time, hrs.
Rate of Cooling, C/Hr.
Mode of Cooling
4. Other Details, if any :
Notes:

The following documents shall be furnished along with the specifications:

- i) Material test certificates
- ii) Assembly/Part Drawing.

.....
**PREPARED BY
CONTRACTOR)**

.....
**REVIEWED BY
(CONTRACTOR)**

.....
**APPROVED BY
(PMC/OWNER)**

EXHIBIT- C

QUALIFICATION WELD REPORT													
Date _____		Test No. _____		Test Type: _____		Procedure _____		Welder _____					
Location _____		Welder (s) _____											
Material Grade 1 _____													
Material Grade 2 _____													
Outside Diameter _____				Wall Thickness _____									
Joint Type _____				Bevel Angle _____									
Backing Type (if applicable) _____				Roll or Fixed Position _____									
RECORDED WELDING PARAMETERS													
Pass	Process and Direction of Welding	Filler Metal Classification and Diameter	Shielding Gas type and flow rate or shielding flux	Preheat / Interpass Temperature	Voltage	Amperage	Travel Speed	Heat Input					
Root Bead													
Second Bead													
Note: Number of weld beads are not intended to be limited by this table and the table should be adjusted to present all required passes. Time between passes: Root Bead to 2 nd Bead: _____, 2 nd bead to 3 rd bead: _____ Cooling Method (if applicable) _____ PWHT _____													
MECHANICAL TEST RESULTS													
TENSILE TESTS Report Number : _____				NICK BREAK TEST Report Number : _____									
Specimen Number	Tensile 1	Tensile 2	Tensile 3	Tensile 4	Specimen Number	Nick 1	Nick 2	Nick 3	Nick 4	Nick 5	Nick 6	Nick 7	Nick 8
Location					Location								
Original specimen dimensions					Result								
Original specimen area					BEND TESTS Report Number: _____								
Maximum load					Specimen Type and Number								
Tensile strength					Location								
Fracture Location					Result								
Remarks _____													
Test made at _____						Date _____							
Tested by _____						Supervised by _____							

Sample Qualification Weld Report Form

WELDING PROCEDURE SPECIFICATION

WPS Number _____

Process(es)/Method of Application _____
 Material grade(s) _____
 Outside diameter _____ Wall thickness _____
 Joint type _____ Bevel angle _____
 Backing type (if applicable) _____ Roll or fixed position _____
 Direction of welding _____ Number of welders _____
 Preheat temperature _____ Interpass Temperature _____
 Method of Heating _____
 Filler metal(s) and Flux _____
 Flame characteristics _____ Cleaning and/or grinding tools _____
 Type and removal of lineup clamp _____ Minimum number of passes _____
 Maximum time between root pass and start of the second pass _____ Maximum time between second pass and start of third pass _____
 Method of cooling _____ PWHT procedure _____

JOINT DESIGN

SEQUENCE OF BEADS

WELDING PARAMETERS

Pass	Process / Electrical Characteristics	Filler Metal Group or Classification	Electrode Size	Shielding Gas Type and Flow Rate or Shielding Flux	Voltage Range	Amperage Range	Travel Speed Range	Heat Input Range
Root Bead								
Second Bead								

Note: Number of weld beads are not intended to be limited by this table and the table should be adjusted to present all required passes.

Supporting qualification weld report No(s): _____

Approved by: _____

Sample Qualification Weld Report Form

**PREPARED BY
CONTRACTOR)**

**REVIEWED BY
(CONTRACTOR)**

**APPROVED BY
(PMC/OWNER)**

EXHIBIT- D

Example of record form for welder qualification test

Welder test certificate	Test no
Project/Contract	Date
Contractor	Inspector
Welder's name	
Address	
Pipe material	
Pipe thickness	
Pipe outside diameter	
Welding process	Root
	Fill and Cap
Reason for failure	
Visual	
Non-destructive testing	
Butt joint	
Fillet weld	
'Number of attempts	
Comments	
Accepted date/Time	

Signed by Contractor

Signed by Inspector

*Delete as necessary

EXHIBIT- E

Welder's Identification Card

Name	:	
Identification	:	Photograph
Date of Testing	:	
Valid till	:	
Approval of Welding	:	
Welding Position	:	
Material	:	
Diameter	:	
Diameter range approved	:	
Wall thickness	:	
Thickness range approved	:	
Type of welding consumables	:	

Approved by:

Employers' Signature with seal

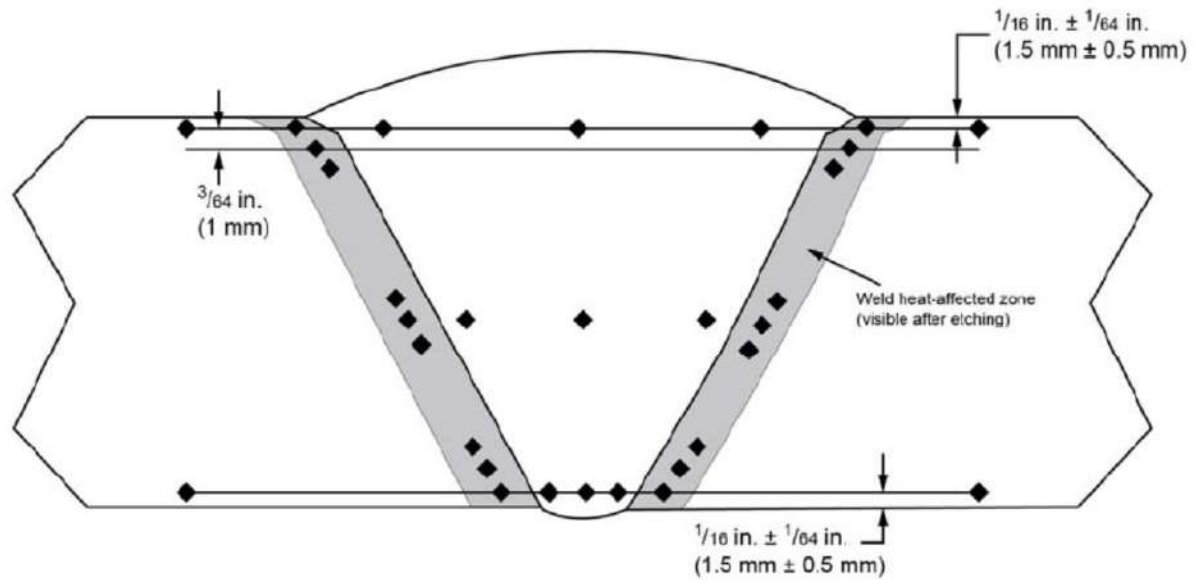
EXHIBIT- F

Radiographic Procedure for Pipe Welding

1. Location
2. Date of Testing
3. Name of Supervised Contractor
4. Material
5. Dia & Thickness
6. Type of weld joint
7. Radiation Source (X-ray, iridium)
8. Type of equipment (External/Internal)
9. Intensifying screens and material
10. Filter type and placement mask, Diaphragm Lead screen etc. adjacent to radiation source or specimen,
11. Exposure Geometry (Source focal spot size, object to film distance, radiation angle with respect to weld and film).
12. Limit of film coverage
13. Film type and make
14. Exposure Conditions (rna, KV, time)
15. Processing (time temperature for development stop bath or rinse, fixation, washing, drying etc.)
16. Density
17. Sensitivity
18. Type of penetrameter
19. Essential wire to be seen on source side:
20. Essential wire accepted for film side viewing:

Approval of the COMPANY

Signature of CONTRACTOR with seal



NOTE Heat-affected zone (HAZ) hardness impressions must be entirely within the HAZ and located as close as possible to the fusion boundary (between the weld metal and HAZ). The wall thickness of the specimen may prevent all the indents as shown from being made, particularly along the mid-point of the specimen.

HARDNESS TESTING – BUTT WELDS

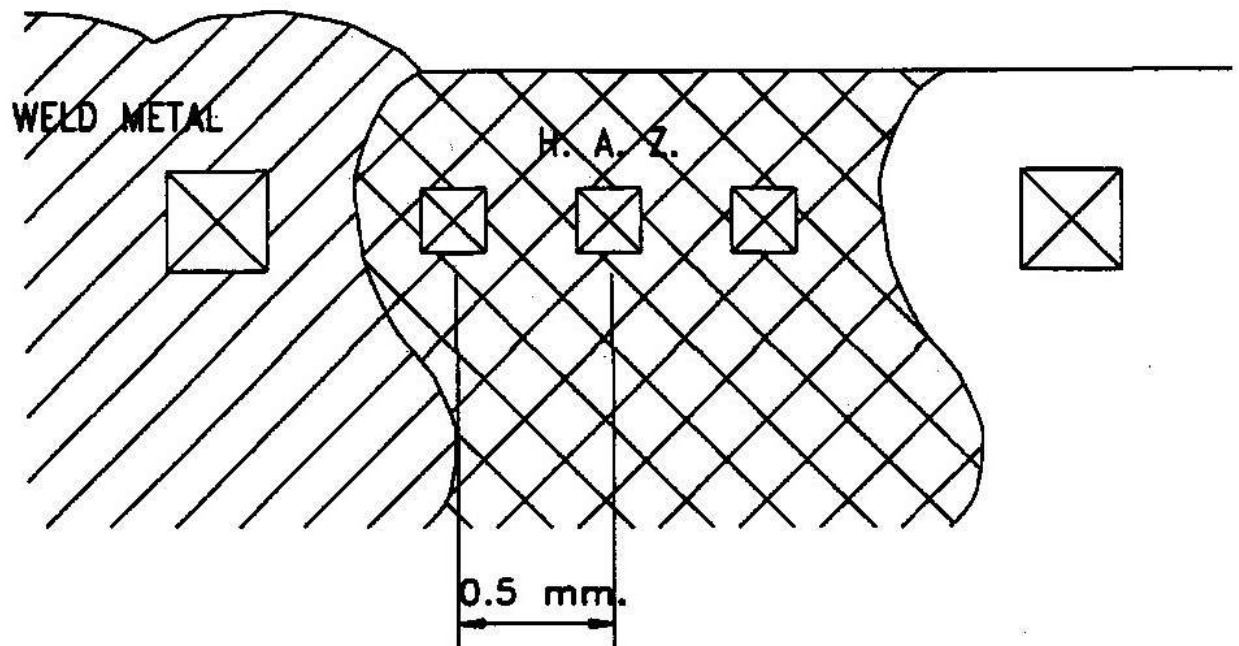


FIGURE 5
HARDNESS TESTING OF WELD JOINTS – SCHEMATIC

NOTCH POSITIONS

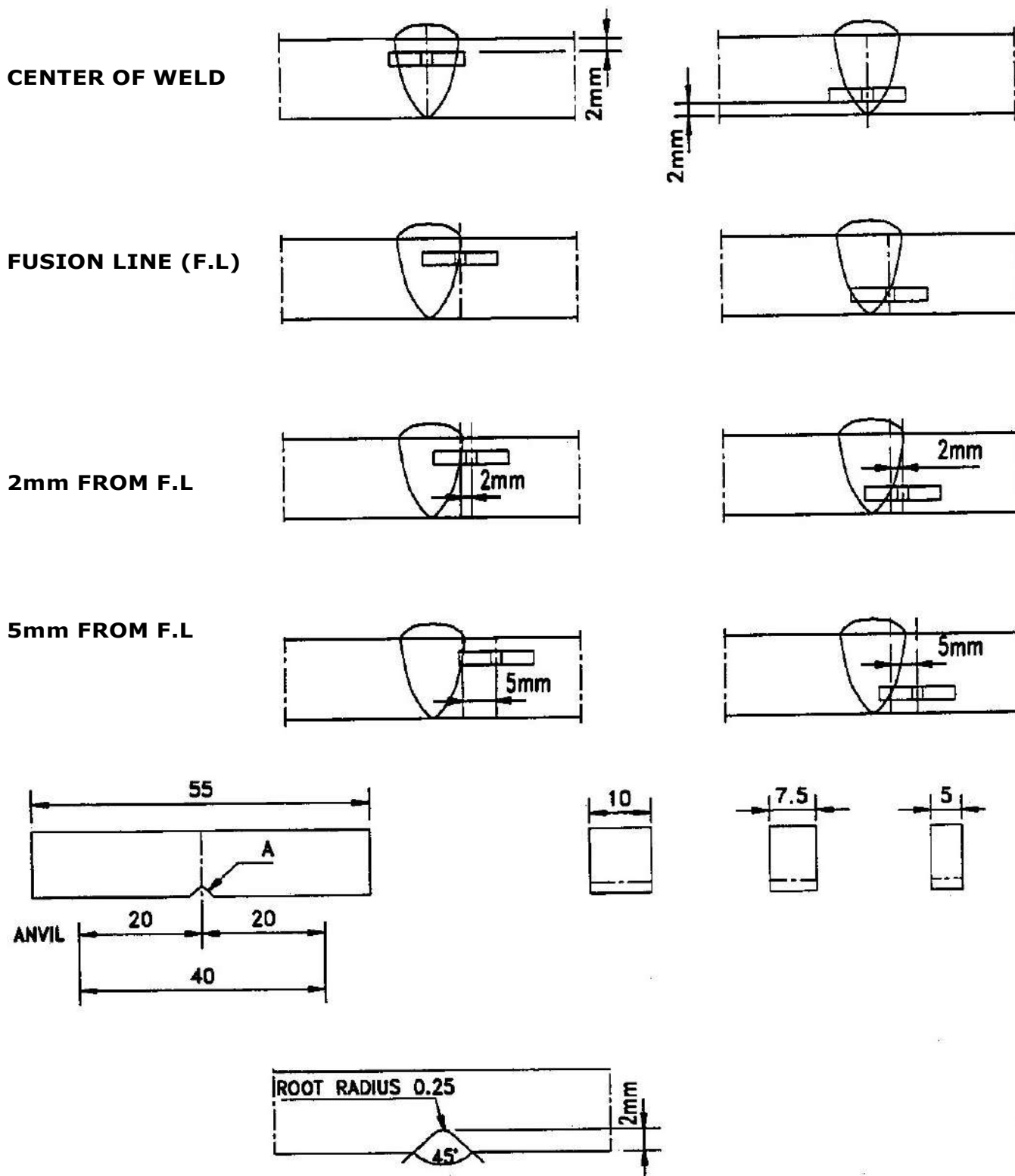


FIGURE 6
CHARPY V – NOTCH TEST SPECIMEN

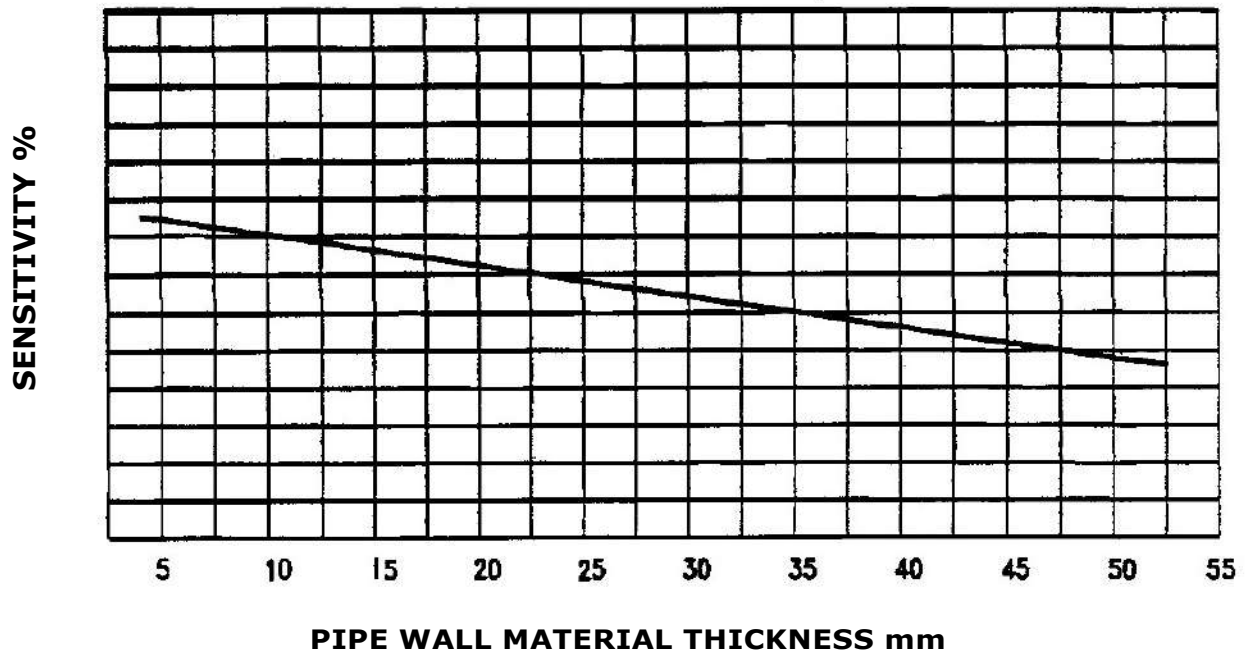


Figure-7

NOTE:-

FOR PRODUCTION RADIOGRAPHY, SENSITIVITY REDINGS BASED ON FILM ON SIDE PENTRAMETERS ARE TO BE JUDGED AS PER RESULT FROM THE PROCEDURE QUALIFICATION WITH PENTRAMETERS PLACED ON THE SOURE SIDE



VCS QUALITY SERVICES PVT. LTD.

WELDING SPECIFICATION FOR FABRICATION OF PIPING

VCS-SS-PP-2509

01	30.06.2022	RP	MC	HK	GW
00	28.01.2020	MB	AK	AD	SK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY	: If printed
CONTROLLED COPY	: If in soft and signed

REVISION RECORD

Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	28.01.2020					
		MB	AK	AD	SK	
01	30.06.2022					VCS QMS Integration
		RP	MC	Hk	GW	

Abbreviations:

ASME	:	American Society of Mechanical Engineers
ASNT	:	American Society for Non-destructive
Testing AWS	:	American Welding Society
BPVC	:	Boiler & Pressure Vessel Code
CFH	:	Cubic Feet per Hour
DWDI	:	Double Wall Double Image
DWSI	:	Double Wall Single Image
GTA	:	Gas Tungsten Arc
GTAW	:	Gas Tungsten Arc Welding
IBR	:	Indian Boiler Regulations
IQI	:	Image Quality Indicator
NDT	:	Non Destructive Testing
PQR	:	Procedure Qualification Record
RT	:	Radiographic Testing
SMAW	:	Shielded Metal Arc Welding
SWSI	:	Single Wall Single Image
UTS	:	Ultimate Tensile Strength

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	FORMATS EXHIBIT A TO EXHIBIT H	

(This specification shall be used in conjunction with Welding Specification Charts).

1.0 GENERAL

This specification shall be followed for the fabrication of all types to welded joints of piping system within the battery limits of the plant.

The welded pipe joints shall include the following:

- a) All pipe joints, longitudinal butt welds, circumferential butt welds and socket welds.
- b) Attachments of forgings, flanges and other supports to pipes.
- c) Welded manifold headers and other sub-assemblies.
- d) Welded branch connections with or without reinforcing pads.
- e) Joints in welded/fabricated piping components.
- f) The attachments of smaller connections for vents drain drips and other instrument tapping's.

Any approval granted by the Engineer-in-Charge or Owner's inspector, shall not relieve the Contractor of his responsibilities and guarantee.

This specification shall not be applicable for welding of pipelines for transportation of liquid petroleum, gas and other similar products in onshore and off shore.

2.0 APPLICABLE CODES & STANDARDS

All welding work, equipment's for welding, heat treatment, other auxiliary functions and the welding personnel shall meet the requirements of the latest editions of the following accepted standards and procedures unless otherwise specified in the Welding Specification Chart and the Technical Notes attached thereof. In the case of conflicting requirements, the requirements mentioned in Welding Specification Chart/Technical Notes shall be applicable.

- i. ASME Code for Pressure Piping - ASME B31.3
- ii. ASME Boiler & Pressure Vessel Code, Sec II Part C, Material Specifications: Welding Rods, Electrodes and Filler metals.
- iii. ASME Boiler & Pressure Vessel Code, Section V, Non-destructive examination.
- iv. ASME Boiler & Pressure Vessel Code, Section VIII, Rules for Construction of Pressure Vessels.
- v. ASME Boiler & Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.
- vi. The Indian Boiler Regulations - I.B.R.

In the event of any differences due to the additional requirements mentioned in this specification, over and above those obligatory as per codes, this specification shall be binding.

3.0 BASE METAL

3.1 In general, use of carbon steel, alloy steel and stainless steel is envisaged. The details of the material specifications are given in the Welding Specification Chart.

3.2 The Contractor shall provide the manufacturer's test certificates for every heat of the materials

supplied by him.

4.0 WELDING CONSUMABLES

- 4.1** The Contractor shall provide, at his own expense, all the welding consumables necessary for the execution of the job such as electrodes, filler wires, argon etc. and these should bear the approval of the Engineer-in-Charge.
- 4.2** The welding electrodes and filler wires supplied by the Contractor shall conform to the class specified in the Welding Specification Chart. The materials shall be of the make approved by the Engineer-in-Charge.
- 4.3** Electrode qualification test records should be submitted as per the Exhibit-A (attached) in respect of the electrodes tested by the Contractor, for obtaining the approval of the Engineer-in-Charge.
- 4.4** The Contractor shall submit batch test certificates, from the electrode manufacturers, giving details of physical and chemical tests carried out by them, for each batch of electrodes to be used.
- 4.5** All electrodes shall be purchased in sealed containers and stored properly to prevent deterioration. The electrodes removed from the containers shall be kept in holding ovens at temperatures recommended by the electrode manufacturer. "Out of the oven time" or electrodes, before they are consumed, shall not exceed the limits recommended by the electrode manufacturer. The electrodes shall be handled with care to avoid any damage to the flux covering.
- 4.6** All low hydrogen type of electrodes shall be rebaked at 350°C for 1 hour minimum and stored in ovens kept at 80-100°C before use. Recommendations of the electrode manufacturer shall be followed, if available.
- 4.7** The electrodes, filler wires and flux used shall be free from rust, oil, grease, earth and other foreign matter which affect the quality of welding.
- 4.8** Tungsten electrodes used shall conform to ASME Sec. II C SFA 5.12 specification. Thoriated Tungsten electrodes shall not be permitted due to possible radiation hazard. Instead, ceriated Tungsten Electrodes (EWCe-2 or equivalent) shall be used for GTA Welding.

5.0 SHIELDING & PURGING GAS

- 5.1** Argon gas used in GTA welding for shielding purposes shall be 99.995% pure. The purity of the gas shall be certified by the manufacturer. The rate of flow for shielding purposes shall be established through procedure qualification tests. Normally this rate may be 12-20 CFH.
- 5.2** Argon gas with a purity level of 99.995% shall be used for purging.
- 5.3** When GTAW process alone or a combination of GTAW and SMAW processes is recommended for the production of a particular joint, the purging shall be maintained during the root pass and for the first filling pass to minimize oxidation on the inner side of the pipe, unless otherwise specified in Welding Specification Chart.
- 5.4** Initial purging shall be maintained for sufficient period of time so that at least 4-5 times the volume between the dams is displaced, in order to completely remove the entrapped air. In no case should the initial purging period be less than 10 minutes. High gas pressure should be avoided.

5.5 After initial purging, the flow of the backing gas should be reduced to a point where only a slight positive pressure prevails. For systems, which have a small volume (up to 1/2 cubic foot) to be purged, a gas flow rate of 6-CFH is usually adequate. Systems of larger volume may require higher flow rates and these should be established during procedure qualification tests.

5.6 Gas backing (purging) is not required for socket type of welded joints.

5.7 Dams, used for conserving inert gas during purging, shall be removed after completion of the welding, and shall be accounted for. Wherever, removal of dams is not possible after welding, use of water-soluble dams should be made.

6.0 EQUIPMENTS & ACCESSORIES

6.1 The Contractor should have the arrangement of sufficient number of welding and cutting equipment's, auxiliaries, and accessories of sufficient capacities so as to meet the target/schedule.

6.2 All the equipment's for performing the heat treatment, including transformers, thermocouples, pyro-meters, automatic temperature recorders (with suitable calibration arrangement etc.) shall be provided by the Contractor at his own expenses and these should bear the approval of the Engineer-in-Charge.

6.3 Contractor shall make arrangements at his own expense, for providing the radiographic equipment's radiographic films, processing equipment all other darkroom facilities and all the equipment's/aterials required for carrying out the dye-penetrant/magnetic particle test/ultrasonic testing for satisfactory and timely completion of the job.

6.4 Redoing of any work, necessitated by faulty equipment's or operation used by the Contractor, will be done at his own expense.

7.0 WELDING PROCESS

7.1 Welding of various materials under this specification shall be carried out using one or more of the following processes with the approval of the Engineer-in-Charge.

- Shielded Metal Arc Welding Process (SMAW)
- Gas Tungsten Arc Welding Process (GTAW)

7.2 The welding processes to be employed are given in the Welding Specification Chart. Any deviation desired by the Contractor shall be obtained through the express consent of the Engineer-in-Charge.

7.3 Automatic and semi-automatic welding processes shall be employed only with the express approval of the Engineer-in-Charge. The welding procedure adopted and consumables used shall be specifically approved.

7.4 A combination of different welding processes could be employed for a particular joint only after duly qualifying the welding procedure to be adopted and obtaining the approval of Engineer-in-Charge.

8.0 EDGE PREPARATION

8.1 General

The edges to be welded shall be prepared to meet the joint design requirements by any of the following methods recommended:

a) Carbon Steel

Gas cutting, machining or grinding methods shall be used. After gas cutting, oxides shall be removed by chipping or grinding.

b) Low Alloy Steels (containing up to 5% Chromium).

Gas cutting, machining or grinding methods shall be used. After gas cutting, machining or grinding shall be carried out on the cut surface.

c) High alloy steel (> 5% Chromium) and stainless steels, nickel alloys:

Plasma cutting, machining or grinding methods shall be used. After plasma cutting, cut surfaces shall be machined or ground smooth.

8.2 Cleaning

a) The ends to be welded shall be properly cleaned to remove paint, oil, grease, rust, oxides, sand, earth and other foreign matter. The ends shall be completely dry before the welding commences.

b) On completion of each run, craters, welding irregularities, slag etc., shall be removed by grinding and chiseling. Wire brushes used for cleaning stainless steel joints shall have stainless steel wires and the grinding wheels used for grinding stainless steel shall be of a suitable type. Separate grinding wheels and wire brushes should be used for carbon steels and stainless steels.

9.0 ALIGNMENT & SPACING

9.1 Components to be welded shall be aligned and spaced as per the requirements laid down in applicable code. Special care must be taken to ensure proper fitting and alignment when the welding is performed by GTAW process. Flame heating for adjustment and correction of ends is not permitted unless specifically approved by the Engineer-in-Charge.

9.2 A wire spacer of suitable diameter may be used for maintaining the weld root opening while tacking, but it must be removed after tack welding and before laying the root bead.

9.3 For pipes of wall thickness 5 mm and above, the ends to be welded shall be secured in position with the aid of couplers, yokes and 'C' clamps, to maintain perfect alignment. Yokes shall be detached after the completion of weld, without causing any surface irregularity. Any irregularity caused on the pipe surface must be suitably repaired to the satisfaction of the Engineer-in-Charge.

9.4 Tack welds, for maintaining the alignment, of pipe joints shall be made only by qualified welders using approved WPS. Since the tack welds become part of the final weldment they shall be executed carefully and shall be free from defects. Defective tack welds must be removed prior to the actual welding of the joints.

9.5 Tacks should be equally spaced. Minimum number of tacks shall be:

3 tacks	-	for 2 1/2" and smaller dia. pipes
4 tacks	-	for 3" to 12" dia. pipes
6 tacks	-	for 14" and larger dia. pipes

9.6 Welding shall commence only after approval of fit-up by the Engineer-In-Charge.

10.0 WEATHER CONDITIONS

- 10.1** The parts being welded and the welding personnel should be adequately protected from rain and strong winds. In the absence of such a protection no welding shall be carried out.
- 10.2** During field welding using GTAW process, particular care shall be exercised to prevent any air current affecting the welding process.

11.0 WELDING TECHNIQUE

11.1 Root Pass

- a) Root pass shall be made with electrodes/filler wires recommended in the welding specification chart. For fillet welding, root welding shall be done with consumables recommended for filler passes. The preferred size of the electrodes is 2.5 mm diameter (12 SWG) but in any case not greater than 3.25 mm (10 SWG).
- b) Upward technique shall be adopted for welding pipe held fixed with its axis horizontal.
- c) The root pass of butt joints should be executed so as to achieve full penetration with complete fusion of the root edges. Weld projection inside the pipe shall be as per applicable code. It shall be limited 3mm max. When the applicable code does not place any restriction.
- d) Any deviation desired from the recommended welding technique and electrodes indicated in the welding specification chart should be adopted only after obtaining express approval of the Engineer-in-Charge.
- e) Welding shall be uninterrupted.
- f) While the welding is in progress care should be taken to avoid any kind of movement of the components, shocks, vibrations and stresses to prevent occurrence of weld cracks.
- g) Peening shall not be used.

11.2 Joint Completion

- a) Joint shall be completed using the class of electrodes, recommended in the Welding Specification Chart. Size of the electrode shall not exceed 4 mm in diameter for stainless steels and alloy steels used for low temperature applications.
- b) Two weld beads shall not be started at the same point in different layers.
- c) Butt joints shall be completed with a cover layer that would affect good fusion at the joint edges and a gradual notch free surface.
- d) Each weld joint shall have a workmanship like finish. Weld identification work shall be stamped clearly at each joint, just adjacent to the weld. Metal stamping shall not be used on thin pipe having wall thickness less than 3.5mm. Suitable paint shall be used on thin wall pipes for identification.
- e) Rust preventive/protective painting shall be done after the weld joint has been approved.

11.3 Dissimilar Welds

Where welds are to be produced between carbon steels and alloy steels preheat and post weld heat treatment requirements shall be those specified for corresponding alloy steels and filler

wire/electrodes shall correspond to ER 70 S-G or AWS E-7016/7018 type. For welds between two dissimilar Cr-Mo low alloy steels, preheat and post weld heat treatments shall be those specified for higher alloy steel and electrodes used shall correspond to those specified for steel of lower alloy content. For carbon steel or alloy steel to stainless welds, use of filler wire/electrodes EIER-309/E-310/E NiCr Fe-3 shall be made. The welding procedure, electrodes/filler wires to be used shall be approved by the Engineer-in-Charge.

12.0 HEAT TREATMENT

12.1 Preheating

- a) No welding shall be performed without preheating the joint to 10°C (50°F) when the ambient temperature is below 10 degree.
- b) Preheating requirements for the various materials shall be as per the Welding Specification Chart attached.
- c) Preheating shall be performed using resistance or induction heating methods. Preheating by gas burners, utilizing oxy-acetylene or oxy-propane gas mixtures, with neutral flame may also be carried when permitted by the Engineer-in-Charge.
- d) Preheating shall extend uniformly to at least three times the thickness of the joint, but not less than 50 mm, on both sides of the weld.
- e) Preheating temperature shall be maintained over the whole length of the joint during welding. Temperature recorders shall be provided by the Contractor to record the temperature.

12.2 Post Heating

In case of alloy steel materials such as Cr-Mo steels, if the post weld heat treatment is not performed immediately after welding, the weld joint and adjacent portion of pipe, at least 50 mm on either side of weld, shall be uniformly heated to 300°C. This temperature shall be maintained for half an hour minimum, and then wrapped with mineral wool before allowing it to cool to room temperature. If the Post Heating temperature specified in the Welding Specification Charts exceeds 300°C, the same shall be followed. Similarly, if the welding specification chart specifies post-heat time, the same shall be applicable. Post weld heat treatment as specified in the Welding Specification Chart shall be carried out later on.

12.3 Post Weld Heat Treatment (PWHT)

- a) Post weld heat treatment, wherever required for joints between pipes, pipes and fittings, pipe body and supports shall be carried out as per the welding specification chart, applicable codes standards and the instructions of the Engineer-in-Charge. In this regard procedure qualification to be done before carrying out PWHT in production welds.
- b) The Contractor shall submit for the approval of the Engineer-in-Charge, well before carrying out actual heat treatment, the details of the post weld heat treatment procedure as per Exhibit B attached, that he proposes to adopt for each of the materials/assembly/part involved.
- c) Post weld heat treatment shall be done in a furnace or by using an electric resistance or induction-heating equipment, as decided by the Engineer-in-Charge.
- d) While carrying out local post weld heat treatment, technique of application of heat must ensure uniform temperature attainment at all points of the portion being heat- treated. Care shall be taken to ensure that width of heated band over which specified post weld

heat treatment temperature attained is at least that specified in the relevant applicable standards/codes. Control of temperature shall be done using microprocessor/computer controlled system. The desired time-temperature cycle shall be entered into the microprocessor/computer.

- e) Throughout the cycle of heat treatment, the portion outside the heated. band shall be suitably wrapped under insulation so as to avoid any harmful temperature gradient at the exposed surface of pipe. For this purpose temperature at the exposed surface should not be allowed to exceed 50% of the peak temperature.
- f) The temperature attained by the portion under heat treatment shall be recorded by means of thermocouple pyrometers. Adequate number of thermocouples should be attached to the pipe directly at equally spaced location along the periphery of the pipe joint. The minimum number of thermocouples attached per joint shall be 1 up to 6" dia., 2 up to 10" dia. and 3 for 12" dia. and above. However, the Engineer-in-Charge can increase the required number of thermocouples to be attached if found necessary.
- g) Automatic temperature recorders, which have been suitably calibrated, shall be employed for measuring & recording temperature. Both, the actual time-temperature graph and the designed time temperature graph shall be available on every chart. The time-temp graph shall be submitted to Engineer-in-Charge immediately on completion of Stress Relieving Cycle the calibration record of each recorder should be submitted to the Engineer-in-Charge prior to starting the heat treatment operations and his approval should be obtained.
- h) Manufacturer's test certificate shall be submitted for the thermocouples materials and record shall be maintained by the Contractor.
- i) Immediately on completion of the Heat Treatment, the Post Weld Heat Treatment charts/records along with the hardness test results on the weld points, wherever required as per the Welding Specification Chart, shall be submitted to Engineer-in- Charge for his approval.
- j) Each weld joint shall bear a unique identification number, which shall be maintained in the piping sketch to be prepared by the Contractor. The weld joint identification number should appear on the corresponding post weld heat treatment charts. The chart containing the identification numbers and piping sketch shall be submitted to the Engineer-in-Charge in suitable folders.

13.0 CLEANING OF THE WELD JOINT

All weld joints shall be free from adherent weld spatters slag, sward, dirt or foreign matter. This can be achieved by brushing. For stainless steels, brushes with only stainless steel bristles shall be used.

14.0 INSPECTION AND TESTING

14.1 General

- a) The Owner's inspector shall have free access to all concerned areas, where the actual work is being performed. The contractor shall also accord the Owner's Inspector all means and facilities necessary to carry out inspection.
- b) The Owner is entitled to depute his own inspector to the shop or field where prefabrication and erection of pipe lines is in progress for (but not limited to) the following objectives:

- i. To check the conformance to relevant standards and suitability of various welding equipment's and the welding performance.
 - ii. To witness the welding procedure qualification.
 - iii. To witness the welder performance qualification.
 - iv. To check whether shop/field welding being executed is in conformity with the relevant specifications and codes of practice followed in piping construction.
- c) Contractor shall intimate sufficiently in advance the commencement of qualification tests, welding works and acceptance tests, to enable the Owner's inspector to be present to supervise them, as decided by the Engineer-In-Charge.

14.2 Welding Procedure Qualification

Welding procedure qualification shall be carried out in accordance with the applicable requirements of ASME Sec. IX latest edition and/or other applicable codes and the job requirements. The contractor shall submit the welding procedure specification in format as per Exhibit-C (attached) immediately after the receipt of the order. Owner's inspector will review, check and approve the welding procedure submitted and shall release the procedure for qualification tests. The procedure qualification test shall be carried out by the Contractor at his own expense. A complete set of test results in the format as per Exhibit-D attached) shall be submitted to the Owner's inspector for his approval immediately after completing the procedure qualification test and at least 2 weeks before the commencement of actual work. Standard test as specified in the code shall be carried out in all cases. In addition to these tests, other tests like macro/micro examination, hardness tests, dye penetrant examination, charpy V-notch, Corrosion tests, impact tests etc. shall be carried out on specimens depending upon the type of base material, operating conditions and requirements laid down in the detailed drawings and specifications. It shall be the responsibility of the Contractor to carry out all the tests required to the satisfaction of the Owner's inspector.

14.3 Welder's Qualification

- a) Welders shall be qualified in accordance with the ASME Section-IX or other applicable codes. The Owners inspector reserves the right to witness the test and certify/approve the qualification of each welder separately. Only those welders who have been approved by the Owner's Inspector shall be employed for welding. Contractor shall submit the welder qualification test reports in the format as per Exhibit-E (attached) and obtain express approval before commencement of work. It shall be the responsibility of Contractor to carry out qualification tests of welders. For welding of the steam piping, falling under the purview of Indian Boiler Regulations, only those welders with IBR Certification, qualified by Boiler Inspectorate, and acceptable to the local Boiler Inspector authority shall be employed.
- b) The welders shall always have in their possession; an identification card containing information contained in Exhibit-G and shall produce it on demand by the Engineer-In-Charge or his representative. It shall be the responsibility of the Contractor to issue the identify cards after it has been duly certified by the, owner's Inspector.
- c) No welder shall be permitted to work without the possession of the identify card.
- d) If a welder is found to perform a type of welding or in a position for which he is not

qualified, he shall be debarred from doing any further work. All welds performed by an unqualified welder shall be cut and redone by a qualified welder at the expense of the Contractor.

14.4 Visual Examination

Visual Examination of all welds shall be carried out as per the latest editions of the applicable codes and specifications. All finished welds shall be visually inspected for parallel and axial alignment of the work, excessive reinforcement, concavity of welds, shrinkage cracks, inadequate penetration, unrepaired burn-through, under cuts, dimensions of the weld, surface porosity and other surface defects. Undercutting adjacent to the completed weld shall not exceed the limits specified in the applicable standard/code.

14.5 Radiographic Examination

- a) Contractor shall appoint agency for carrying out the radiography works at site from the list of agency enclosed in the bid document or separately supplied by owner/ VCS.
- b) The Radiographic Examination procedures to be adopted shall be submitted by the contractor as per Exhibit-F and shall be got approved from the Owner's Inspector prior to employment. A person qualified to ASNT Level-II or ASNT Level-III in Radiographic testing shall prepare the procedure. The Radiography Procedure shall be established to demonstrate that the required sensitivity can be consistently achieved under the most unfavorable parameters (e.g. source to film distance, geometric unsharpness, thickness etc.). The radiographic technique and procedure adopted shall conform of the requirements mentioned in Article 2 as well as Article 22 of ASME Sec. V. The IQI sensitivity obtained shall be equal to or better than the requirements mentioned in Article 2 of ASME Sec. V. Source side penetrameter shall be used in establishing radiographic procedure/ technique. The acceptance criteria shall be as per the relevant codes of Fabrication and overriding requirements if mentioned elsewhere in the technical specifications of the contract. The Contractor shall be responsible for carrying out Radiography; rectification of defects and re-radiography of welds repaired/rectified at his cost.
- c) The extent of Radiography shall be as per specifications to be supplied to the Contractor. For welds between dissimilar materials, the extent of Radiographic Examination shall be the more stringent of the two recommended for the materials being welded. Wherever random Radiography is called for, in a particular piping class, the dissimilar materials weld joints shall essentially be included.
- d) Type of Radiation source and film to be used shall be as per Exhibit-H for carrying out radiographic examination. However if specifications (as given elsewhere in the contract) for some critical material require usage of X-Radiation, then Radiography shall be done using X-Rays only.
- e) The Contractor shall fulfill all the statutory and owner's safety requirements while handling X-ray and Gamma-ray equipment's.
- f) In case of random radiography, the joints for Radiography shall be selected by the Owner's Inspector and the Radiography shall be performed in his presence, if he instructs the contractor to do so. The contractor shall furnish all the radiographs, to the Owner's Inspector immediately after processing along with evaluation by a person qualified to ASNT

Level-II in Radiographic testing, in line with Article 2 of ASME Sec. V. The certificate of ASNT/ISNT Level II qualification of the NDT personnel shall be submitted to owner's inspector for his approval prior to start of job.

- g) The Contractor shall provide the Owner's Inspector, all the necessary facilities at site such as a dark room with controlled temperature, illuminator (viewer) suitable for varying densities, a duly calibrated electronic densitometer with batteries, magnifying glass, tracing papers, ruler, marking pencils etc. to enable him to review the radiographs.
- h) Where random radiography is specified, the first weld of each welder shall be completely radiographed. In the case of pipe of size 6" and below, the first two welds shall be completely radiographed.
- i) For each weld performed by a welder found unacceptable, two additional checks shall be carried out on welds performed by the same welder. This operation is iterative and the of two additional welds for each weld deemed unsatisfactory shall be continued till such time that two consecutive welds of satisfactory quality are found for every defective weld.
- j) The Contractor shall carry out these additional radiographic testing at his own expense. To avoid the possibility of too many defective welds by a single welder remaining undetected for a long period to time, the Contractor shall promptly arrange for Radiographic Examination so that there is no accumulation of defective joints.
- k) Contractor shall quote rates for X-ray as well as Gamma Ray for joints indicated to be radiographed by X-ray in Table of Exhibit-H.

14.5.1 Check shots

- a) Owner / Engineer - in - charge or his representative shall select 5% of the total joints radiographed on a day for check shots. Contractor shall carry out check shots as directed.
- b) Weld profiles of check shots shall be compared with weld profile observed in the earlier Radiographs. In the event of anyone variation in the check shots and earlier Radiographs, contractor shall re-shoot the entire lot of joints radiographed by particular Radiography agency on the particular date. All the re-shot films shall be compared with the originally submitted films.

14.6 Liquid Penetrant and Magnetic Particle Examination

- a) Whenever such tests are specified, the tests shall be carried out on joints chosen by the Owner's inspector, as per ASME Section V article 6 and 7 respectively. The tests are to be performed by a person possessing a valid ASNT/ISNT Level-II qualification in the method being used.
- b) For austenitic stainless steels and other nonmagnetic materials, liquid (dye) penetrant test shall be carried out. For carrying out this test, the materials shall be brought within a temperature limit of 15°to 50°C.

14.7 Hardness Test

Hardness requirements for welds shall be as per the Welding Specification Chart Non Destructive Examination Specification attached elsewhere in the contract. Hardness testing shall be carried out by Vickers Hardness Tester during welding procedure qualification and shall be cross sectional. For production welds, hardness testing shall be carried out by portable

digital hardness testers. Poldi hardness tester shall not be permitted. Contractor shall produce documentary evidence/calibration certificate to the Owner's Inspector and obtain approval of the hardness testing equipment.

14.8 Proof Tests

Hydrostatic and pneumatic tests shall be performed as per the requirements laid down by respective flushing and Testing specification/applicable codes to demonstrate the soundness of the welds. The tests shall be conducted after fulfilling the requirement of visual examinations radiography etc. and after the entire work has been certified by the Owner's inspector to be fit for being subjected to such tests.

15.0 REPAIRS OF WELDS

- a) Defects ascertained, through the inspection methods, which are beyond acceptable limits shall be removed after the joint is completely radiographed by the process of chipping and grinding.
- b) When the entire joint is judged unacceptable, the welding shall be completely cut and edges suitably prepared as per required alignment tolerances. The re-welded joint shall again be examined following standard practices.
- c) No repair shall be carried out without prior permission of the Owner's inspector.
- d) Repairs and/or work of defective welds shall be done in time to avoid difficulties in meeting the construction schedules.

16.0 DOCUMENTS TO BE SUBMITTED BY CONTRACTOR (4 COPIES EACH)

- a) Electrode and Welding Consumable Qualification Records as per Exhibit-A, for the Welding Consumables tested and approved for the work.
- b) Batch Test Certificates, for the Electrodes used, obtained from the Electrode Manufacturers.
- c) Proposed Heat Treatment Procedure as per Exhibit-B
- d) Heat Treatment Charts.
- e) Weld joint hardness test results.
- f) Welding Procedure Specifications as per Exhibit-C immediately after receipt of the order.
- g) Welding Procedure Qualification records as per Exhibit-D.
- h) Welder Performance Qualification records as per Exhibit-E immediately after conducting Welder Qualification Tests.
- i) Radiography Procedure as per Exhibit-F and other NDT procedures.
- j) Radiographic test Report along with Radiographs and other NDT reports.
- k) Piping Sketch (Isometric) giving all the details regarding the pipe specifications, welded joints, joints radiographed magnetic particle, tested, ultrasonic tested, penetrant tested, joints heat treated, WPS used, welders identification number, etc.

EXHIBIT -A

Sheet 1 of3

ELECTRODE QUALIFICATION TEST RECORD

- A) Tested at (Site name) : Date:
- Manufacturer's Name :
- Brand Name :
- Batch Number & Size tested :
- Classification & Code :
- Intended for welding in position :
- In combination with (if any) :
- Code of Reference (used for testing) :
- Special Requirements (if any) :
- B) All-weld Tensile Test :
- Base Material used :
- Pre-heat temperature :
- Post welds heat treatment details :
- Visual examination :
- Radiographic examination results :
- Tensile test results :

Identification No.	U.T.S.	Yield Point	Elongation	Remarks
1.				
2.				

EXHIBIT-A

Sheet 2 of 3

C) Impact Test Results

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

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

D) Chemical Analysis Results

Electrode Size Result :
Batch No. :

%C	%S	%P	%Si	%Mn	%Cr	%Ni	%Mn	Other

E) Fillet Weld Test Results :

Welding Positions :

Base Materials :

Size of electrode used :

Visual Inspection Results :

1)

2)

3)

EXHIBIT-A

Sheet 3 of3

Macro Test Results :
Fracture Test Results :
Remarks :

F) Other Test Results

1. Transverse tensile test :

In combination with :
Base material used :
Position of welding :
Preheat temperature :
Post weld heat treatment :
Radiography :

Identification No.	U.T.S	Fracture in	Remarks

2. Guided Bend Test :

Position	Identification No.	Root, Face or Side Bend	Remarks
	1.		
	2.		
	3.		
	4.		
	5.		

G) Any other tests :

H) Conclusions :

.....
PREPARED BY
(CONTRACTOR)

.....
REVIEWD
(CONTRACTOR)

.....
APPROVED BY
(VCS/OWNER)

EXHIBIT-B
Sheet 1 of 1

STRESS RELIEF HEAT TREATMENT PROCEDURE SPECIFICATION

Contractor : _____

Name of the Heat treater : _____

Name of the Project : _____ Specification

Reference No. _____

1. General Details _____ Other Details

Name of the

Equipment: _____

Type of Heating: Elec. Res. / Induction

(Tick mark applicable method) Maximum
Permissible Temp at Uncovered Parent
Metal _____

Width of heated band _____

Width of Insulation _____

2. Material: _____

No. of Thermocouples (Dia wise)

Type of Thermo couples _____

3. Heat Treatment Cycle Details

Charging temp °C _____

Rate of heating ° C /Hr. _____

Soaking Temperature, °C _____

Soaking Time, Hrs. _____

Rate of Cooling 0 C/Hr. _____

Method of Cooling _____

4. Other details, if any _____

EXHIBIT -C
SHEET 1 OF 3

FORMAT FOR WELDING PROCEDURE SPECIFICATION (WPS)

Company Name _____ by _____

Welding Procedure Specification No. _____ Date _____

Welding Process (es) _____ Type (s) _____

(Automatic, Manual, Machines or Semi Auto)

JOINTS

Joint Design _____

Backing (Yes) _____ (No) _____

Backing Material (Type) _____

Sketches Production Drawings. Weld Symbols Written

Description should show the general arrangement of the parts to be welded. Where applicable, the root spacing and the details of weld groove may be specified.

(At the option of the Manufacturer sketches may be attached to illustrate joint design weld layers and bead sequence e.g. for notch toughness procedures, for multiple process procedures, etc.)

BASE METALS

P.No. _____ Group No. _____ to P. No. _____ Group No. _____

OR

Specification type and grade _____

to Specification type and grade _____

OR

Chem. Analysis and Mech. Prop. _____

to Chem. Analysis and Mech. Prop. _____

Thickness Range:

Base Metal: Groove _____ Fillet _____

Deposited Weld Metal: Groove _____ Fillet _____

Pipe Dia Range: Groove: _____ Fillet _____

Other _____

EXHIBIT -C
SHEET 2 OF 3

**FILLER
METALS**

F.No. _____ Other _____
A.No. _____ Other _____
Spec. No. (SFA) _____
AWS No.(Class) _____
Size of filler metals _____

(Electrodes, Cold Wire, Hot Wire etc.)

Electrode-Flux (Class) _____
Flux Trade Name _____
Consumable Inset _____
Each base metal/filler metal combination should be recorded individually.
WPSNO _____ Rev. _____

POSITIONS: Position(s) of Groove _____ Welding Progression: UP _____ Down _____ Positions of fillet _____	POSTWELDED HEAT TREATMENT Temperature Range _____ Time Range _____
PREHEAT Preheat Temp. Mon. _____ Interpass Temp. Max. _____ Preheat Maintenance _____	GAS Shielding Gas (es) _____ Percent Composition (mixtures) _____ Flow Rate _____ Gas Backing _____ Trailing Shielding Gas Composition _____

ELECTRICAL CHARACTERISTICS

Current AC or DC _____ Polarity _____
Amps (Range) _____ Volts (Range) _____
(Amps and volts range should be recorded for each electrode size, position, and thickness, etc.
This information may be listed in a tabular form similar to that shown below).
Tungsten Electrode Size and Type _____
(Pure Tungsten, 2% Ceriated, etc.)
Mode of Metal Transfer for GMA W _____
(Spray arc, short circuiting arc, etc.)
Electrode Wire feed speed range _____

EXHIBIT-C
SHEET 3 OF 3

TECHNIQUE

String or Weave Bead _____

Orifice or Gas Cup Size _____

Initial and Interpass Cleaning (Brushing, Grinding, etc.) _____

Method of Back Gouging _____

Oscillation _____

Contact Tube to Work Distance _____

Multiple or Single Pass (per side) _____

Multiple or Single Electrodes _____

Travel Speed (Range) _____

Peening _____

Other _____

Weld Layer(s)	Process	Filler metal		Current		Volt Range	Travel Speed Range	Other
		Class.	Dia.	Type polarity	Amp. Range			
								e.g. Remarks, Comments, Hot wire Addition, Technique Torch Angle, etc.



EXHIBIT-D
SHEET 1 OF 2

FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR)
RECORD ACTUAL CONDITIONS USED TO WELD TEST
COUPON

Company Name _____
Procedure Qualification Record No. _____ Date _____
WPS No. _____
Welding Process (es) _____
Types (Manual, Automatic, Semi-Auto) _____

JOINTS

Groove Design of Test Coupon

(For combination qualification the deposited weld metal thickness shall be recorded for each Filler metal or process weld)

BASE METALS Material Spec. _____ Type of Grade _____ P.No. _____ to P.No. _____ Thickness of Test Coupon _____ Diameter of Test Coupon _____ Other _____	POSTWELD HEAT TREATMENT Temperature _____ Time _____ Other _____
FILLER METALS Weld Metal Analysis A No _____ Size of Filler Metal _____ Filler Metal E.No. _____ SFA Specification _____ AWS Classification _____ Other _____	GAS Type of Gas on Gases _____ Composition of Gas Mixture _____ Other _____
POSITION Position of Groove _____ Weld Progression (Uphill, Downhill) _____ Other _____ 	ELECTRICAL CHARACTERISTICS Current _____ Polarity _____ Amps _____ Tungsten Electrode Size _____ Other _____



**WELDING SPECIFICATION FOR FABRICATION OF
PIPING**

**DOCNO: VCS-SS-PP-2509
Rev No : 01**

PREHEAT	TECHNIQUE
Preheat Temp. _____	Travel Speed _____
Inter pass Temp. _____	String or Weave Bead _____
	Oscillation _____
	Multi pass or Single Pass (per side) _____
	Single or Multiple Electrodes _____
	Other _____

EXHIBIT-D

SHEET 2 OF 2

GUIDED BEND TESTS

Type of Figure No	Result

TOUGHNESS TESTS

Specimen No.	Notch Location	Notch Type	Test Temp.	Impact Value	Lateral Exp.		Drop Weight	
					% Shear	Mils	Break	No Break

FILLET WELD TEST

Result – Satisfactory: Yes ____ No ____ Penetration into Parent Metal: Yes ____ No ____

Macro – Results _____

OTHER TESTS

Type of Test _____

Deposit Analysis _____

Other _____

Welder's Name _____ Clock No. _____ Stamp No. _____

Test Conducted by _____ Laboratory Test No. _____

We certified that the statements in this record are correct and test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

Date _____ Manufacturer _____

By _____

(Detail of record of tests are illustrative only and may be molded to conform to the type and number of tests required by codes and specifications).



EXHIBIT-E

SHEET 1 OF 2

FORMAT FOR MANUFACTURER'S RECORD FOR WELDER OR WELDING OPERATOR
QUALIFICATION TESTS

Welder Name _____ Check No. _____ Stamp No. _____

Using WPS No. _____ Rev. _____

The above welder is qualified for the following ranges

<u>Variable</u>	<u>Record Actual Values Used in Qualification</u>	<u>Qualification Range</u>
Process	_____	_____
Process Type	_____	_____
Backing (metal, Weld metal, flux, etc.,)	_____	_____
Material Spec.	_____ to _____	_____ to _____
Thickness		
Groove	_____	_____
Filler	_____	_____
Diameter		
Groove	_____	_____
Filler	_____	_____
Filler Metal		
Spec. No.	_____	_____
Class	_____	_____
F. No.	_____	_____
Position	_____	=====
Weld Progression	_____	_____
Gas Type	_____	_____
Electrical Characteristics		_____
Current	_____	_____
Polarity	_____	_____

EXHIBIT-E

SHEET 2 OF 2

Guided Bend Test Results

Type and Fig.No.	Result

Radiographic Test Results

For alternative qualification of groove welds by radiography

Radiographic Results _____

Fillet Weld Test Results

Fracture Test (Describe the location, nature and size of any crack or tearing of the specimen _____

Length and Per Cent of Defects _____ inches _____ %

Macro Test – Fusion _____

Appearance - Fillet Size (ing) _____ x _____ Convexity or Concavity _____

Test Conducted by _____ Laboratory - Test No. _____

We certify that the statements in this record are correct and that the test welds were prepared.
Welded and tested in accordance with the requirements of Section IX of the ASME Code.

Date _____

Organization _____

By _____

(Details of record tests are illustrative only and may be modified to conformation to the type & number of tests required by the Code).

Note: Any essential variables in addition to those above shall be recorded

EXHIBIT – F

RADIOGRAPHIC PROCEDURE QUALIFICATION RECORD FOR PIPE

WELDING

1. Location
2. Date of Testing
3. Name of the Contractor/Agency
4. Material: Carbon steel/Alloy Steel/Stainless
4. Technique: DWSIISWSI/DWDI
5. Diameter & Thickness
6. Type of Weld Joint
7. Radiation Source
8. Intensifying Screens/Lead Screens
9. Geometric Relationship:
10. Limit of Film Coverage:
11. Film Type and Make:
12. Exposure Time:
13. Processing:
14. Density:
15. Sensitivity:
- 16.* Type of penetrameter:
(Source side)
- 17.* Type of penetrameter:
(Film side)

Signature of Contractor/Agency with Seal

Approval of VCS's Inspector

Ref. Para regarding recommended practice on placement of penetrameters Article 22, SE 142, ASME Sec. V.

For "Random Radiography" lines placement of penetrameters as per Article 2, ASME, Sec. V is permitted.

EXHIBIT - G

WELDER'S IDENTIFICATION CARD

1. Name
2. Identification
3. Date of Testing
4. Process
5. Thickness Range
6. Diameter Range
7. F. No.
8. Date of approval of welding
9. Position(s)

Photograph

Approved by:

Employer's Signature with Seal

EXHIBIT - H

Type of Source and Films to be used for RADIOGRAPHY

NOMINAL WALL THICKNESS(T) IN mm		SHOP WELDED JOINTS		IN-SITU WELDS	
		SOURCE	FILM : CEN Class	SOURCE	FILM : CEN Class
$T \geq 19$	All Materials	Gamma Ray	C5	Gamma ray	C5
$8 \leq T < 19$	Carbon steel	Gamma ray	C4	Gamma ray	C4
< 8	All other materials	Gamma ray	C3	Gamma ray	C3
	Carbon Steel Other than Inspection Class IV *	Gamma ray	C3	Gamma ray	C3/C1
	All Other Materials and Carbon Steel of Inspection Class IV *	X-Ray	C4	X-ray with C4 or Equivalent to be used. Gamma Ray (Se 75 Source only) with C3/C2 Equivalent may be allowed only if in the assessment of owner's inspector, Joints are in accessible for X-ray equipment and radiographic sensitivity is achieved.	

Note: Integral to above table

- 1) Films slower than the above may have to be used, if required radiographic sensitivity is not achieved consistently.

COMPARISION OF FILM FROM DIFFERENT MANUFACTURERS.

CEN Classification	KODAK	AGFA	FUJI
---	CX	D8	---
C5	AA400	D7	IX100
C4	T200	D5	IX80
C3	MX125	D4	IX50
C2	M100	D3	---
C1	DR50	D2	IX25
---	SR**	---	---

****Special films, extremely fine grain & very high resolution**



VCS PROJECT CONSULTANTS PVT. LTD.

TECHNICAL NOTES FOR PIPES

VPC – SS – PI - 0011

00	12.01.2018	ISSUED AS STANDARD	AS	SM	AD
REV. No	DATE	Purpose	Prepared By	Checked By	Approved By

**ABBREVIATIONS:**

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
BIS	Bureau of Indian Standards
E.FS.W	Electric Fusion Weld
E.R.W	Electric Resistance Weld
HAZ	Heat Affected Zone
HIC	Hydrogen Induced Cracking
IBR	Indian Boiler Regulations
IGC	Inter Granular Corrosion
IS	Indian Standard
LT	Low Temperature
MR	Material Requisition
NACE MR	National Association of Corrosion Engineers : Material Requirement
NB	Nominal Bore
NPT	Nominal Pipe Thread
PMI	Positive Material Identification
PR	Purchase Requisition
SMYS	Specified Minimum Yield Strength
SS	Stainless Steel



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1. 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 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 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. PMI shall be performed as per the scope and procedures at supplier`s work.

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. Pipe with screwed ends shall have NPT external taper pipe threads conforming to ASME/ANSI B1.20.1 up to 1.5" NB & IS 554 for 2" to 6" NB.

1.7. Pipe with beveled 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	Up to 22 mm	Figure 2 Type A
	> 22 mm	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
	> 25 mm	Figure 6 Type A

- 1.8.** Galvanized pipes shall be coated with zinc by hot dip process conforming to IS 4736 / ASTM A 153.
- 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. (Inter Granular Corrosion) 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 with acceptance criteria of no cracks at 20X magnification and microstructure to be observed at 250X magnification shall ensure the absence of any cracks/ fissures. When testing is conducted as per practice 'E' photograph of microstructure shall be submitted for record.
- 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 'CRYO' & '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 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 "HIC1" shall meet the requirements given in NACE MR-0103 unless mentioned otherwise.



- 1.12.2.** Pipes made from plates and designated as "HIC1" shall meet the HIC requirements of specification 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 1Cr-1/2Mo and 1 ¼ Cr-1/2Mo 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 normalized. Cold drawn pipes shall be normalized after the final cold draw pass for all thicknesses.
- 1.17.2.** All alloy steel (Cr-Mo) pipes shall be normalized 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 psig.
- 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 austenitic stainless steels, the weld deposit shall be checked for ferrite content. A Ferrite No.(FN) not less than 3% and not more than 10% is required to avoid sigma phase embrittlement during heat treatment. FN shall be determined by Ferritescope prior to post weld heat treatment.
- 1.17.5.** 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. Impact energies at 0°Celsius shall average greater than 27J (20 ft-lb) per set of three specimens, with a minimum of 19J (15 ft-lb).
- 1.18.** For dual grades of SS where specified, chemical composition and mechanical properties of both grades specified shall be ensured.



2. IBR PIPES

2.1. IBR Documentation

- 2.1.1.** Pipes under purview of IBR shall be accompanied with IBR certificate original in Form III-A duly approved and countersigned by IBR authority/local authority empowered by the Central Boiler Board of India (Photocopy of the original certificate duly attested by the local boiler inspector where the supplier is located is the minimum requirement for acceptance) or Form III-D [for well known pipe manufacturers as per IBR] signed by Manufacturer's authorized representative. Well known pipe manufacturers, as recognized by IBR, shall submit a duly attested copy of Form XVI-G along with Form III-D.
- 2.1.2.** For materials $1\frac{1}{4}$ Cr - $\frac{1}{2}$ Mo (ASTM A335 Gr.P11 / A691 Gr. $1\frac{1}{4}$ Cr), $2\frac{1}{4}$ Cr - 1Mo (ASTM A335 Gr.P22 / A691 Gr. $2\frac{1}{4}$ Cr) & 9Cr -1Mo-V (A335 Gr.P91/A691 Gr.91), Form III-A approved by IBR shall include the tabulation of E_t , S_c & S_r values for the entire temperature range given below. E_t , S_c & S_r values shall be such that throughout the temperature range

$$\begin{array}{lcl} E_t/1.5 & \geq & \\ S_r/1.5 & \geq & S_A \\ S_c & \geq & \end{array}$$

where,

S_A Allowable stress at the working metal temperature.

E_t Yield point (0.2% proof stress at the working metal temperature)

S_c The average stress to produce elongation of 1%(creep) in 100000 hrs at the working metal temperature.

S_r The average stress to produce rupture in 100000 hrs at the working metal temperature and in no case more than 1.33 times the lowest stress to produce rupture at this temperature

Temp (°F) Material	SA (psi)											
	500	600	650	700	750	800	850	900	950	1000	1050	1100
A335 Gr.P11	17200	16700	16200	15600	15200	15000	14500	12800	9300	6300	4200	2800
A691 Gr. $1\frac{1}{4}$ Cr	18900	18300	18000	17600	17300	16800	16300	15000	9900	6300	4200	2800



Temp (°F) Material	SA (psi)											
	500	600	650	700	750	800	850	900	950	1000	1050	1100
A335 Gr.P22 / A691 Gr. 2¼ Cr	1790 0	1790 0	1790 0	1790 0	1790 0	1780 0	1450 0	1280 0	1080 0	7800	5100	3200
A335 Gr.P91 / A691 Gr.91	2810 0	2770 0	2730 0	2670 0	2590 0	2490 0	2370 0	2230 0	2070 0	1800 0	1400 0	1030 0

Note : S_A values shall be as per the latest edition prevailing.

- 2.2.** For carbon steel pipes under IBR the chemical composition shall conform to the following:

Carbon (max) : 0.25%

Others (S, P, Mn) : As prescribed in IBR.

The chemical composition as indicated in this clause is not applicable for pipes other than IBR services.

3. ACCEPTABLE DEVIATIONS

- 3.1.** Pipes to IS 3589 Gr.410 are acceptable in place of IS 3589 Gr.330.
- 3.2.** Pipes of Grades SS317 of corresponding material are acceptable in place of Grades SS316 or SS316(2.5 Mo min.).
- 3.3.** Pipes of Grades SS317L of corresponding material are acceptable in place of Grades SS316L or SS316L(2.5Mo min.).
- 3.4.** Seamless pipes are acceptable in place of welded pipes except in the case of welded SS321/SS321H pipes with nominal thickness greater than 9.53mm.

4. HYDROSTATIC TEST

- 4.1.** All pipes shall be hydrostatically tested.
- 4.2.** The mill test pressure shall be as follows:
- 4.2.1.** 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.	ASTM A530

b) Seamless 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 No. 2200	ASTM B161
ASTM B165 UNS No. 4400	ASTM B165
ASTM B167 UNS No. 6600	ASTM B167
ASTM B407 UNS No. 8800	ASTM B407

e) Welded Nickel Alloy

Material Std.	Test Pressure Std.
ASTM B725 UNS No. 2200,4400	ASTM B725



ASTM B517 UNS No. 6600	ASTM B517
ASTM B514 UNS No. 8800	ASTM B514

4.2.2. Electric Fusion Weld

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

Material Std	Test Pressure Std.
API 5L Gr.B ASTM A671 Gr.CC65, 70 (CI.32) ASTM A672 Gr.C60, 65, 70 (CI.12,22) ASTM A671 Gr.CF60, 65, 66, 70 (CI.32) ASTM A691 Gr. ½ Cr, 1Cr, 1¼ Cr, 2¼ Cr, 5Cr, 9Cr (CI.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 : 10S		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 Pipe to BIS Standards

Material Std	Test Pressure Std.
IS 1239	IS 1239
IS 3589	IS 3589

- 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 50ppm.

5. 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 "IBR", "CRYO", "NACE", "H2" etc. shall also be marked.
- 5.2.** Pipes under "IBR", "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.



ENERGISING QUALITY

VCS PROJECT CONSULTANTS PVT. LTD.

WELDING SPECIFICATION FOR ONSHORE PIPELINE FOR TRANSPORTATION OF GAS

VPC – SS – PL - 0037

00	08.04.2019	ISSUED AS STANDARD	RK	MC	AD
REV. No	DATE	Purpose	Prepared By	Checked By	Approved By

**ABBREVIATIONS:**

ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
BS	British Standard
CRT	Cathode Ray Tube
CTOD	Crack Tip Opening Displacement
GMAW	Gas Metal Arc Welding
GTAW	Gas Tungsten Arc Welding
HAZ	Heat Affected Zone
HV	Vickers Hardness
IIW	International Institute of Welding
IQI	Image Quality Indicato
ISO	International Organization for Standardisation
MPI	Magnetic Particle Inspection
PQR	Procedure Qualification Record
SMAW	Shielded Metal Arc Welding
UT	Ultrasonic Testing
UTS	Ultimate Tensile Strength
WPS	Welding Procedure Specification

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1.0 SCOPE

The requirements stated herein shall be followed for the fabrication of all types of welded joints of carbon steel piping systems connected with the pipeline and related facilities.

The welded pipe joints shall include the following:

- a) All line pipe joints of the longitudinal and circumferential butt-welded and socket welded types.
- b) Attachments of castings, forgings, flanges and other supports to pipes.
- c) Welded manifold headers and other sub-assemblies.
- d) Welded branch connections.
- e) Joints in welded / fabricated piping components.
- f) The attachments of smaller connections for vents drain drips and other instrument tapings.

Any approval granted by the COMPANY shall not relieve the CONTRACTOR of his Responsibilities and guarantees.

2.0 APPLICABLE CODE AND STANDARDS

All welding work, equipment for welding, heat treatment, other auxiliary functions and the welding personnel shall meet the requirements of the latest editions of the codes, standards and specifications listed below:

- a) Code for Gas Transmission and Distribution Piping Systems, ANSI B 31.8
- b) Standard for welding of Pipelines and Related Facilities, API 1104
- c) Specification for welding Electrodes and Filler Materials ASME Sec. II C
- d) Non Destructive examination, ASME Sec. V

3.0 BASE MATERIAL

In general carbon steel is used in this specification. The details of material specifications are given in the welding Specification Chart attached along with other project data sheets. The CONTRACTOR will arrange and maintain the record of test certificates of all the materials for the reference of the welding engineer.

4.0 WELDING CONSUMABLES

- a) The CONTRACTOR shall provide at his own expense all the welding consumables necessary for the execution of the job such as electrodes, oxygen, acetylene etc. and These shall bear the approval of the COMPANY.
- b) The welding electrodes / filler wires supplied by the CONTRACTOR shall conform to the class specified in the welding specification chart attached along with other project data sheets. The materials shall be of the make approved by the COMPANY.
- c) The electrode shall be suitable for the welding process recommended and the base metal used. Physical properties of the welds produced by an electrode recommended for the welding of a particular base metal shall not be lower than the minimum values specified for the base metal unless otherwise specified in the Welding Specification Chart and shall correspond to the physical properties of the class of electrode adopted. The choice of electrode shall be made after conducting the required tests on the electrodes as per relevant standards, and shall be the sole prerogative of the COMPANY.
- d) The CONTRACTOR shall submit batch test certificates from each electrode manufacturers giving details of physical and chemical tests carried out by them for each batch of electrodes to be used.
- e) Electrode Qualification test records shall be submitted as per the Exhibit-A (attached) in respect of the electrodes tested by the CONTRACTOR for obtaining the approval of the COMPANY.
- f) All electrodes shall be purchased in sealed containers and stored properly to prevent deterioration. The electrodes removed from the containers (except cellulosic coated electrodes) shall be kept in the holding ovens, at the temperature recommended by the electrode manufacturer. Ovens shall be used for the low hydrogen electrodes only. Out-of-the oven time of electrodes before they are consumed shall not exceed the limits recommended by the electrode manufacturer. The electrodes shall be handled with care to avoid any damage to the flux covering. Different grades of electrodes shall be stored separately. Cellulosic electrodes used shall however be used as per the specific recommendations of manufacturer.
- g) The electrodes used shall be free from rust, oil, grease, earth and other foreign matter, which affect the quality of welding.



- h) Shielding Gas The composition and the purity of shielding gas when required by the welding
- Processes other than shielded metal arc welding, when permitted by the COMPANY shall bear the approval of the COMPANY. Where appropriate, gases or gas mixture of the following quality shall be used.
- I. Argon gas complying with BS 4365.
 2. Carbon dioxide gas complying with type 1 specified in BS 4105
 3. Gas mixtures that have been proved to be satisfactory as a result of procedure approval tests.
- When a gas mixture is used, which has specified additions, e.g. 2% O₂, 5% CO₂ the variation of such addition shall not exceed ± 1 0% of that stated. Moisture content shall correspond to a dew point of -30°C or lower.

5.0 EQUIPMENT & ACCESSORIES

The CONTRACTOR shall have sufficient number of welding and cutting equipment, Auxiliaries and accessories of sufficient capacities to meet the target schedules.

- 5.1 All the equipment for performing the heat treatment, including transformers, thermocouples, pyro-meters, automatic temperature recorders with suitable calibration arrangements, etc. shall be provided by the CONTRACTOR, at his own expense and these shall bear the approval of the COMPANY. Adequate means of measuring current and voltage shall be available.
- 5.2 Redoing of any work necessitated by faulty equipment or operation used by the CONTRACTOR, will be done at his own expense.

6.0 WELDING PROCESSES

- 6.1 Welding of various materials under this specification shall be carried out using Shielded Metal Arc Welding process (SMAW) with the approval of the COMPANY.
- 6.2 The welding processes to be employed are given in the welding specification chart attached along with other project data sheets. Any deviation desired by the CONTRACTOR shall be obtained through the express consent of the COMPANY.
- 6.3 Automatic process shall be employed only with the express approval of the COMPANY. The welding procedure adopted and the consumables used shall be specifically approved.
- 6.4 A combination of different welding processes or a combination of electrodes of different classes / makes could be employed for a particular joint only after duly qualifying the welding procedures to be adopted and obtaining the approval of the COMPANY.

7.0 BEVEL CLEANING / BEVEL INSPECTION

The Line Pipe supplied by COMPANY shall have bevel ends as specified in the applicable specification for the Line Pipe attached with the Bid Package. Any modification thereto, if required by the CONTRACTOR due to his special welding technique, shall be carried out by the CONTRACTOR at his own cost. Before welding, all the rust and the foreign matter shall be removed from the bevelled ends by power operated tools. This shall be effected inside and outside and for a minimum distance of 25 mm from the edge of the weld bevel. The bevels shall be thoroughly inspected at this stage. If any of the ends of the pipe joints are damaged to the extent that, in the opinion of the COMPANY, satisfactory weld spacing cannot be obtained and local repair by grinding cannot be successfully done, the damaged ends shall be cut and bevelled to the satisfaction of the COMPANY, with an approved bevelling machine. Manual cutting and weld repairs of bevels is not allowed. Should laminations, split ends or inherent manufacturing defects in the pipe be discovered, the lengths of pipe containing such defects shall be removed from the line to the satisfaction of COMPANY. On pipes, which have been cut back, a zone extending 25 mm back from the new field bevel, shall be ultrasonically tested to the requirement of the line pipe specification to ensure freedom from laminations. The new bevel shall be 100% visual and 100% dye penetrant/MTI tested. A report shall be written for all the testing and records kept.

8.0 ALIGNMENT AND SPACING

Immediately prior to line-up CONTRACTOR shall inspect the pipe ends inside and outside for damage, dents, laminations etc. Pipe for welding shall be set up, correctly spaced, allowing for the temperature changes during welding. In correct alignment shall in no circumstances be sprung into position. Temporary attachments of any kind shall not be welded to the pipe. Welds joining the sections of the pipeline, valve installation or similar welds classified as tie in welds shall be made in the trench. Otherwise the alignment and welding shall be made alongside the ditch with the pipe supported on skids and pack pads or other suitable means approved by COMPANY, at least 500 mm above the ground unless approved by the COMPANY in specific cases.

Seam orientation of welded pipe shall be selected to ensure that at the circumferential welds, the longitudinal welds shall be staggered in the top 90° of the pipeline, or 250 mm whichever is the lesser. A longitudinal joint shall pass an appurtenance of a structural element at a minimum distance of 50 mm. Should a



section of the line containing uncompleted welds fall from the skids, the CONTRACTOR shall immediately inform the COMPANY.

Every effort shall be made to reduce misalignment by the use of the clamp and rotation of the pipes to the best fit. For pipe of same nominal wall thickness the offset shall not exceed 1.6 mm. The offset may be checked from outside using dial gauges. Any branch connection sleeve, etc. shall be at least 150 mm from any other weld. The welds for fittings shall be so located that the toe of the weld shall not come within 50 mm of any other weld. Cold dressing is permissible only in cases of slight misalignment and may only be carried out with a bronze headed hammer. Hot dressing shall not be permitted. When welding pipes of different wall thickness (as directed by COMPANY) a special transition piece shall be used. This shall have a minimum of 1:4 taper. The welds shall be subject to both ultrasonic and radiographic inspection.

The root gap shall be accurately checked and shall conform to the qualified welding procedure. The use of internal Line-up Clamps is mandatory for pipe diameters 10" and above. However, in some cases (tie-in welds, flanges, fittings, diameter of pipe 10" etc.) where it is impossible to use internal clamps, an external line-up clamp may be used.

The internal line-up clamp shall not be released before the entire first pass has been completed.

When an external line-up clamp is used, all the spaces between the bars or at least 60% of the first pass shall be welded before the clamp is released and the pipe remaining adequately supported on each side of the joint.

Segments thus welded shall be equally spaced around the circumference of the pipe. Slag, etc. shall be cleaned off and the ends of the segments shall be prepared by grinding, so as to ensure continuity of the weld bead.

9.0 WEATHER CONDITIONS

The parts being welded and the welding personnel shall be adequately protected from rain and strong winds. In the absence of such a protection no welding shall be carried out. The completed welds shall be suitably protected in case of bad weather conditions.

10.0 WELDING

10.1 Root Pass

- a) The root pass shall be made with the electrodes/filler wires recommended in the welding specification chart attached along with the other project data sheets. The size of the electrodes used shall be as per the approved welding procedure.
- b) Position or roll welding may be permitted. Separate procedures shall be submitted and qualified for uphill, downhill, vertical down and roll welding. The vertical up method of welding shall be used for the root pass of the tie-ins, special crossings, fittings and special parts, fillet welds, repairs and when an external line up clamp is used. The downhill welding may be used for the root run welding of tie-ins and special crossings when (a) the edges are machined or have equivalent preparation (b) line up clamps are used and the fit up is geometrically and mechanically similar to one of the ordinary line welding without misalignment or unevenness.
- c) The root pass of butt joints shall be executed properly so as to achieve full penetration with complete fusion of the root edges. Weld projection inside the pipe shall not exceed 3 mm wherever not specified by the applicable code.
- d) Any deviations desired from the recommended welding technique and electrodes indicated in the welding specification chart shall be adopted only after obtaining express approval of the COMPANY.
- e) Welding shall be continuous and uninterrupted during a pass.
- f) On completion of each run, craters, welding irregularities, slag etc., shall be removed by grinding and chiseling.
- g) While the welding is in progress care shall be taken to avoid any kind of movement of the components, shocks, vibration and stresses to prevent occurrence of weld cracks.
- h) Fillet welds shall be made by shielded metal arc welding process irrespective of the thickness and class of piping. Electrode size shall not exceed 3.25 mm diameter for the socket joints. At least two passes shall be made on the socket weld joints.
- i) Peening shall not be used.

10.2 Joint Completion

In case of manual welding, the first pass shall be carried out by a minimum of two welders, working simultaneously and so placed as to cause minimum distortion of the pipe.



The number of welders and the allowable welding sequences shall be as those laid down in the qualified welding procedure specification. Once the deposit of the first pass has been started, it must be completed as rapidly as possible, reducing interruptions to the minimum. The welding and wire speed shall be approximately same as that established in the qualified welding procedure specification.

The pipe shall always be adequately supported and must not be bumped or shaken during welding. The clamp shall be removed, as indicated in clause 8.0 above. Before starting the second pass, the first pass shall be cleaned and flattened with rotating grinders.

The interruption between completion of the first pass and starting the second pass shall be as stated in the procedure specification, normally not exceeding four minutes.

For crack prevention a top and bottom reinforcement of at least one electrode shall be applied before lowering the pipe on the skid.

The welding speed selected shall enable production of a bead which is sufficiently thick and which shows no under cutting.

The time lapse between the second and the third pass shall be as stated in the procedure specification, normally not exceeding five minutes. After completion of the third or following passes, welding operations may be suspended, so allowing the joint to cool down, provided that the thickness of the weld metal deposited is equal to at least 50% of the pipe thickness. Upon restarting, depending on the materials, wall thickness and welding process, a preheating of at least 100°C shall be applied. Subsequent passes up to weld completion shall be protected to avoid rapid cooling, if meteorological conditions so dictate. Cleaning between the passes shall be done carefully so as to reduce the possibility of inclusions.

The electrode starting and finishing points shall be staggered from pass to pass. Arc-strikes outside the bevel on the pipe surface are not permitted. Arc-strike or arc-burn on the pipe surface outside the weld, which are caused accidentally by electrical arcs between the electrode, electrode holder, welding cable or welding cable round and the pipe shall be removed by grinding in accordance with a procedure approved by the COMPANY and the repair checked by ultrasonic, radiographic, magnetic particle or dye penetrant tests which the COMPANY feels



necessary. The pipe wall thickness after grinding shall not be less than the minimum thickness limit permitted for the pipe. Repair of arc strikes by welding is prohibited.

The completed weld shall be carefully brushed and cleaned and shall appear free from spatters, scales, etc.

These requirements apply not only to completed welds but also to the bare strip at least so wide as to allow full skid examination at both ends of the pipe to allow a good ultrasonic inspection when it is required.

11.0 HEAT TREATMENT

11.1 Preheating

- a) Preheating requirements for the various materials shall be as per the welding Specification chart attached along with other project data sheets.
- b) Preheating shall be performed using resistance or induction heating methods. Pre-heating for tie-in welds, repair welds or welds at point spreads may be done using a propane gas burner ring with prior approval from owner. The contractor may be asked to demonstrate the effectiveness of the arrangement.
- c) Preheating shall extend uniformly to at least three times the thickness of the joint, but not less than 50 mm, on both sides of the weld.
- d) Preheating temperature shall be maintained over the whole length of the joint during welding. Temperature indicating crayons or other temperature indicating devices shall be provided by the CONTRACTOR to check the temperature.

11.2 Post Weld Heat Treatment

- a) Post weld heat treatment, wherever required for joints between pipes and fittings, pipe body and supports shall be carried out by the CONTRACTOR at his expense as per the relevant specifications, applicable standards and the instructions of the COMPANY.
- b) The heat treatment of welded joints shall be carried out as per the requirements laid down in ANSI B31.8 and other special requirements mentioned in welding Specification chart.
- c) The CONTRACTOR shall submit for the approval of the COMPANY, well before Carrying out actual heat treatments the details of the post weld heat treatment Procedure, as per Exhibit 'B' attached, that he proposes to adopt for each of the Materials/assembly/part involved.
- d) Post weld heat treatment shall be done in a furnace or by using an electric resistance or induction heating equipment, as decided by the COMPANY.



- e) While carrying out local post weld heat treatment, technique of application of heat must ensure uniform temperature attainment at all points of the portion being heat- treated. Care shall be taken to ensure that width of heated band over which specified post weld heat treatment temperature is attained is at least as that specified in the relevant applicable standards/codes.
- f) The width of the heated band centered on the weld shall at least be equal to the width of weld plus 2" (50 mm). The temperature gradient shall be such that the length of the material on each side of the weld, at a temperature exceeding half the heat treatment temperature, is at least $2.5 \cdot r \cdot t$ where r is the bore radius and t is the pipe thickness at the weld.
- g) Throughout the cycle of heat treatment, the portion outside the heat band shall be suitably wrapped under insulation so as to avoid any harmful temperature gradient at the exposed surface of pipe. For this purpose temperature at the exposed surface of the pipe shall not be allowed to exceed 400°C .
- h) The temperature attained by the portion under heat treatment shall be recorded by means of thermocouple pyrometers. Adequate number of thermocouples shall be attached to the pipe directly at equally spaced locations along the periphery of the pipe joint. The minimum number of thermocouples attached per joint shall be 2 up to 10" dia and 3 for 12" dia and above. However, the COMPANY can increase the required minimum number of thermocouples to be attached if found necessary.
- i) Automatic temperature recorders, which have been suitably calibrated, shall be Employed. The calibration chart of each recorder shall be submitted to the COMPANY prior to starting the heat treatment operation and its approval shall be Obtained.
- j) Immediately on completion of the heat treatment, the post weld heat treatment charts/records along with the hardness test results on the weld joints (whenever required as per the welding specification chart) shall be submitted to COMPANY for its approval.
- k) Each joint shall bear an identification number, which shall be maintained in the piping sketch to be prepared by the CONTRACTOR. The joint identification number shall appear on the corresponding post weld heat treatment charts. The same identification numbers shall also be followed for identification of corresponding radiographic films. The chart containing the identification number and the piping sketch shall be submitted to the COMPANY in suitable folders.
- l) Vickers hardness/Brinell hardness of the heat affected zone as well as of the weld metal, after heat treatment shall be measured using a suitable hardness tester and shall not exceed the maximum hardness specified in the welding

specification chart. The weld joint shall be subjected to reheat treatment, when hardness measured exceeds the specified limit, at the CONTRACTOR'S own expense.

- m) The CONTRACTOR shall arrange for the hardness testing and shall maintain the Records of all the joints tested. These records shall be checked by the plant COMPANY'S inspector.

12.0 INSPECTION & TESTING

12.1 General

- a) The COMPANY'S Inspector shall have free access to all the concerned areas, where the actual work is being performed. The CONTRACTOR shall also afford the COMPANY'S inspector all means and facilities necessary to carry out inspection.
- b) The COMPANY is entitled to depute its own inspector to the shop or field where prefabrication and erection of pipelines are being done, with (but not limited to) the following objectives:
- i) To check the conformance to relevant standards and suitability of various Welding equipment and the welding performance.
 - ii) To supervise the welding procedure qualification.
 - iii) To supervise the welders' performance qualification.
 - iv) To check whether shop/field welding being executed is in conformity with the relevant specifications and codes of practice followed in pipe construction.
- c) CONTRACTOR shall intimate sufficiently in advance the commencement of the Qualification tests, welding works and acceptance tests, to enable the COMPANY'S inspector to be present to supervise them.

12.2 Welding Procedure Qualification

- a) Welding procedure qualification shall be carried out in accordance with the relevant requirements of API 1104 latest edition or other applicable codes and other job requirements by the CONTRACTOR at his expense. The CONTRACTOR shall submit the welding procedure specifications in format as per Exhibit-C (attached) immediately after the receipt of the order.
- b) COMPANY'S inspector will review, check and approve the welding procedure submitted and shall release the procedure for procedure qualification tests. The Procedure qualification test shall be carried out by the CONTRACTOR under field conditions at his own expense. A complete set of the test results in format as per Exhibit-C (attached) shall be submitted to the COMPANY'S Inspector for approval immediately after completing the procedure qualification test and at least 2 weeks before the commencement of actual work. Standard tests as

specified in the code shall be carried out in all cases. In addition to these tests, other tests like radiography, macro/micro examination, hardness tests, dye penetrant examination, charpy v-notch etc. shall be carried out on the specimens. It shall be the responsibility of the CONTRACTOR to carry out all the tests required to the satisfaction of the COMPANY'S Inspector. The destructive testing of welded joints shall be as per Annexure - 1.

12.3 Welder's Qualification

- a) Welders shall be qualified in accordance with the API 1104 and other applicable specifications by the CONTRACTOR at his expense. The butt weld test pieces of the qualification test shall meet the radiographic test requirements specified in Clause 12.5 and Annexure-3 of this specification. The COMPANY'S inspector shall witness the test and certify the qualification of each welder separately. Only those welders who have been approved by the COMPANY'S inspector shall be employed for welding. CONTRACTOR shall submit the welder qualification test reports in the standard format as shown in Exhibit - D and obtain express approval, before commencement of the work. It shall be the responsibility of CONTRACTOR to carry out qualification tests of welders.
- b) The welders shall always have in their possession the identification card as shown in Exhibit-E and shall produce it on demand by the COMPANY'S Inspector. It shall be the responsibility of the CONTRACTOR to issue the identity cards after the COMPANY has duly certified it.
- c) No welder shall be permitted to work without the possession of identity card.
- d) If a welder is found to perform a type of welding or in a position for which he is not qualified, he shall be debarred from doing any further work. All welds performed by an unqualified welder shall be cut and redone by a qualified welder at the expense of the CONTRACTOR.

12.4 Visual Inspection

COMP ANY shall carry out inspection of all welds as per the latest editions of the applicable codes and specifications. All finished welds shall be visually inspected for parallel and axial alignment of the work, excessive reinforcement, concavity, shrinkage, cracks, under-cuts, dimensions, surface porosity and other surface defects. Undercutting adjacent to the completed weld shall not exceed the limits specified in the applicable standard I code.

12.5 Non Destructive Examination

The non-destructive examination shall mainly consist of examination using x-ray radiography as detailed in Annexure 3.

Radiographic examination of one hundred percent (100%) girth welds will be required by the COMPANY. Welds shall meet the standards of acceptability as set forth in API 1104 and as well as the requirements laid in subsequent paragraphs.



The CONTRACTOR shall make all the arrangements for the radiographic examination of work covered by the specification at his expense.

The COMPANY will review all the radiographs of welds and inform the CONTRACTOR regarding unacceptable welds. The decision of the COMPANY shall be final and binding in this regard.

All the requirements mentioned in the specification shall be arranged and executed by the CONTRACTOR through his own resources. In addition, ultrasonic inspection is required in the following cases as per Annexure - 2 of this Specification.

- a) On the first 100 welded joints corresponding to each automatic (GTAW/GMAW) welding procedure used.
- b) When 20 mm or more are cut from the pipe end as supplied, the ends shall be ultrasonically inspected for an additional length of 20 mm to assure no laminations exist.
- c) When welds are repaired.
- d) When in the opinion of COMPANY, ultrasonic inspection is required to confirm or clarify defects indicated by radiography.
- e) When automatic procedure is used at least 10 em on each weld shall be ultrasonically inspected at COMPANY's discretion.
- f) Welding of transition piece of pipe.

In addition, ultrasonic inspection may be required for certain critical welds of the pipeline (i.e. tie-ins, welding of valves, flanges) randomly selected at COMPANY's discretion. All fillet and groove welds other than those radiographed shall be subjected to dye penetrant! MP inspection. The non- destructive test system used for inspecting welds must by approved by the COMPANY.

12.5.1 Acceptance Criteria

Weld quality as judged on the basis of the acceptability criteria mentioned below:

- i) Any weld, which as a result of radiographic and/or ultrasonic examination in the opinion of COMPANY exhibits imperfections greater than the limits, stated in API 1104 latest edition or as superseded in this article shall be considered defective and shall so be marked with an identification point marker.
- ii) In addition to the API 1104 requirements, the welds containing cracks including crater cracks regardless of size or location are unacceptable.

Lack of fusion and lack of root penetration may be permitted only up to a maximum individual length of t , where t is nominal pipe wall thickness. Cumulative length of the defect shall not exceed 25 mm in any 300 mm length of weld. For welds less than 300 mm length, the aggregate length shall not exceed 8 percent of the weld length. Defects situated in line and separated by less than the length of the shortest defect shall be considered as one defect. However, no Lack of fusion or lack of root penetration is permitted at any intersections of welds.

Suitable records shall be maintained by the CONTRACTOR as desired by the COMPANY on the day to day work done on welding radiography, ultrasonic testing. The CONTRACTOR shall present the records to the COMPANY on day-to-day basis and whenever demanded, for approval.

12.6 Destructive Testing

The COMPANY has the authority to order the cutting of up to 0.1 % of the total number of welds completed for subjecting to destructive tests at no extra cost to COMPANY. The destructive testing of weld joints shall be made as per Annexure - 1.

In addition, welds already cut out for defects for any reason may also be subjected to destructive testing. The sampling and the re-execution of welds shall be carried out by the CONTRACTOR at his own expense. If the results are unsatisfactory, welding operations shall be suspended and may not be restarted until the causes have been identified and the CONTRACTOR has adopted measures, which guarantee acceptable results. If it is necessary in the COMPANY's opinion the procedure shall be requalified. The weld joint represented by unsatisfactory welds shall stand rejected unless investigation proves otherwise.

13.0 REPAIRS OF WELDS

- 13.1 With the prior permission of COMPANY welds, which do not comply with the standards of acceptability, shall be repaired or the joint cut out and re-welded. A separate welding procedure specification sheet shall be formulated and qualified by CONTRACTOR for repair welds simulating the proposed repair to be carried out. Separate procedures are required to be qualified for (a) through thickness repair (b) external repair and (c) internal repair. Welders shall be qualified in advance for repairs. The root pass, for repairs opening the root, shall be replaced by the vertical uphill technique. The procedure shall be proven by satisfactory procedure test to API-1104 including the special requirements of the specification, and shall also be subjected to metallographic examination, hardness surveys and Charpy tests to determine the effects of repair welding on the associated structure.

Root sealing or single pass repair deposit shall not be allowed. Internal root defects shall be ground thoroughly and welded with a minimum of two passes. However, while grinding for repairs, care shall be taken to ensure that no grinding marks are made on the pipe surface anywhere.

The repair shall be subjected, as a minimum requirement to the same testing and inspection requirements as the original weld. After the repair of the circumferential weld, re-radiography of the full joint shall be carried out. A 100% ultrasonic test shall be done at the repaired area externally. Any repaired area that is wide, irregular or rough shall be rejected and a full cut out shall be done.

Repairs are limited to a maximum of 30% of the weld length. Not more than two repairs are permitted on the same location. All repairs shall be carried out the day after initial radiography or earlier. A full report of all repairs made shall be submitted every day to the COMPANY.



13.2 Weld Rejected by Accumulation of Defects

Where a weld is rejected by the accumulation of defect clause, as defined by API-1104 and this specification, repairs within these limitations are permitted. Defects in the filling and capping passes shall be repaired preferentially.

ANNEXURE-I

1.0 DESTRUCTIVE TESTING OF WELDED JOINT - BUTT WELDS

1.1 Preparation

Having passed the visual and the non-destructive inspection, the test weld shall be subjected to mechanical test.

After satisfactory completion of all visual and non-destructive testing the procedure test weld shall be set-aside for a period not less than 24 hours. No further work on the test weld and no cutting of test specimens from the weld shall be performed until a period of at least 24 hours has expired.

Weld specimens shall be taken from the positions indicated in fig.1 & IA of this specification from areas as free from defects as possible; for this reason it is necessary to take the previous non-destructive tests into account. The minimum number of tests to be carried out is given in Table - 1 of this specification.

The test shall be carried out at laboratories approved by the COMPANY. The specimens shall be prepared in accordance with the figures given in the paragraphs that refer to the individual test.

1.2 Tensile Strength

Specimens shall be taken from the position indicated in fig.1 & IA of this specification. Two ISO type specimens and two API-type specimens shall be taken.

The ISO test specimens are shown in fig.2 of this specification.

1.2.1 Method

The test shall be carried out in accordance with ISO 375

TABLE 1

PIPE SIZE OUT SIZE DIAMETER	NUMBER OF SPECIMENS									
	TENSILE API	TENSILE ISO	NICK BREAK	ROOT BEND	FACE BEND	SIDE BEND	MACRO	HARDNESS	IMPACT	TOTAL
	WALL THICKNESS Y> INCH (12.7 mm) AND UNDER									
UNDER 2	0	0	2	2	0	0	0	0	0	4
2 TO 41/2 INCLUDING	0	0	2	2	0	0	0	0	0	4
OVER 41/2 LESS THAN 123/4	2	0	2	2	2	0	2	2	12	24
123/4 AND OVER	2	2	4	4	4	0	2	2	24	44
	WALL THICKNESS OVER Y> INCH (12.7 mm)									
41/2 AND SMALLER	0	2	0	0	0	2	0	0	0	4
OVER 41/2 LESS THAN 123/4	2	0	2	2	2	0	2	2	12	24
123/4 AND OVER	2	2	4	0	0	8	2	2	24	44

1.3 Nick-Break Test

1.3.1 Preparation

Specification for nick-break test with notches thus worked can break in the base metal, instead of in the fusion zone; therefore an alternative test piece may be used after authorization by the COMPANY with a notch cut in the reinforcement of outside weld bead to a maximum depth of 1.5mm, measured from the surface of the weld bead.

1.4 Macroscopic Inspection

104.1 Preparation

Specimens shall be taken from the positions indicated in Fig. I of this specification and shall be prepared in accordance with ASTM E2 and E3. The width of the macro section has to be at least three times the width of the weld.

The section is to be prepared by grinding and polishing and etched to clearly reveal the weld metal and heat affected zone.

104.2 Method

Specimens shall be carefully examined under the microscope, with a magnification of at least 25 times (25:1). The COMPANY may ask for a macrograph with 5 times (5:1) magnification, for DOCUMENTATION purposes.

104.3 Requirements

Under macroscopic examination, the welded joints shall show good penetration and fusion, without any defect exceeding the limits stated in the evaluation criteria of the nick bream test

1.5 Hardness Test

1.5.1 Preparation

The prepared macro section is to be used for hardness testing using the vickers method with 10 kg load indentations are to be made along traverses each approximately 1 mm below the surface at both side of the weld.

In the weld metal a minimum of 6 indentations equally spaced along the traverses are to be made. The HAZ indentations are to be made along the traverses for approximately 0.5 mm each into unaffected material, and starting as close to the fusion line as possible.

One indentation at each side of the weld along each traverse has to be made on parent metal. Reference is made to Fig. 3 of this specification. The indentations are to be made in the adjacent region as well as on the opposite side of the macro section along the specified traverses.

1.5.2 Method

The test shall be carried out in accordance with recommendation ISO R81, Vickers hardness, using a laboratory type machine controlled as pre-recommendation ISO R 146 and using a diamond pyramid penetrator set at 2.37 rad (136") with a load of 10 kg.

1.5.3 Requirements

Hardness value shall not exceed the limit specified in welding specification chart. In case of a single reading strictly (+ IOHV) higher than the specified limit, further indentations shall be made to check if the high value was an isolated case.

All the hardness values contained from the heat-affected zone shall not exceed 100 HV with respect to the average hardness of the values

obtained for the base metal. If these additional tests give hardness within the specification limit the slightly higher value may be accepted.

1.6 Charpy V-Notch Impact Test

1.6.1 Specimens shall be taken from the position indicated in Fig. 1 of this specification. The test specimens will be prepared in accordance with ISO R 148. Charpy V-Notch specimens shall have dimensions as given in Fig. 4 of the specification. Three test specimens shall be taken from each sample and they shall be cut and worked so that their length is transversal and perpendicular to the weld bead with the notch position as shown in Fig. 4 of this specification. The notch shall be perpendicular to the roller surface. The test specimen width shall depend upon the pipe wall nominal thickness as per the following table:

Nominal wall thickness (mm)	Test specimen width (mm)
Over 12	10
Over 9.5 and up to 12	7.5
From 7 up to 9.5	5
Less than 7	2.5

1.6.2 Test Method

The test shall be carried out as indicated in ISO R 148 "Beam Impact Test V-Notch".

Test pieces shall be immersed in a thermostatic bath and maintained at the test temperature for at least 15 minutes. They shall then be placed in the testing machine and broken within 5 seconds of their removal from the bath. The test temperature shall be as mentioned in welding specification chart.

1.6.3 Requirements (Note 1)

The impact energy shall be:

Test specimen in (mm)	Average of three specimen (Note 2) joule (Min.)	Minimum single value (Note 1)
10.0	27.0	22.0
7.5	21.5	17.5
5.0	18.5	15.0
2.5	10.0	8.0

**Note:**

- (1) These values are specified for resistance to brittle fracture only. Where additional requirements are specified in project data sheet (Ex. pipeline materials with arrest properties i.e. a higher upper shelf charpy V energy for resistance against propagating ductile fractures) the same shall be followed.
- (2) Only one value is permitted to be lower than average value up to the value specified.

1.7 Bend Test Requirements

The Bend test Specimens shall be made and tested as per the requirements of API 1104 Nineteenth Edition, September 1999. However, the dimensions of the Jig for guided bend test in Fig. 9 shall be modified as specified below:

Radius of the Plunger 'A' = $2t$

Radius of the die. 'B' = $3t + 1.6 \text{ mm}$

Width of the die. 'C' = 50.8

The acceptance criteria shall however be as per para 5.6.4.3 and 5.6.5.3 of API 1104 Nineteenth edition, September 1999.

Note: t = thickness of specimen

ANNEXURE-2

1.0 ULTRASONIC INSPECTION

In addition the radiographic inspection, ultrasonic inspection is required as per conditions listed in paragraph 12.5 of this specification. This section concerns manual ultrasonic inspection. However ultrasonic inspection by automatic equipment may be used if approved by the COMPANY.

1.1 General:

The CONTRACTOR who carries out the ultrasonic inspections shall have sufficient no. of qualified personnel, equipment and instruments at his disposal to be able to effect the tests without hindering or delaying the pipeline assembly operations. The CONTRACTOR appointed to carry out ultrasonic inspections shall supply all the instruments necessary for their execution on site.

1.2 Specification for Ultrasonic Testing Procedure Qualification

Before work begins, the CONTRACTOR shall present a specification describing the proposed U.T. procedure qualification. This specification shall state, all the parameters described in API 1104 and the following information:

- a) Type of U.T. Equipment used;
- b) Type and dimensions of transducers
- c) Frequency range
- d) Details for calibration
- e) Coupling medium
- f) Inspection technique
- g) Record details
- h) Reference to the welding procedure where it is intended to adopt the specification
- I) Temperature range of the joints to be inspected.

1.3 Qualification of Ultrasonic Inspection Procedure

The ultrasonic inspection procedure shall be approved by the COMPANY. Before inspection begins, the COMPANY may require the qualification test of the ultrasonic inspection procedure. This specification test consists in testing (under normal operating conditions) some CONTRACTOR welds made according to the same production procedure, where there are typical defects the test intends to detect.

This test shall be conducted in the presence of the COMPANY.

1.4 Test Procedure

Circumferential welds shall be inspected from both sides using angle probes. The surface with which the probe comes into contact shall be free of metal spatter, dirt, iron oxide, and scales of any type; therefore it shall be necessary to clean a strip at least 50 mm wide on both sides of the weld with steel-wire brushes and anyhow the cleaned strip must be at least wide enough to allow one and a half skip examination.

If, during the test, echoes of doubtful origin appear, it shall be necessary to inspect a convenient area on the pipe surface, close to the weld, with a straight beam transducer in order to check whether any manufacturing defects are present which could have interfered with the ultrasonic beam.

By way of an example, the equipment shall include but not be limited to the following:

- a) Ultrasonic equipment and coupling medium
- b) Sample sections for calibration of instruments
- c) Equipment for cleaning of surface to be examined
- d) Rules calibrated in centimeters for exact location of the position of defects.

The characteristics of the above listed instruments and equipment shall guarantee:

- a) That the required standards of the inspection procedure, as previously established and approved by the COMPANY, are satisfied.
- b) Continuous operation

All the instruments and equipment shall be approved by the COMPANY before being used. The COMPANY has the authority to reject any item that is considered unsuitable. The decision of the COMPANY is final. The CONTRACTOR appointed to carry out ultrasonic inspections shall also ensure the operational efficiency and maintenance of the instruments and equipment, and shall immediately substitute any item rejected by the COMPANY.

All the instruments and equipment necessary for carrying out ultrasonic inspection on site shall satisfy the requirements laid down by the public boards of institutions that regulate 'safety at work'.

1.5 Ultrasonic Instruments

The ultrasonic instrument:

- a) Shall be pulse echo type, able to generate, receive and display, on the screen a Cathode Ray Tube (CRT), pulse at frequencies between 1 and 6 MHz. The useful part of the CRT screen shall be at least 70mm wide and

at least 50mm high shall have variable amplification, with steps of 1 or 2 dB over a range of a least 60 dB.

- b) the regulation control shall be accurate to within ± 1 dB and this accuracy shall be certified by the instrument manufacturer.
- c) may be powered by a battery or an electric generator. In the first case, the autonomy of operation (endurance) of the instrument shall be sufficient to carry on working without frequent interruptions, and the instrument shall be equipped with an automatic switch which switches if off when the battery runs down; in the second case, there must be a voltage stabilising device with a tolerance of ± 2 Volts.

1.6 Probes

The probes used shall have dimensions, frequencies, and a refraction angle suited to the type of steel, the diameter, and the thickness of the pipeline and to the joint design.

1.7 Reference Sample Pieces

The efficiency of the equipment used, the effective refraction angle of the probe, and the beam output point, shall be checked using a VI and V2 sample block, IIW type or the calibration block ASTM E-428.

For manual ultrasonic testing and automated ultrasonic testing the reference sample pieces shall be as described in API 1104, Nineteenth Edition, para 11.4.5.

1.8 Calibration

The calibration, qualification of the testing procedure shall be done as provided in API 1104.

1.9 Regulation of Amplification during Production Testing

Scanning sensitivity shall be as provided in API 1104 para 11.4.7.2 & 11.4.7.3. 1.10 Qualification of Ultrasonic Testing Operators Before the inspection begins or during the same inspection, the COMPANY may require a qualification test for the ultrasonic equipment operators.

The operators shall be fully qualified as per a recognized standard (ASME Sec V or equivalent) and they shall have as minimum level II as described in para II.4.3, API 1104, Nineteenth Edition. The operators shall be able to:

- a) calibrate the equipment;
- b) perform an operational test under production conditions;
- c) interpret the screen picture;
- d) evaluate the size and location of reflectors
- e) interpret the type of defects detected



The COMPANY has the option of checking the ability of personnel employed for ultrasonic

Testing by means of qualification tests.

1.11 Evaluation of Indications given by Ultrasonic Tests

Each time that echoes from the weld bead appear during production testing, the instrument amplification shall be altered to coincide with the reference amplifications and the probe shall be moved until maximum response is obtained, paying attention all the time to the probe-tube coupling.

If, under these conditions, the height of the defect echo is equal to or greater than that of the reference echo, the defect shall be evaluated according to clause 12.5 of this specification. If the defect has also been detected by the radiographic and/or visual examination, the dimensions shall be judged according to the type of examination which detects the greater defect. Returns that are less than 50% of the reference echo will not be considered. If returns are above 50% but lower than 100% of the reference echo, and if the operator has good reasons to suspect that the returns are caused by unfavorably oriented cracks, he shall inform the COMPANY. Moreover, when there is a defect to be repaired, such defect shall be removed for a length corresponding to the one where no more return echo is given.

1.12 Other Equipment

The use of rules calibrated in centimeters, attached if possible to the probe, for the precise location of the position of welding defects, is recommended. Defect location is effected by measuring the projection distance between the probe output and the reflecting surface.

The operators carrying out the tests shall have, besides the probing instrument, tools for cleaning the pipe surface (files, brushes, etc.) as well as the coupling liquid or paste appropriate for the temperature of the section to be examined.

ANNEXURE-3

RADIOGRAPHY

1.0 SCOPE

This annexure covers the radiographic inspection of all types of welded joints of the main pipeline.

The welded joints shall include the following:

- i) Full girth welds on the mainline construction including double jointing of pipe, if adopted.
- ii) Welds for installation of block valves, insulating joints and other appurtenances and tie-ins.
- iii) Welds at scraper launching and receiving barrels.
- iv) Terminal Piping

2.0 APPLICABLE STANDARDS

This specification shall apply in conjunction with the following (all latest editions):

- i) API 1104, Standard for welding Pipelines and Related Facilities
- ii) ANSI B 31.8, Code for Gas Transmission and Distribution Piping Systems.
- iii) ANSI B 31.4, Code for Transportation System for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia and Alcohols.
- iv) ASTM E 94, Recommended practice for Radiographic Testing
- v) ASTM E 142, Standard Method for Controlling Quality of Radiographic Testing
- vi) The American Society for Nondestructive Testing. Recommended Practice no. SNT-TC-IA Supplement A.

3.0 PROCEDURE

3.1 The radiographic examination procedure to be adopted shall be submitted by the CONTRACTOR as per EXhibit-F.

3.2 The procedure of radiographic examination shall be qualified to the entire satisfaction of COMP ANY prior to use. It shall include but not be limited to the following requirements:

- i) Lead foil intensifying screens, at the rear of the film shall be used for all exposures.



- ii) Type 2 and 3 films as per ASTM E-94 shall be used.
 - iii) A densitometer shall be used to determine film density. The transmitted film density shall be between 2.0 and 3.5 throughout the weld. The unexposed base density of the film shall not exceed 0.30.
 - iv) Radiographic identification system and documentation for radiographic interpretation reports and their recording system.
- 3.3 The CONTRACTOR shall qualify each procedure in the presence of the COMPANY prior to use.
- 3.4 The procedure of radiographic examination shall produce radiographs of sufficient density, clarity and contrast so that defects in the weld or in the pipe adjacent to the weld are clearly discernible.
- 3.5 One Check shot of the full joint on main line welds shall be taken per 100 circumferential welds or one per day of the production whichever is more for cross checking the correctness of the radiographs of weld joints executed by the contractors. For taking check shots on completed/accepted sections, contractor has to separately mobilize either internal crawler/external X-ray unit, as appropriate.
- 3.6 All the girth welds of mainline shall be subjected to 100% radiographic examination. The CONTRACTOR shall furnish all the radiographs to the COMPANY, immediately after processing them, together with the corresponding interpretation reports on approved format. The details of the radiographs along with the joint identification number shall be duly entered in a register and signed by the CONTRACTOR and submitted to the COMPANY for approval.
- 3.7 When the radiation source and the film are both on the outside of the weld and located diametrically opposite each other, the maximum acceptable length of film for each exposure shall not exceed the values given. The minimum film overlap, in such cases, shall be 40mm. The ellipse exposure technique may be used on nominal pipe sizes of 2 inch and smaller provided that the source of film distance used is a minimum of 12 inch.
- 3.8 Three copies of each acceptable radiographic procedure (as per Exhibit-F) and three copies of radiographic qualification records shall be supplied to COMPANY. One set of the qualifying radiographs on the job shall be kept by the CONTRACTOR's authorized representative to be used as a standard for the quality of production radiographic during the job. The other two sets shall be retained by COMPANY for its permanent record.
- 3.9 Three copies of the exposure charts relating to material thickness, kilo voltage, source of film distance and exposure time shall also be made available to COMPANY by the CONTRACTOR.
- 3.10 The CONTRACTOR shall, on a daily basis, record for each radiograph (1) radiograph's number, (2) approximate chainage of weld location, (3) whether or not the welds meet the specified acceptance standards and (4) the nature and approximate location of unacceptable defects observed. It must be possible to

relate back to a particular butt weld and welder on piping drawing and pipeline alignment drawing.

- 3.11 Each day's production of processed radiographs shall be properly packaged separately, identified by at least the (1) date, (2) radiographic unit, (3) job locations, (4) starting and ending progress survey stations and (5) shall include original and three copies of the daily radiographic record. The package shall be submitted to the COMPANY daily when possible, but in no event later than noon of the following day.
- 3.12 The CONTRACTOR shall provide all the necessary facilities at site, such as a dark room with controlled temperature, film viewer etc. to enable the COMPANY to examine the radiographs.
- 3.13 The CONTRACTOR, if found necessary, may modify the procedure of radiographic examination suiting to the local conditions prevailing. This shall, however, be subject to the approval of the Company.
- 3.14 COMPANY shall have free access to all the CONTRACTOR's work facilities in the field.
- 3.15 Any approval granted by the COMPANY shall not relieve the CONTRACTOR of his responsibilities and guarantees.

4.0 RADIATION SOURCE

- 4.1 Radiographic examination shall be carried out using X-radiations; radiographic examination by Gamma rays using slow speed films may be allowed, at the discretion of the COMPANY, in case of inaccessible joints. Radiography by Gamma ray for tie-in-joints shall be acceptable provided D4 AGF A film or equivalent is used and the required sensitivity obtained.
- 4.2 Whenever possible, pipeline welds will be inspected by placing the radiation source inside the pipe. on the pipeline axis. with a radiation of 6.28 red. (360).

5.0 LEVEL OF QUALITY

The quality level of Radiographic sensitivity required for radiographic inspection shall be at least equivalent to the values in Figure-5.

6.0 PENETRAMETERS

The Image Quality Indicator (abbreviation:IQI) shall be used for the qualification of the welding procedure and during normal line production. Radiographic sensitivity shall be measured with the wire image quality indicator (Penetrameter). The Penetrameter shall be selected according to DIN-54109 or ISO-I 027. For radiographs made with the source on the outside, a Penetrameter shall be placed on each side of the film with the smaller wire of the Penetrameter turned towards the end of the film itself. When a complete weld is radiographed in a single exposure using a source inside the piping, four penetrameters approximately equally spaced around the circumference shall be used. During the procedure qualification, IQI shall be placed both on the source side and on the film side.



The sensitivity obtained with IQI on the source side shall not be less than the values shown in Fig. 5 of this specification. The sensitivity limit may be considered to have been reached when the outline of the IQI, its identification number and the wire of the required diameter show up clearly on the radiograph.

The COMPANY may authorize use of types of IQI other than those planned, provided that they conform with recognized standards and only if the CONTRACTOR is able to demonstrate that the minimum sensitivity level required is obtained. For this demonstration, a test shall be carried out comparing the IQI specified and the CONTRACTOR's to show up the identification number and other details of the proposed IQI, which must be visible in the test radiograph.

7.0 FILM IDENTIFICATION MARKERS

All films shall be clearly identified by lead numbers, letters, and/or markers. The image of the markers shall appear on the films, without interfering with the interpretation. These markers positions shall also be marked on the part to be radiographed and shall be maintained during radiography.

8.0 PROTECTION AND CARE OF FILM

- 8.1 All unexposed films shall be protected and stored properly as per the requirements of API1104 standard and ASTM E.94.
- 8.2 The exposed and unexposed film shall be protected from heat, light, dust and moisture. Sufficient shielding shall be supplied to prevent exposure of film to damaging radiation prior to and following the use of the film for radiographic exposure.

9.0 RE-RADIOGRAPHY

- 9.1 The weld joints shall be re-radiographed in case of unsatisfactory quality of the radiographs, at the expense of the CONTRACTOR.
- 9.2 All the repaired weld joints shall be re-radiographed at no extra cost to the COMPANY in the same manner as that followed for the original welds. In addition, the repaired weld areas shall be identified with the original identification number plus the letter R to indicate the repair.
- 9.3 When evaluating repair film, radiographers shall compare each section (exposure) of the weld with the original film to assure repair was correctly marked and original defect removed.
- 9.4 The COMPANY will review prior to any repair of welds, all the radiographs of welds that contain, according to the CONTRACTOR's interpretation, unacceptable defects. The final disposition of all unacceptable welds shall be decided by the COMPANY.

10.0 QUALIFICATION OF RADIOGRAPHERS

- 10.1 Pipeline radiographers shall be qualified in accordance with the requirement of API 1104 and to the full satisfaction of COMPANY.



- 10.2 Certification of all the radiographers, qualified as per 10.1 above, shall be furnished by the CONTRACTOR to the COMPANY before a radiographer will be permitted to perform production radiography. The certificate record shall include:
- i) Background and Experience Record
 - ii) Training Course Record
 - iii) Technical Examination Record
 - iv) Doctor's report on radiographer's Jacque 0-1 acuity eye test
 - v) Date of qualification
- 10.3 The radiographers shall be required to qualify with each radiographic procedure they use, prior to performing the work assigned to him in accordance with the specification.

11.0 PRESERVATION OF RADIOGRAPHS

- 11.1 The radiographs shall be processed to allow storage of films without any discoloration for at least three years. All the radiographs shall be presented in suitable folders for preservation along with necessary documentation.
- 11.2 All radiographs shall become property of the COMPANY.

12.0 EQUIPMENT AND ACCESSORIES

- 12.1 CONTRACTOR shall make necessary arrangements at his own expense, for providing the radiographic equipment, radiographic films and all the accessories for carrying out the radiographic examination for satisfactory and timely completion of the job.
- 12.2 For carrying out the mainline radiographic examination the CONTRACTOR shall be equipped with suitable mobile/stationary type dark rooms. These shall have all the required facilities for film processing. Film viewer used shall be equipped with the film illuminator that has a light source of sufficient intensity and suitably controlled to allow viewing film densities up to 4.0 without damaging the film.

13.0 RADIATION PROTECTION

- 13.1 CONTRACTOR shall be responsible for the protection and personnel monitoring of every man with or near radiation sources.
- 13.2 The protection and monitoring shall comply with local regulations.
- 13.3 In view of visual hazards in the handling of Radioactive source of material, CONTRACTOR shall be solely responsible for complying with all rules and regulations set forth by Atomic Energy Commission or any other Government agencies of India in this regard and COMPANY shall not be responsible and shall

be kept indemnified by the CONTRACTOR for default (s) of whatever nature by the CONTRACTOR. Safety equipment as considered adequate by the COMPANY for all necessary personnel shall be made available for use and maintained for immediate and proper use by the CONTRACTOR.

14.0 DISPLAY OF SAFETY INSTRUCTIONS

The safety provisions shall be brought to the notice of all concerned by display on a notice board at prominent place at the work spot. The person responsible for the "Safety" shall be named by the CONTRACTOR.

15.0 ENFORCEMENT OF SAFETY REGULATIONS

To ensure effective enforcement of the rules and regulations relating to safety precautions, the arrangement made by the CONTRACTOR shall be open to inspection by COMPANY or its representatives.

16.0 FIRST AID AND INDUSTRIAL INJURIES

- 16.1 CONTRACTOR shall maintain first aid facilities for its employees and those of sub-Contractors.
- 16.2 CONTRACTOR shall make outside arrangements for ambulance service and for treatment of industrial injuries. Names of those providing these services shall be furnished to COMPANY prior to start of work and their telephone no. Shall be posted prominently in CONTRACTOR'S field office.
- 16.3 All critical industrial injuries shall be reported promptly to the COMPANY and a copy of CONTRACTOR's report covering each personal injury requiring the attention of physician shall be furnished to the COMPANY.

17.0 NO EXEMPTION

Notwithstanding the above there is nothing in these to exempt the CONTRACTOR from the operation of any other act or rules in force.

**EXHIBIT- A****ELECTRODE QUALIFICATION TEST RECORD**

- A.** Tested at (Site name) : Date:
- Manufacturer's Name
- Brand Name: :
- Batch Number & Size tested :
- Classification & Code :
- Intended for welding in position: :
- In combination with (if any) :
- Code of Reference (used for testing) :
- Special Requirements (if any) :
- B.** All-weld Tensile Test :
- Base Material used :
- Pre-heat temperature :
- Post weld heat treatment details: :
- Visual examination :
- Radiographic examination results :
- Tensile test results :

Identification No.	U.T.S.	Yield Point	Elongation	Remarks
1.				
2.				

C. Impact Test Results

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



Specimen No.	Impact Value	Average
1		
2		
3		
4		
5		

D. Chemical Analysis Results

Electrode Size Result :

Batch No. :

%C	%S	%P	%Si	%Mn	%Cr	%Ni	%Mo	Other

E. Fillet Weld Test Results :

Welding Positions :

Base Materials :

Size of electrode used :

Visual Inspection Results :

1)

2)

3)

Macro Test Results :

Fracture Test Results :

Remarks :

F. Other Test Results

1. Transverse tensile test :

In combination with :

Base material used :

Position of welding :



ENERGISING QUALITY

**WELDING SPECIFICATION FOR
ONSHORE PIPELINE FOR
TRANSPORTATION OF GAS**

**DOCNO: VPC-SS-PL-0037
Rev No : 00**

Preheat temperature :

Post weld heat treatment :

Radiography :

Identification No. U.T.S. Fracture in Remarks

2. Guided Bend Test :

Position	Identification No.	Root, Face or Side Bend	Remark
	1		
	2		
	3		
	4		
	5		

G. Any other tests :

H. Conclusions

.....
**PREPARED BY
(CONTRACTOR)**

.....
**REVIEWED BY
(CONTRACTOR)**

.....
**APPROVED
(OWNER)**

**EXHIBIT- B****STRESS RELIEF HEAT TREATMENT PROCEDURE SPECIFICATION**

Name of the Heat-treater :
Name of the Project : Specification Reference No.

1. General Detail:
Name of the Equipment:
Name of the Assembly/Part:
Drawing No:
Material:
2. Furnace Details
Type of Heating : Gas/Oil/Elect.
Res/ induction Type of Heating
Capacity (Size)
Maximum Temp. (C) :
Method of temp. Measurement
Atmosphere Control :
3. Heat Treatment Cycle Details
Charging Temp. C
Rate of heating, C/Hr.
Soaking Temp. C
Soaking Time, hrs.
Rate of Cooling, C/Hr.
Mode of Cooling
4. Other Details, if any :
Notes:

The following documents shall be furnished along with the specifications:

- i) Material test certificates
- ii) Assembly/Part Drawing.

.....
PREPARED BY
CONTRACTOR)

.....
REVIEWED BY
(CONTRACTOR)

.....
APPROVED BY
(EIL/OWNER)

EXHIBIT- C

Example of record form for welding procedure qualification test

Project! Contractor
Contract
Pipe and fitting material!
Process
Outside
Diameter
Pipe
Thickness
Joint design (Sketch attached)

	Make and type of Filler metal	Diameter	Current Voltage

Root			
Second run			
Other runs			
Other	electrical	a.c/d.c	Electrode negative/ Positive
Characteristics			

Shielding gas
Type of mixture
Flow
Shielding flux
Position

Direction of welding	
Root	Vertical up*/ Vertical down
Secon	Vertical up*/ Vertical down
Other runs	Vertical up*/ Vertical down

Number of welders
Root
Second run
Other runs



Time lapse between commencements of second
Run and commencement of other runs

Minimum number of runs before joint allowed
to cool

Maximum time between commencement and
Completion of weld

Type of line-up clamp

Removal of clamp after run

Lowering off after run

Cleaning

Preheating

Minimum temperature C

Ambient

Temperature C

Type of heater to be used

Interposes temperature

Minimum C

Maximum C

Maximum C

Post weld heat treatment

Speed of travel

Test Results

State acceptable 'non-acceptable (with
Reasons) or give numerical results

Non-destructive tests

Visual

Radiograph



Destructive tests	1	2	3	4
Transverse tensile				
Tensile strength (with units)				
Fracture location				
Test temperature				
Macro-examination				
fillet weld fracture				
Hardness survey				
Type				
Hardness range :				
Parent metal				
Heat affected zone				
weld				
Charpy V-notch impact tests				
Specimen location and size				
Notch location				
Test temperature				
Results (with units)				

Additional test (s) and results. e.g. chemical analysis, micro-examination, CTOD tests, Bend Tests, Nick Break test.

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

Contractor

Position

Date

Inspector

Witnessed by

Date

**EXHIBIT- D****Example of record form for welder qualification test**

Welder test certificate	Test no
Project/Contract	Date
Contractor	Inspector
Welder's name	
Address	
Pipe material	
Pipe thickness	
Pipe outside diameter	
Welding process	Root
	Fill and Cap
Reason for failure	
Visual	
Non-destructive testing	
Butt joint	
Fillet weld	
'Number of attempts	
Comments	
Accepted date/Time	

Signed by Contractor

Signed by Inspector

*Delete as necessary

**EXHIBIT- E****Welder's Identification Card**

Name	:	
Identification	:	Photograph
Date of Testing	:	
Valid till	:	
Approval of Welding	:	
Welding Position	:	
Material	:	
Diameter	:	
Diameter range approved	:	
Wall thickness	:	
Thickness range approved	:	
Type of welding consumables	:	

Approved by:

Employers' Signature with seal

**EXHIBIT- F****Radiographic Procedure for Pipe Welding**

1. Location
2. Date of Testing
3. Name of Supervised Contractor
4. Material
5. Dia & Thickness
6. Type of weld joint
7. Radiation Source (X-ray, iridium)
8. Type of equipment (External/Internal)
9. Intensifying screens and material
10. Filter type and placement mask, Diaphragm Lead screen etc. adjacent to radiation source or specimen,
11. Exposure Geometry (Source focal spot size, object to film distance, radiation angle with respect to weld and film).
12. Limit of film coverage
13. Film type and make
14. Exposure Conditions (rna, KV, time)
15. Processing (time temperature for development stop bath or rinse, fixation, washing, drying etc.)
16. Density
17. Sensitivity
18. Type of penetrameter
19. Essential wire to be seen on source side:
20. Essential wire accepted for film side viewing:

Approval of the COMPANY

Signature of CONTRACTOR with seal

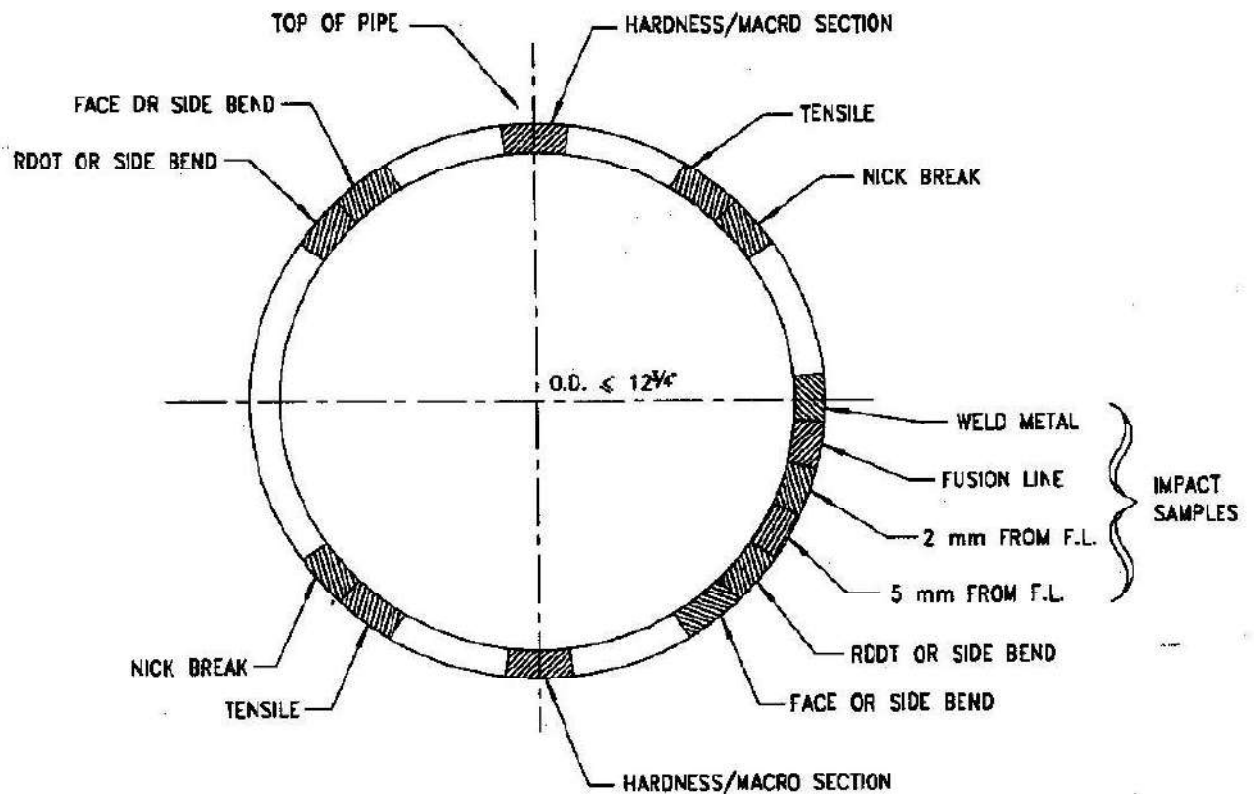


FIGURE 1.
LOCATION OF SPECIMENS FOR WELD PROCEDURE
QUALIFICATION FOR PIPE DIA. < 12 3/4"

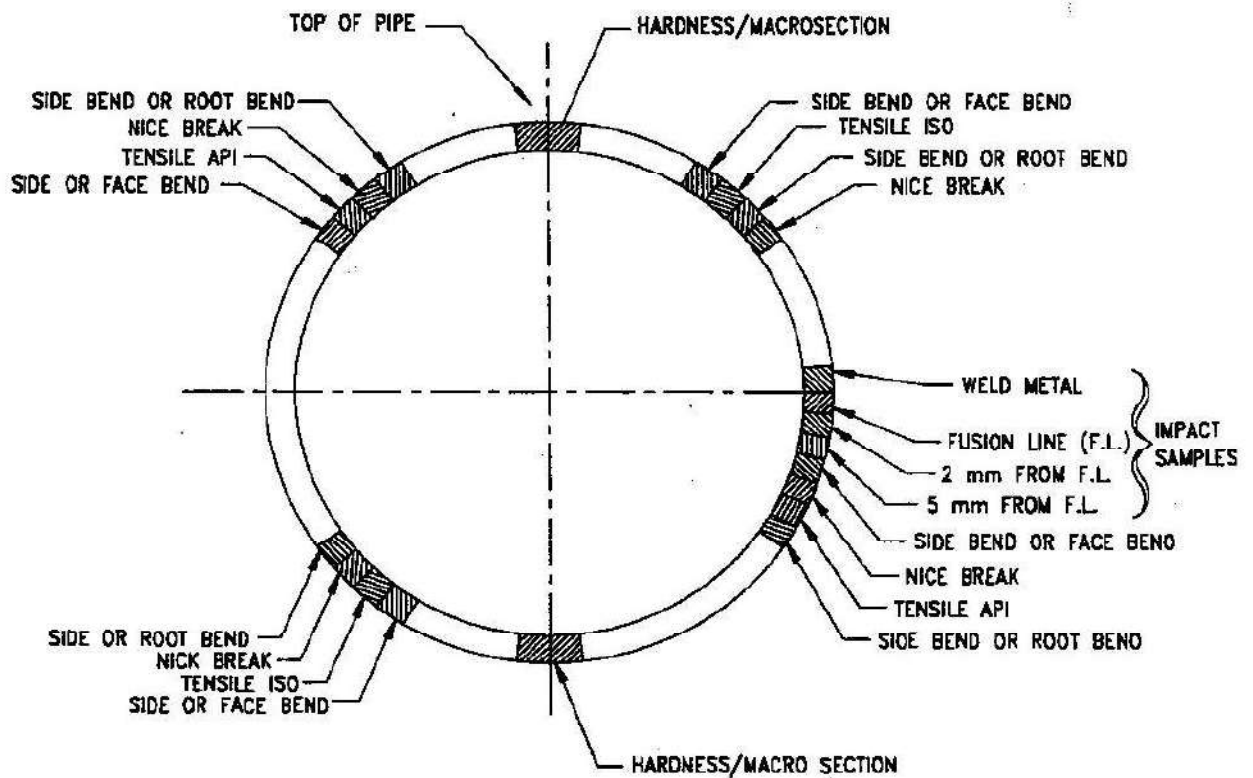


FIGURE 1A.
LOCATION OF SPECIMENS FOR WELD PROCEDURE
QUALIFICATION FOR PIPE DIA. > 123/4

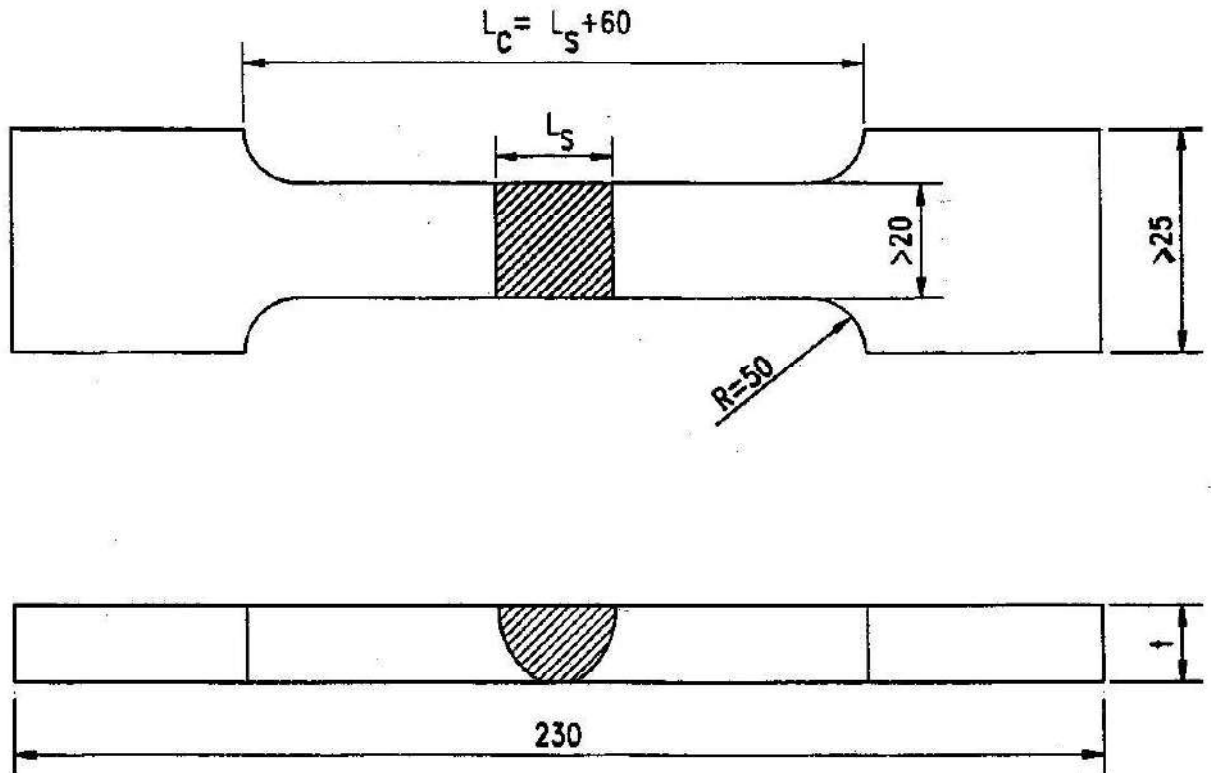


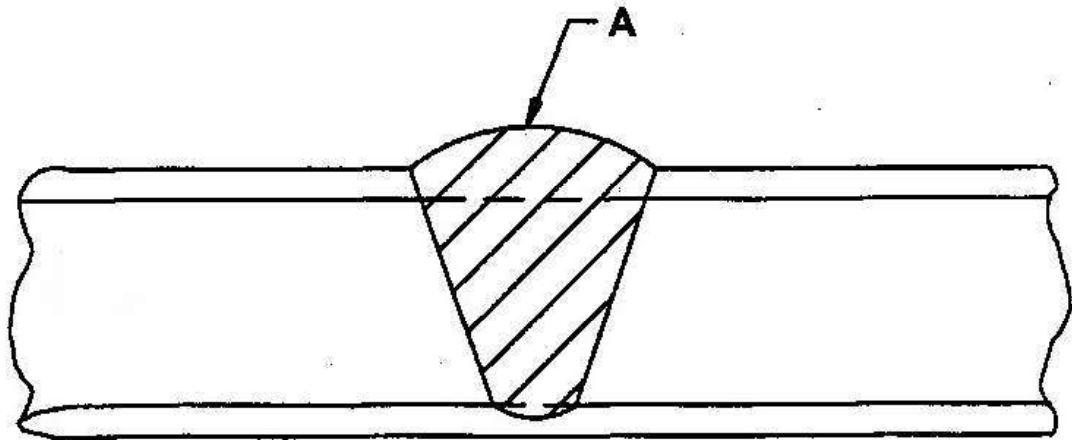
FIGURE 2.
ISO TENSILE TEST SPECIMEN

LEGEND

t = PIPE WALL THICKNESS

L_S = WELD WIDTH AFTER LEVELLING

L_C = LENGTH OF PARALLEL EDGES



HARDNESS TESTING – BUTT WELDS

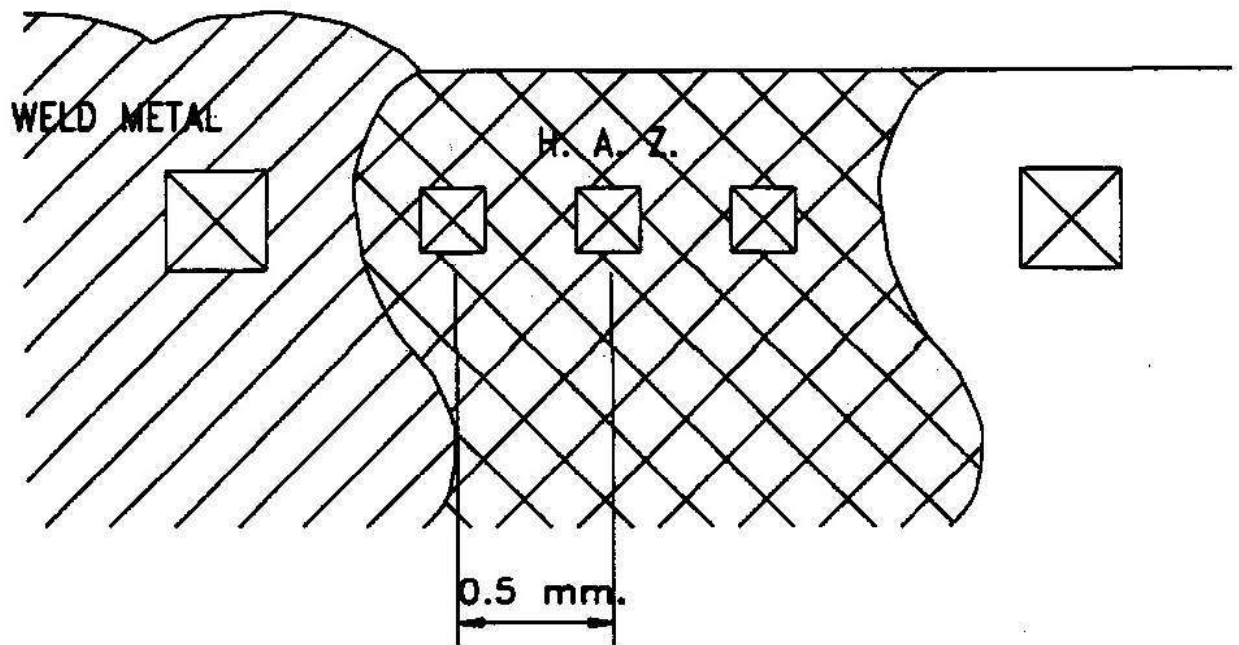


FIGURE 3.
HARDNESS TESTING OF WELD JOINTS – SCHEMATIC

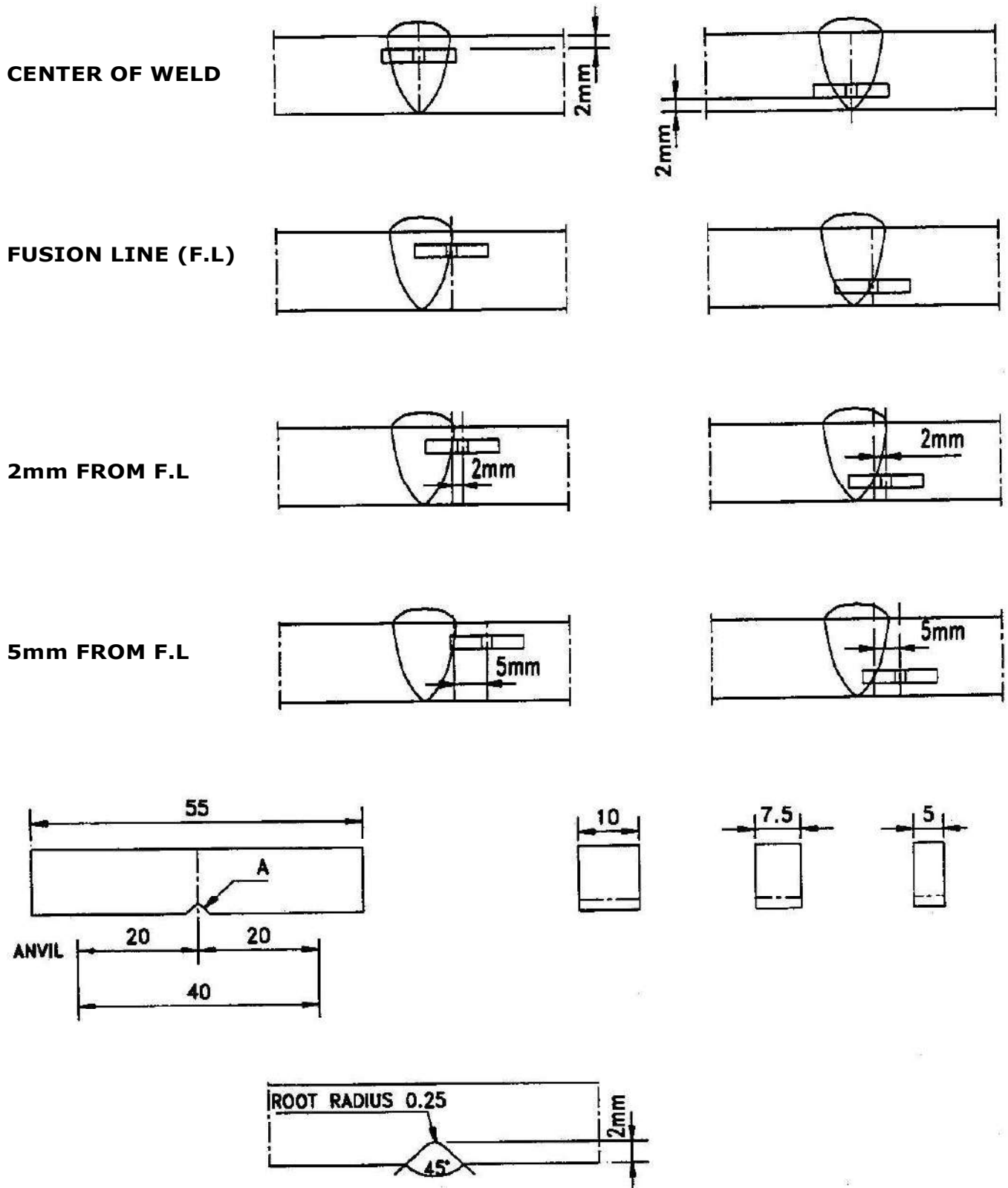
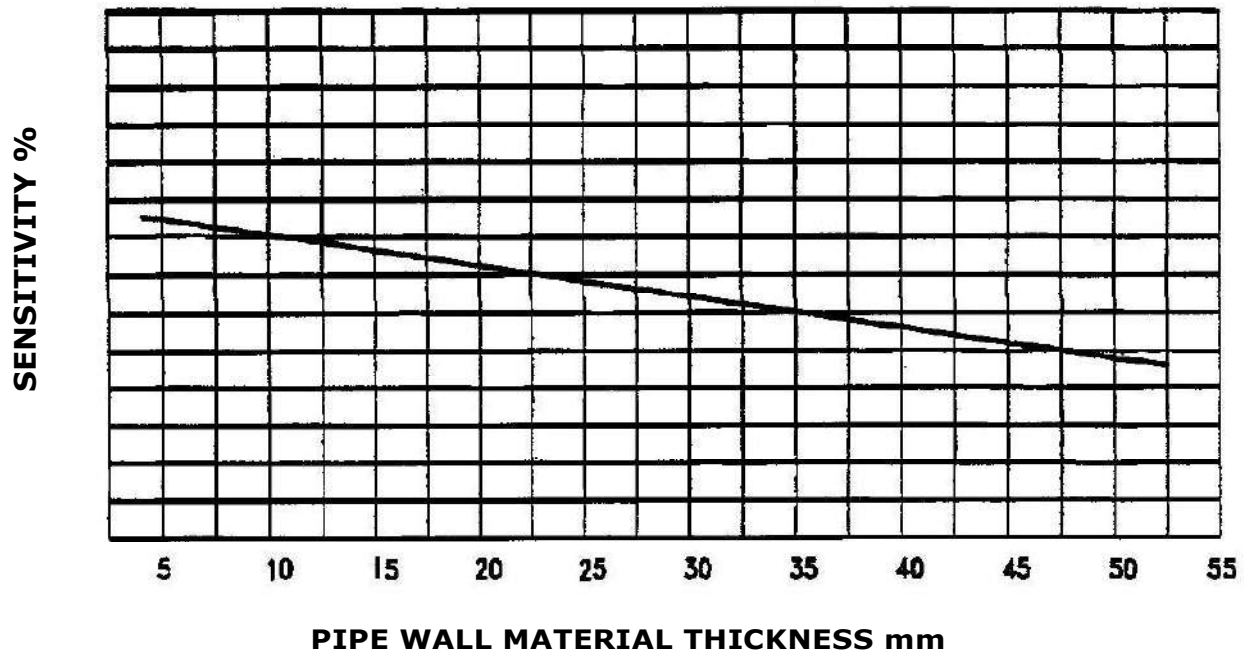
**NOTCH POSITIONS**

FIGURE 4.
CHARPY V – NOTCH TEST SPECIMEN



NOTE:-

FOR PRODUCTION RADIOGRAPHY, SENSITIVITY REDINGS BASED ON FILM ON SIDE PENTRAMETERS ARE TO BE JUDGED AS PER RESULT FROM THE PROCEDURE QUALIFICATION WITH PENTRAMETERS PLACED ON THE SOURE SIDE



ENERGISING QUALITY

VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION FOR FABRICATION AND ERECTION OF PIPING

VCS-SS-PP-2507

					
01	30.06.2022	RP	MC	HK	GW
00	13.05.2017	CM	SM	AD	SK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By
UNCONTROLLED COPY : If printed					
CONTROLLED COPY : If in soft and signed					

REVISION RECORD

Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	28.01.2020					
		MB	AK	AD	SK	
01	30.06.2022					VCS QMS Integration
		RP	MC	HK	GW	

Abbreviations:

AS	:	Alloy Steel
ASME	:	American Society of Mechanical Engineers
CI	:	Cast Iron
CS	:	Carbon Steel
HMTD	:	Heat & Mass Transfer Division
IBR	:	Indian Boiler Regulations
LTCS	:	Low Temperature Carbon Steel
NACE	:	National Association of Corrosion Engineers
NB	:	Nominal Bore
NDT	:	Non Destructive Testing
P & ID	:	Piping and Instrumentation Diagram
PMI	:	Positive Material Identification
SS	:	Stainless Steel
SMMS	:	Specialist Material & Maintenance Services

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3.0	BASIS FOR WORK	6
4.0	FABRICATION.....	7
5.0	ERECTION	10

1.0 SCOPE

This specification covers general requirements of fabrication and erection of above ground and trench piping systems at site. The specification covers the scope of work of Contractor, basis of work to be carried out by Contractor and standards, specifications and normal practice to be followed during fabrication and erection by the Contractor.

2.0 SCOPE OF WORK OF CONTRACTOR

Generally the scope of work of Contractor shall include the following:

2.1 Transportation of required piping materials (as described in C1.2.1.1), pipe support (material as described in C1. 2.3) and all other necessary piping materials from Owner's storage point or Contractor's storage point (in case of Contractor's scope of supply) to work site/shop including raising store requisitions for issue of materials in the prescribed format & maintaining an account of the materials received from Owner's stores.

2.1.1 Piping materials include the following but not limited to the same.

- a. Pipes (All sizes and schedule)
- b. Flanges (All sizes, types & Pressure ratings).
- c. Fittings (All sizes, types and schedule)
- d. Valves (All sizes, types and Ratings)
- e. Gaskets (All sizes, types & Ratings)
- f. Bolts, Nuts or M/C Bolts (All types)
- g. Expansion Joint/Bellows (All types)
- h. Specialty items like online filters, ejectors, sample coolers, steam traps, strainers, air traps, springs, silencers, snubbers, steam and condensate manifolds, injection nozzles, MOVs, sight glass, spray nozzles, integrated steam traps, hoses, hose couplings, etc.
- i. Online instruments like control valve, orifice flange, rotameter, safety valves, restriction orifice, rupture disc, de-super heaters, corrosion probes, annubar, magnetic flow meter, ultrasonic flow meter, Coriolis mass flow meters, venturi PG/PT/ Flow transmitter, ejectors, static mixers, flame arrestors, thermal flow switches, pre-fabricated hook-ups etc.
- j. Shutdown Valves with and without fire box.

2.2 Shop & field fabrication and erection of piping in accordance with documents listed under C1.3.0 i.e. 'BASIS OF WORK' including erection of all piping materials enumerated above.

2.3 Fabrication and erection of pipe supports like shoe, saddle, guide, stops, anchors, clips, cradles, hangers, tum-buckles, supporting fixtures, bracket cantilevers, struts, tee-posts including erection of spring supports, sway braces, dummy pipes, corrosion pads/protection shields, low friction pads, clamps, special support, expansion bellows, steam and condensate manifolds supports etc. Corrosion Pads/Protection shields, stiffeners and stiffening rings, if not covered in the specifications/standards, shall be of the same material as of parent pipes.

2.4 Site fabrication of Piping items

Site fabrication of Piping items shall include but not be limited to the following

- 2.4.1 Fabrication of piping specials like special radius bends, reducers, mitres etc.
- 2.4.2 Fabrication of plain and threaded nipples from pipes as required during erection.
- 2.4.3 Fabrication of swage nipples as and when required.
- 2.4.4 Fabrication of odd angle elbow like 60°, 30° or any other angle from 90°/45° elbows as and when required.
- 2.4.5 Fabrication of flange, reducing flange, blind flange, spectacle blinds as and when required.
- 2.4.6 Fabrication of stub-in connection with or without reinforcement.
- 2.4.7 Grinding of edges of pipes, fittings, flanges etc. to match mating edges of uneven/different thickness wherever required.
- 2.4.8 Fabrication of circular pipe for steam rings, fire water lines, utility lines.
- 2.4.9 Threading of all small bore piping as per piping material specifications.
- 2.4.10 Drilling on blind flange for inserting / joining small bore lines.
- 2.4.11 Fabrication and welding of reinforcement pads at branch pipe locations wherever required.
- 2.4.12 Equipment nozzle reinforcement with pads, jacket & stiffeners wherever required.
- 2.4.13 Fabrication of injection nozzles as per details provided wherever required.
- 2.4.14 Fabrication of chain operation arrangement for valves, wherever required. All material required for this modification shall be supplied by Contractor.
- 2.4.15 Fabrication and erection in position of funnels required for OWS/ SS/ Condensate blow down system as per direction of Engineer-in-charge.
- 2.4.16 Grinding & finishing of uneven surfaces/ joints after welding. Internal grinding of welds of orifice flanges to render smooth surface.
- 2.4.17 Tapping and drilling of holes in flanges, blind flanges, piping connections for jack screw, if required.
- 2.4.18 Providing bird screens at the outlet of lines open to atmosphere.
- 2.5 Modifications like providing additional cleats, extension of stem of valve, locking arrangement of valves etc. as and when required.
- 2.6 Piping isometrics for main process/utility lines shall be provided to the Contractor.

Preparation of miscellaneous small bore isometrics with bill of materials for process and utility lines (up to 1½" size) like instruments & pump flushing / cooling, sample connection, purging, pump casing vents & drains, pump base plate drains, control valve drains / vent to flare, instrument drains & vents, steam tracing (non-IBR) from steam supply stations up to condensate recovery station, and lines specified as field routed within the Unit battery limit as and when required are in Contractor's scope of work. Approval for these isometrics prepared by the Contractor shall be taken from Engineer-in-charge before erection.

Small bore piping isometrics given by Owner shall be rechecked by Contractor before erection and installation.
- 2.7 Obtaining approval for drawings prepared by Contractor from statutory authority, if required.
- 2.8 Spun concrete lining of the inside of pipes 3" NB & above including fittings and flanges as

required in accordance with specification.

- 2.9 Rubber lining inside pipes, fittings, flanges as and when required, in accordance with specification.
- 2.10 Radiography, stress relieving, dye penetration, magnetic particle test etc. as required in specification.
- 2.11 Performing PMI using alloy analysers as per Standard Specification for Positive Material Identification at Construction Sites, VCS-SS-PP-2502.
- 2.12 Casting of concrete pedestals and Fabrication and erection of small structures/ platforms for pipe supports and valve operation / attending some instruments, spectacle blinds etc., providing brackets, modification / extension of platforms, providing additional platforms / ladders for improving / providing accessibility.
- 2.13 Providing insert plates with anchor fasteners in concrete structures / paved floors and repair of platform gratings around pipe openings and providing suitable members for support under the platform grating.
- 2.14 Making material reconciliation statement and return of Owner's supply left over materials to Owner's storage.
- 2.15 Flushing and testing of all piping systems as per standard specification for inspection, flushing and testing of piping systems (Specification No. 6-44-0013). The accessories required for blinding the line like flange, blind flange, gasket (all sizes, type and rating), stud-bolts, flexible hoses etc. are to be arranged by the Contractor. During flushing the discharged water / air shall be drained / routed as directed by the Engineer - In Charge.
- 2.16 Contractor shall prepare welding specifications for all weld joints where dissimilar welding will be performed, and obtain approval from VCS.
- 2.17 Contractor to ensure meeting all requirements for carrying out work in shutdown/running plant.
- 2.18 Pickling (as and when applicable) as per Job specification(s) for chemical cleaning of CS suction piping of compressors, SS Piping, Weldment etc., as applicable.
- 2.19 Chemical Cleaning/ Hydro jet cleaning as per marked-up P&IDs with supply of chemicals, consumables, DM water, equipment's, boilers, coupons, tools & tackles and other testing equipment's required for the same.

3.0 BASIS FOR WORK

- 3.1 The complete piping work shall be carried out in accordance with the following:
 - 3.1.1 "Approved for Construction" drawings and sketches issued by VCS to the Contractor - Plans and/or Isometrics.
 - 3.1.2 "Approved for Construction" drawings and sketches issued by Turn-key bidders to the Contractor - Plans and/or Isometrics.
 - 3.1.3 Approved Process Licensors standards and specifications.
 - 3.1.4 Drawings, sketches and documents prepared by Contractor duly approved by Engineer-in-Charge (such as isometrics of small bore piping and offsite piping etc.).
 - 3.1.5 VCS specifications / documents as below:

- a. Process and Instrument Diagram.
- b. Job Piping Materials Specification (****-6-44-0005). **** denotes job number.
- c. Piping support, engineering standards.
- d. Line list
- e. Piping support indices (only in offsite), if supports are not shown in plan.
- f. Job specification of Non-destructive Requirement of Piping (VCS-SS-PP-0036)
- g. Job Welding specification for fabrication of piping (VCS-SS-PP-0040).
- h. Any other VCS or OTHER specifications attached with Piping Material Specification or special condition of contract (such as standard for cement lining of pipe, standard of jacketed piping, standard for steam tracing, Dimensional Tolerances etc.)
- i. Standard specification for positive material identification (PMI) at construction sites, 6-82-0002
- j. Standard Spec for application of torque & hydraulic bolt tension for flange joints (6-76-0002) and its addendum, if any.

3.1.6 Following codes, standards and regulations

a.	ASME B 31.3	:	Process Piping
b.	ASME Sec. VIII	:	Code for unfired pressure vessel.
c.	IBR Regulations		
d.	ASME Sec. IX	:	Qualification standard for welding and brazing procedures, welders, brazers and welding and brazing operators.
e.	NACE Std.	:	Code for Sour Services material requirements MR-0175/MR0103/Job spec(NACE), as applicable

Note: All codes referred shall be latest edition, at the time of award of contract.

3.2 Deviations

Where a deviation from the "Basis of Work" and approved job procedure described above is required or where the basis of work does not cover a particular situation, the matter shall be brought to the notice of Engineer-in-Charge and the work carried out only after obtaining written approval from him in each case.

4.0 FABRICATION

4.1 Piping Material

Pipe, pipe fittings, flanges, valves, gaskets, studs bolts etc. used in a given piping system shall be strictly as per the "Piping Material Specification" for the "Pipe Class" specified for that system. To ensure the above requirement, all piping material supplied by the Owner / Contractor shall have proper identification marks as per relevant standards / VCS specifications / Licensors specification. Contractor shall provide identification marks on left over pipe lengths wherever marked up pipe lengths have been fabricated / erected. Material-

traceability is to be maintained for A.S., S.S., NACE, L TCS, material for Hydrogen service and other exotic materials by way of transferring heat number, etc. (hard punching) as per approved procedure. This shall be in addition to colour coding for all piping materials to avoid mix-up.

For the purpose of common understanding the construction job procedure, to be submitted by the Contractor, shall include proposal for

Maximizing prefabrication, inspection and testing at fabrication shop with minimum field joints.

Positive material identification, handling, storage & preservation.

4.2 Dimensional Tolerances

The Contractor shall be responsible for working to the dimensions shown on the drawings. However, the Contractor shall bear in mind that there may be variations between the dimensions shown in the drawing and those actually existing at site due to minor variations in the location of equipment's, inserts, structures etc. To take care of these variations "Field Welds" shall be provided during piping fabrication. An extra pipe length of 100 mm over and above the dimensions indicated in the drawing may be left on one side of the pipe at each of the field welds. During erection, the pipe end with extra length at each field weld shall be cut to obtain the actual dimension occurring at site. Isometrics, if supplied may have the field welds marked on them. However, it is the responsibility of the Contractor to provide adequate number of field welds. In any case no extra claims will be entertained from the Contractor on this account. Wherever errors / omissions occur in drawings and Bills of Materials it shall be the Contractor's responsibility to notify the Engineer-in-Charge prior to fabrication or erection.

4.3 IBR Piping

- 4.3.1 Contractor shall obtain approval for the piping systems falling under purview of IBR from the statutory Indian Boiler Regulations (IBR) authority of the state where the plant is situated. The Owner shall provide documentation for the IBR System. The Contractor shall carry out the fabrications, erection and testing of this piping as per requirements of Indian Boiler Regulations and to the entire satisfaction of the local Boiler Inspector. The Contractor shall also get the approval of IBR inspector for all fabrication and testing done by him at his own cost. All certificates of approval shall be in proper IBR forms.
- 4.3.2 IBR Package for residual, field routed and site modified steam lines shall be prepared by the Contractor. IBR approval for the same shall be in Contractor's scope, at his own cost.

4.4 Pipe Joints

The piping class of each line specifies the type of pipe joints to be adopted. In general, joining of lines 2" and above in process and utility piping shall be accomplished by butt- welds. Joining of lines 1-1/2" and below shall be by socket welding/butt welding/threaded joints as specified in "Piping Material Specifications". However, in piping 1-1/2" and below where socket welding/ threaded joints are specified butt - welds may be used with the approval of Engineer-in-Charge for pipe to pipe joining in long runs of piping. This is only applicable for non-galvanized piping without lining.

Flange joints shall be used at connections to Vessels, Equipment's, Valves and where required for ease of erection and maintenance as indicated in drawings.

4.5 Butt Welded and Socket Welded Piping

End preparation, alignment and fit-up of pipe pieces to be welded, welding, pre-heating, post-heating and heat treatment shall be as described in the Job welding specification (VCS-SS-PP-0040) and NDT specification (VCS-SS-PP-0036).

4.6 Screwed Piping

In general, Galvanized piping shall have threads as per IS:554 or ANSI B2.1 NPT as required to match threads on fittings, valves etc. All other piping shall have threads as per ANSI B2.1, tapered unless specified otherwise.

Threads shall be clean cut, without any burrs or stripping and the ends shall be reamed. Threading of pipes shall be done preferably after bending, forging or heat treating operations. If this is not possible, threads shall be gauge checked and chased after welding heat treatment etc.

During assembly of threaded joints, all threads of pipes and fittings shall be thoroughly cleaned of cuttings, dirt, oil or any other foreign matter. The male threads shall be coated with thread sealant and the joint tightened sufficiently for the threads to seize and give a leak-proof joint. Threaded joints to be seal-welded shall be cleaned of all foreign matter, including sealant and made up to full thread engagement before seal welding.

4.7 Flange Connections

All flange facings shall be true and perpendicular to the axis of pipe to which they are attached. Flanged bolt holes shall straddle the normal centrelines unless different orientation is shown in the drawing.

Wherever jack screws are to be provided, drilling and tapping for the jack screws in the flange, shall be done as per VCS Standard before welding it to the pipe.

4.8 Branch Connections

Branch connections shall be as indicated in the piping material specifications. For end preparation, alignment, spacing, fit-up and welding of branch connections refer welding specifications. Templates shall be used wherever required to ensure accurate cutting and proper fit-up.

For all branch connections accomplished either by pipe to pipe connections or by using forged tees the rates quoted for piping shall be inclusive of this work.

Reinforcement pads shall be provided wherever indicated in drawings / specifications etc.

4.9 Bending

Bending shall be as per ASME B31.3 except that corrugated or creased bends shall not be used.

Cold bends for lines 1-1/2" and below, with a bend radius of 5 times the nominal diameter shall be used as required in place of elbows wherever allowed by piping specifications. Bending of pipes 2" and above may be required in some cases like that for headers around heaters, reactors etc.

The completed bend shall have a smooth surface, free from cracks, buckles, wrinkles, bulges, flat spots and other serious defects. They shall be true to dimensions. The flattening of a bend, as measured by the difference between the maximum and minimum diameters at any

cross-section, shall not exceed 8% and 3% of the nominal outside diameter, for internal and external pressure respectively.

4.10 Forging and Forming

Forging and forming of small bore fittings, like reducing nipples for piping 1-1/2" and below, shall be as per ASME B 31.3.

4.11 Mitre Bends and Fabricated Reducers

The specific application of welded mitre bends and fabricated reducers shall be governed by the Piping Material Specifications. Reducers shall be fabricated as per directions of Engineer-in-Charge. The radiographic requirements shall be as per Material Specifications for process and utility systems and NDT Specification for steam piping under IBR, radiographic requirements of IBR shall be complied with.

4.12 Cutting and Trimming of Standard Fittings & Pipes

Components like pipes, elbows, couplings, half-couplings etc. shall be cut / trimmed / edge prepared wherever required to meet fabrication and erection requirements, as per drawings and instructions of Engineer-in-Charge. Nipples as required shall be prepared from straight length piping.

4.13 Galvanized Piping

Galvanized carbon steel piping shall be completely cold worked, so as not to damage galvanized surfaces. This piping involves only threaded joints and additional external threading on pipes may be required to be done as per requirement.

4.14 Jacketed Piping

The Jacketing shall be done in accordance with VCS Specification or Licensors specification as suggested in material specification or special condition of contract.

Pre-assembly of jacketed elements to the maximum extent possible shall be accomplished at shop by Contractor. Position of jump-over and nozzles on the jacket pipes, fittings etc. shall be marked according to pipe disposition and those shall be prefabricated to avoid damaging of inner pipe and obstruction of jacket space. However, valves, flow glasses, in line instruments or even fittings shall be supplied as jacketed.

4.15 Shop Fabrication / Prefabrication

The purpose of shop fabrication or pre-fabrication is to minimize work during erection to the extent possible. Piping spool, after fabrication, shall be stacked with proper identification marks, so as facilitate their withdrawal at any time during erection. During this period all flange (gasket contact faces) and threads shall be adequately fabricated by coating with removable rust preventive. Care shall also be taken to avoid any physical damage to flange faces and threads.

4.16 Miscellaneous

4.16.1 Contractor shall fabricate miscellaneous elements like flash pot, seal pot, sample cooler, supporting elements like tum-buckles, extension of spindles and interlocking arrangement of valves, operating platforms as required by Engineer-in-Charge.

4.16.2 Spun Concrete Lining

The work of inside spun concrete lining of pipes and specials of diameter 3" and above shall be done as per material specifications and special condition contract.

4.16.3 Fabrication of pipes from plate

Pipes shall be fabricated at site as and when required as per the specifications and the actual Piping Material Specification.

5.0 ERECTION

5.1 Cleaning of Piping before Erection

Before erection all pre-fabricated spool pieces, pipes, fittings etc. shall be cleaned inside and outside by suitable means. The cleaning process shall include removal of all foreign matter such as scale, sand, weld spatter chips etc. by wire brushes, cleaning tools etc. and blowing with compressed air/or flushing out with water. Special cleaning requirements for some services, if any, shall be as specified in the piping material specification or isometric or line list. S.S jacketed piping requiring pickling shall be pickled to remove oxidation and discoloring due to welding.

5.2 Piping Routing

No deviations from the piping route indicated in drawings shall be permitted without the consent of Engineer-in-Charge.

Pipe to pipe, pipe to structure / equipment's distances / clearances as shown in the drawings shall be strictly followed as these clearances may be required for the free expansion of piping / equipment. No deviations from these clearances shall be permissible without the approval of Engineer-in-Charge.

In case of fouling of a line with other piping, structure, equipment etc. the matter shall be brought to the notice of Engineer-in-Charge and corrective action shall be taken as per his instructions.

5.3 Cold Pull

Wherever cold pull is specified, the Contractor shall maintain the necessary gap, as indicated in the drawing. Confirmation in writing shall be obtained by the Contractor from the Engineer-in-Charge, certifying that the gap between the pipes is as indicated in the drawing, before drawing the cold pull. Stress relieving shall be performed before removing the gadgets for cold pulling.

5.4 Slopes

Slopes specified for various lines in the drawings / P&ID shall be maintained by the Contractor. Corrective action shall be taken by the Contractor in consultation with Engineer-in-Charge wherever the Contractor is not able to maintain the specified slope.

5.5 Expansion Joints / Bellows

Installation of Expansion Joints/Bellows shall be as follows:

5.5.1. All Expansion joints / Bellows shall be installed in accordance with the specification and installation drawings, supplied to the Contractor.

5.5.2. a. Upon receipt, the Contractor shall remove the Expansion Joints / Bellows from the case(s) and check for any damage occurred during transit.

- b. The Contractor shall bring to the notice of the Engineer-in- Charge any damage done to the bellows / corrugations, hinges, tie-rods, flanges/ weld ends etc.
 - c. Each Expansion Joint / Bellow shall be blown free of dust / foreign matter with compressed air or cleaned with a piece of cloth.
- 5.5.3. a. For handling and installation of Expansion Joints, great care shall be taken while aligning. An Expansion Joints shall never be slinged from bellows corrugations/ external shrouds, tie / rods, angles.
- b. An Expansion Joints / Bellow shall preferably be slinged from the end pipes / flanges or on the middle pipe.
- 5.5.4. a. All Expansion Joints shall be delivered to the Contractor at "Installation length", maintained by means of shipping rods, angles welded to the flanges or weld ends or by wooden or metallic stops.
- b. Expansion Joints stop blocks shall be carefully removed after hydrostatic testing. Angles welded to the flanges or weld ends shall be trimmed by saw as per manufacturer's instructions and the flanges or weld ends shall be ground smooth.
- 5.5.5. a. The pipe ends in which the Expansion Joint is to be installed shall be perfectly aligned or shall have specified lateral deflection as noted on the relevant drawings.
- b. The pipe ends / flanges shall be spaced at a distance specified in the drawings.
- 5.5.6. The Expansion Joint shall be placed between the mating pipe ends / flanges and shall be tack welded/bolted. The mating pipes shall again be checked for correct alignment.
- 5.5.7. Butt-welding shall be carried out at each end of the expansion joint. For flanged Expansion Joint, the mating flanges shall be bolted.
- 5.5.8. After the Expansion Joint is installed the Contractor shall ensure that the mating pipes and Expansion Joints are in correct alignment and that the pipes are well supported and guided.
- 5.5.9. The Expansion Joint shall not have any lateral deflection. The Contractor shall maintain parallelism of restraining rings or bellows convolutions.
- 5.5.10. Precautions
- a. For carrying out welding, earthing lead shall not be attached with the Expansion Joint.
 - b. The Expansion bellow shall be protected from arc weld spot and welding spatter.
 - c. Hydrostatic Testing of the system having Expansion Joint shall be performed with shipping lugs in position. These lugs shall be removed after testing and certification IS over.

5.6 Flange Connections

While fitting up mating flanges, care shall be exercised to properly align the pipes and to check the flanges for trueness, so that faces of the flanges can be pulled together, without inducing any stresses in the pipes and the equipment nozzles. Extra care shall be taken for flange connections to pumps, turbines, compressors, cold boxes, air coolers etc. The flange connections to these equipment's shall be checked for misalignment, excessive gap etc. after the final alignment of the equipment is over. The joint shall be made up after obtaining

approval of Engineer-in-Charge.

Hydraulic bolt tensioning & torque tensioning shall be performed on flange joints as per the requirements specified in "standard Specification for application of Torque & bolt Tension for flange joints,VCS-SS-PP-0041 and its addendum, if any.

Temporary protective covers shall be retained on all flange connections of pumps, turbines, compressors and other similar equipment's, until the piping is finally connected, so as to avoid any foreign material from entering these equipment's.

The assembly of a flange joint shall be done in such a way that the gasket between these flange faces is uniformly compressed. To achieve this, the bolts shall be tightened in a proper sequence. All bolts shall extend completely through their nuts but not more than 1/4".

Steel to C.I. flange joints, if any, shall be made up with extreme care, tightening the bolts uniformly after bringing flange flush with gaskets with accurate pattern and lateral alignment.

5.7 Vents and Drains

High point vents and low point drains shall be provided as per the instructions of Engineer-in-Charge, even if these are not shown in the drawings. The details of vents and drains shall be as per piping material specifications / job standards.

5.8 Valves

Valves shall be installed with spindle / actuator orientation / position as shown in the layout drawings. In case of any difficulty in doing this or if the spindle orientation / position is not shown in the drawings, the Engineer-in-Charge shall be consulted and work done as per his instructions. Care shall be exercised to ensure that globe valves, check valves, and other uni- directional valves are installed with the "Flow direction arrow "on the valve body points in the correct direction. If the direction of the arrow is not marked on such valves, this shall be done in the presence of Engineer-in-Charge before installation.

Fabrication of stem extensions, locking arrangements and interlocking arrangements of valves (if called for), shall be carried out as per drawings / instructions of Engineer-in-Charge.

5.9 Instruments

Installation of in-line instruments such as control valve, orifice flange, rotameter, safety valves, restriction orifice, rupture disc, de-super heaters, corrosion probes, annubar, magnetic flow meter, ultrasonic flow meter, Coriolis mass flow meters, venturi PG/PTI Flow transmitter, ejectors, etc. and Shut Down Valves with fireboxes shall form a part of piping erection work.

Fabrication and erection of piping upto first block valve / nozzle / flange for installation of offline Instruments for measurement of level, pressure, temperature, flow etc. shall also form part of piping construction work. The limits of piping and instrumentation work will be shown in drawings / standards / specifications. Orientations / locations of take-offs for temperature, pressure, flow, level connections etc. shown in drawings shall be maintained.

Flushing and testing of piping systems which include instruments mentioned above and the precautions to be taken are covered in flushing, testing and inspection of piping (VCS Spec.

VCS-SS-PI-0007). Care shall be exercised and adequate precautions taken to avoid damage and entry foreign matter into instruments during transportation, installation, testing etc.

5.10 Line Mounted Equipment's / Items

Installation of line mounted items like filters, strainers, steam traps, air traps, de-super heaters, ejectors, samples coolers, mixers, flame arrestors, sight glasses etc., including their supporting arrangements shall form part of piping erection work.

5.11 Bolts and Nuts

The Contractor shall apply molycoat grease mixed with graphite powder (unless otherwise specified in piping classes) all bolts and nuts during storage, after erection and wherever flange connections are broken and made-up for any purpose whatsoever. The grease and graphite powder shall be supplied by the Contractor within the rates for piping work.

5.12 Pipe Supports

Pipe supports are designed and located to effectively sustain the weight and thermal effects of the piping system and to prevent its vibrations. Location and design of pipe supports will be shown in drawings for lines 2" NB & above. For lines 1½"NB & below Contractor shall locate and design pipe supports in line with VCS Std's. In case of IBR Lines 1½"NB & below only indicative supporting shall be provided & detailing of such supports is in Contractor's scope. Contractor shall obtain approval of Engineer - in - Charge on drawings prepared by Contractor, before erection. However, any extra supports desired by Engineer- in-Charge shall also be installed.

No pipe shoe / cradle shall be offset unless specifically shown in the drawings.

Hanger rods shall be installed inclined in a direction opposite to the direction in which the pipe move during expansion.

Pre-set pins of all spring supports shall be removed only after hydrostatic testing and insulation is over. Springs shall be checked for the range of movement and adjusted if necessary to obtain the correct positioning in cold condition. These shall be subsequently adjusted to hot setting in operating condition. The following points shall be checked after installation, with the Engineer-in-Charge and necessary confirmation in writing obtained certifying that:

All restraints have been installed correctly.

Clearances have been maintained as per support drawings.

Insulation does not restrict thermal expansion.

All temporary tack welds provided during erection have been fully removed.

All welded supports have been fully welded.



ENERGISING QUALITY

VCS QUALITY SERVICES PVT. LTD.

TECHINICAL NOTES FOR BOLTS AND NUTS

VCS-SS-PP-2510

					
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Abbreviations:

ASME	The American Society of Mechanical Engineers
ASTM	The American Society for Testing and Materials
MR	Material Requisition
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 MRIPR stipulations and no deviation 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. Stress Rupture Test as detailed in ASTM A453 shall be carried out for all ASTM A453 bolting material irrespective of the temperature.

1.2.4. Refer Specification no VCS-PL-ITP-0012 for '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 B 18.2.2 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 VCS.

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 -196DC 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 A 193.
- 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 "IBR", "L T", "H2", etc. other than **"CRYO"** & **"NACE"** shall be ignored.
- 2.0 ACCEPTABLE DEVIATIONS**
- 2.1** Nuts to ASTM A194Gr.7 are acceptable in place of ASTM A194Gr 4.
- 2.2** Stud Bolts to ASTM A453 Gr.660 C1.B are acceptable in lieu of ASTM A453 Gr.660C1.A and vice versa



VCS QUALITY SERVICES PVT. LTD.

TECHINICAL NOTES FOR GASKETS

VCS-SS-PP-2511

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Abbreviations:

AARH	Average Arithmetic Root Height
BHN	Brinell Hardness Number
CS	Carbon Steel
MR	Material Requisition
PMI	Positive Material Identification
RTJ	Ring Type Joint

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1.0 GENERAL

- 1.1** All gaskets shall conform 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:
- Manufacturer's test certificate for filler material and spiral material as per the relevant material specifications.
 - Manufacturer's test certificate for raw materials and tests for compressibility! seal- ability & recovery as per the relevant material specifications.
- 1.3.4. Refer Specification no VCS-PL-ITP-0013 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** For spiral wound gaskets, material of Inner Compression ring shall be same as Spiral Strip material. Inner rings shall be provided for all Spiral Wound Gaskets.
- 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. $\frac{1}{2}$ Mo	130
Type 304, 316, 321, 347	140
Type 304L, 316L	120
Inconel UNS N06625	200
Incoloy UNS N08825	190
Duplex SS UNS N032205, N031803	230

- 1.3.5. Face finish of metallic RTJ gaskets shall be 32 to 63 AARH.

- 1.3.6. 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.
- 1.3.7. All items shall be inspected and approved by VCS.
- 1.3.8. Any additional requirements specified in the requisition, shall be fully complied with.
- 1.3.9. Non-metallic ring gaskets as per ASME B 16.21 shall match flanges to ASME B 16.5 upto 24" and to ASME B 16.47B above 24" unless specified otherwise.
- 1.3.10. Spiral wound gasket as per ASME B 16.20 shall match flanges to ASME B 16.5 upto 24" and to ASME B 16.47B above 24" unless specifically mentioned otherwise.
- 1.3.11. The following abbreviations have been used in the Material Requisition for Spiral Wound Gaskets:
- | | | |
|--------|---|----------------|
| (I) | : | Inner Ring |
| (O) | : | Outer Ring |
| GRAFJL | : | Grafoil Filler |
- 1.3.12. Specialties mentioned in item description like "IBR", "LT", "HICI", "H2", etc. shall be ignored.



VCS QUALITY SERVICES PVT.LTD.

STANDARD SPECIFICATION FOR ASSORTED VALVES

VCS – SS – PP - 2504

					
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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
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
PM	:	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. 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 all valves, no deviations whatsoever shall be accepted.
- 1.3** All codes and standards for manufacture, testing, inspection etc. shall be of latest editions as on issue date of Material Requisition.

2. DOCUMENTATION

- 2.1** For all valves, vendor shall submit the following documents with the offer:
- 2.1.1 Manufacturers complete descriptive and illustrative catalogue/ literature.
- 2.1.2 Detailed dimensioned cross section drawing with parts/ material lists, weight etc.
- 2.1.3 Drawings for valves with accessories like gear operator, hydraulic/ pneumatic operator, motor, extension bonnet, extended stems with stands, bypass etc. giving major salient dimensions.
- 2.1.4 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.
- 2.1.5 If the valve is regretted or has no deviation, the manufacturer shall write clearly on valve specification sheets as "Regret" or "No Deviation".
- 2.1.6 On failure to submit documents as specified in clauses 2.2.1 to 2.2.6 above, the offer is likely to be rejected.
- 2.2** The following documents shall be submitted in soft and hard copy after placement of the order.
- 2.2.1 For all 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/ review.
- 2.2.2 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 3.15.
- 2.2.3 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.
- 2.3** Catalogues/Drawings (6 sets) shall be 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. 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
	> 22 mm	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
	> 25 mm	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 this Specification No. SS-PI-012_A1.

3.7.3 By-pass valve shall be a globe valve. The sizes shall be as under:

On main valve ≤ 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 Piping Material Specification (PMS).

3.8 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.

3.9 Valve body / bonnet shall be forged / cast as specified. Forgings are acceptable in place of casting but not vice-versa.

3.10 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.

3.11 Stellite/ hardfacing by deposition shall be minimum 1.6 mm.

3.12 Renewable seat rings shall be seal welded for valves of size 3" and above to prevent loosening in service.

3.13 For Low Temperature & Cryogenic valve requirements, refer Specification. No. SS-PI-012_A2 unless otherwise specified.

3.14 For all austenitic stainless steel valves Inter Granular Corrosion (IGC) test shall be conducted as per the following:

3.14.1 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.

3.14.2 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.

3.14.3 For the IGC test as described in Clauses 3.15.1 & 3.15.2, 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', of the microscopic structure shall be submitted for record.

3.15 All types of 321 or 347 stainless steel valves 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.

3.16 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 case of non-circular spiral wound gasket used in 150# valve provided the outermost layer of spiral touches the bolts ascertaining the centering.

3.17 All Stainless Steel Castings shall be solution heat treated.

3.18 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

3.19 Ball / Plug / Butterfly Valves

3.19.1 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 approved third party inspection agency 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.

3.19.2 Each valve shall be supplied with a lever / wrench except for gear operated / motor operated valves.

3.19.3 Soft-seated ball, plug & butterfly valves shall be supplied with antistatic devices.

3.19.4 BW / SW end ball valves shall have pipe nipple/ pup piece welded to each end of the valve. As specified in valve datasheets nipples/ pup piece are to be welded prior to assembling Teflon seats / seals. Specifications of the nipples shall be as indicated in the MR.

3.19.5 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 patterns).

3.19.6 The ball of ball valve shall not protrude outside the end flanges of valve.

3.19.7 All 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

3.19.8 Unless otherwise specified in the data sheets/ MR, bore of all reduced bore ball valves shall be limited to one size lower than the nominal bore.

3.20 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.

3.21 Ends of flanged valves of 22" size shall match corresponding flanges to MSS-SP44 unless otherwise specified.

3.22 Yoke material shall be same as bonnet material where maximum temperature specified is more than 427°C.

4. 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	12" and larger
	300 Class	12" and larger
	600 Class	10" and larger
	900 Class	6" and larger
	1500 Class	3" and larger
	2500 Class	3" and larger
Ball Valve / Plug Valve (Other than pressure balance plug valves)	150 Class	6" and larger
	300 Class	6" and larger
	600 Class	4" and larger
	900 Class	3" and larger
	1500 Class	3" 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 4.6 are met.

- 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 4.1 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 4.3.

5. 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 any third party as approved by the purchaser. For IBR valves refer clause 7.0.
- 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 company/ company representative 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. 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 6.1 shall be done by X-ray / Gamma-ray to get the required sensitivity.

7. 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. 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. 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.

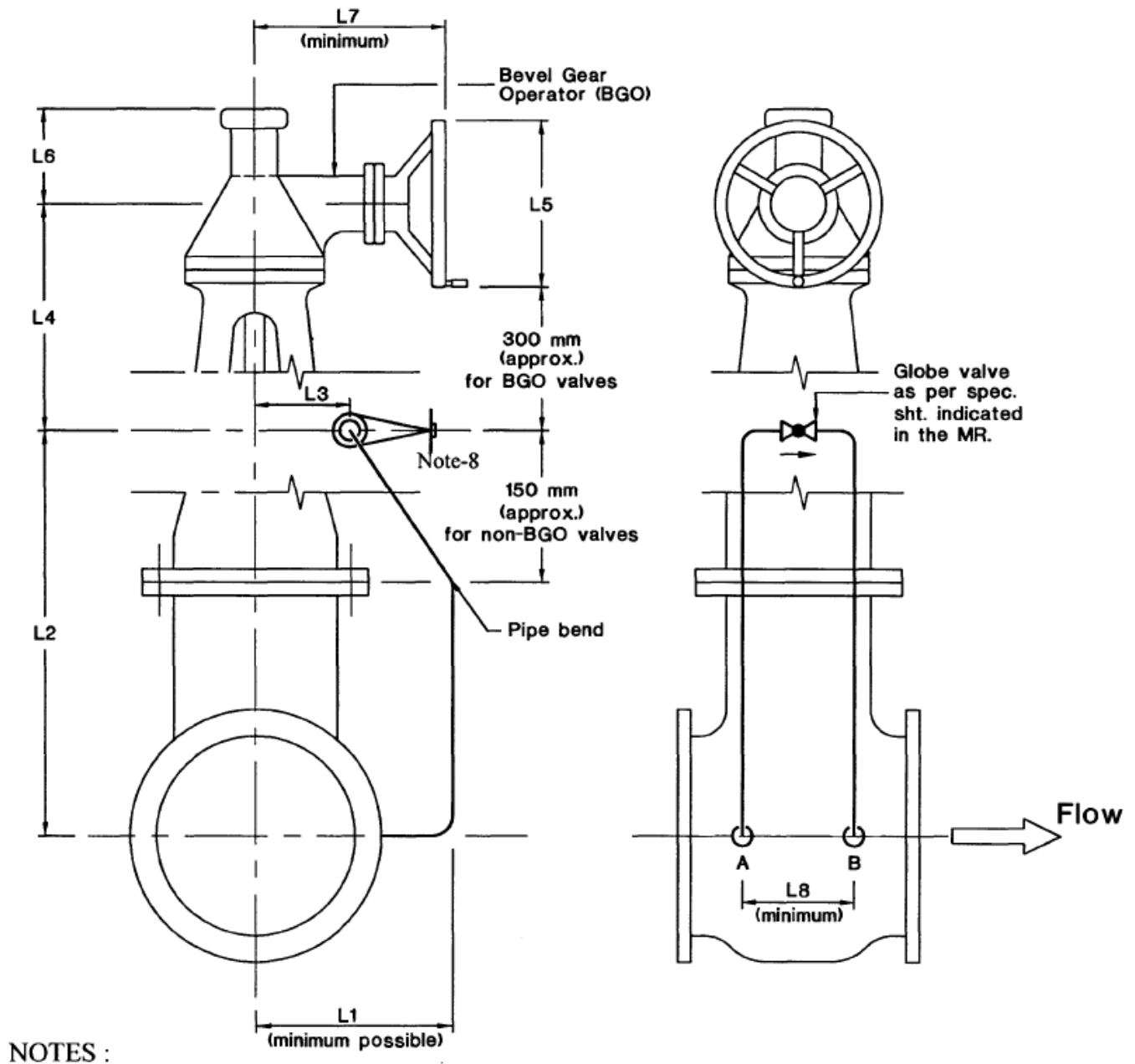
9.6 End protectors to be used on beveled end shall be securely and tightly attached.

9.7 For special service valves additional requirement for dispatch shall be as prescribed in data sheet.

10. ATTACHMENTS

SS-PI-012_A1	:	Bypass Piping Arrangement
SS-PI-012_A2	:	Special Requirements for Low Temperature and Cryogenic Valves

**BYPASS PIPING ARRANGEMENT
(SS-PI-012-A1)**



1. The orientation & location of hand wheel 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.
6. 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

SPECIAL REQUIREMENTS FOR LOW TEMPERATURE & CRYOGENIC VALVES (SS-PI-012-A2)

11. SCOPE

All valves of Low Temperature Carbon Steel (LTCS) and all grades of austenitic (CRYO) materials 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:

12. QUALIFICATION CRITERIA

- I. Both cryogenic test (clause 2.1) and reference list (clause 2.2) together shall be 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 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 2.1 & 2.3 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.

12.1 Cryogenic Test

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

- 12.1.1 Test shall be as per BS 6364.
- 12.1.2 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.
- 12.1.3 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.
- 12.1.4 Tests should have been witnessed and certified by approved third party inspection agencies.
- 12.1.5 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.

12.2 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.

12.3 Post Order Testing Procedure

12.3.1 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.

12.3.2 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.

12.3.3 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 of the purchase order including cancellation of the purchase order at the risk and cost of vendor.

- 13.** 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.
- 14.** Bonnet and Gland extension joints shall be of butt welded/integrally cast construction.
- 15.** 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.
- 16.** 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.



VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION FOR FLAME ARRESTORS

VCS – SS – PP - 2032

					
01	23.11.2022	AY	MC	HK	GW
00	28.01.2020	MB	MD	AD	SK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

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CONTROLLED COPY	:	If in soft and signed

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	28.01.2020					
		MB	MD	AD	SK	
01	23.11.2022					VCS QMS Integration
		AY	MC	HK	GW	



ABBREVIATIONS:

AARH	Arithmetic Average Roughness Height
MAWP	Maximum Allowable Working Pressure
MESG	Maximum Energy Safe Gap
NPT	National Pipe Thread



ENERGISING QUALITY

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1.0 GENERAL

1.1 Scope

1.1.1 This specification, together with the datasheets covers the requirements for the design, materials, nameplate marking, inspection, testing and shipping of flame arresters.

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 Engineers	
	B 16.5	Pipe Flanges and Flanged Fittings
	B 16.20	Metallic Gaskets for Pipe Flanges- Ring Joint, Spiral Wound and Jacketed
IS/ IEC	Indian Standards/ International Electro technical Commission	
	IS/IEC 60079	Electrical Apparatus for Explosive Gas Atmosphere.
EN	European Standards	
	10204	Inspection Documents for Metallic Products.
ISO	International Organization of Standardization	
	16852	Flame arresters — Performance requirements, test methods and limits for use
API	American Petroleum Institute	
	S-2000	Venting Atmospheric and Low-Pressure Storage Tanks, Non-Refrigerated and Refrigerated

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

- Statutory Regulations
- Datasheets
- Standard Specification
- Codes and Standards

1.1.4 In addition to compliance to purchaser's specifications in totality, vendors extent of responsibility includes the following:

- a) Purchaser datasheets specify the length of pipe from source of ignition to flame arrester and combustion processes for which flash back safety is required. Vendor shall be responsible for selecting the proper type of flame arrester based on the piping configuration indicated. Purchaser's datasheets may specify the type and size of the flame arrester. However, vendor shall be responsible for proper selection of the flame arresters of suitable type and size as per the breathing rates, differential pressure, maximum operating pressure / vacuum and maximum operating temperature indicated in the purchaser's datasheets based on the type test certification of the offered model of flame arrester for the specific combustion process.
- c) Purchaser's datasheets specify the material for the body, internals and other parts of the flame arrester. Alternate superior material of construction shall also be acceptable provided vendor assumes complete responsibility for the selected materials for their compatibility with the process fluid and its operating conditions.

1.2 Bids

1.2.1 Vendor's quotation shall be strictly as per the bidding instructions to vendor attached with the material requisition Vendor's quotation shall be strictly as per the bidding instructions to vendor attached with the material requisition.

1.2.2 Vendor's quotation shall include the following:

- a) Detailed specification sheet for each item which shall provide information regarding size, type and material of construction. The material specifications and units of measurement for various items in vendor's specification sheets shall be to the same standards as those indicated in purchaser's datasheet.
- b) Sizing calculations and / or flow versus differential pressure graph for each flame arrester tag number wise.
- c) Capacity data for the type of flame arrester selected. These data shall be presented as per clause 1.7.2 of API S-2000 with the following exceptions:
 - I. Air flow shall be presented in m³/h (Standard) (i.e. at the reference of 15°C and 1.013 bar absolute pressure).
 - II. Pressure and vacuum shall be expressed in mm of water.
- d) The capacity calculations/curves for the combination whenever flame arrester is specified together with breather valve or atmospheric vent.

- e) Proven references for each offered model number inline with clause 1.2.3 of this specification, whenever specifically indicated in purchaser's specifications.
- f) Deviations on technical requirements shall not be entertained. In case vendor has any valid technical reason, they must include a list of deviations tag number wise summing up all the deviations from the purchaser's datasheets and other technical specifications along with the technical reasons for each of these deviations.
- g) Catalogues giving detailed technical specifications, certified capacity curves / data covered, model decoding details and other related information for each type of flame arrester covered in the bid.
- h) Two years operational spares for each flame arrester and its accessories, which shall include gasket, o-ring, flame arrester element etc. as a minimum.
- i) Any special tools and tackles needed for maintenance work on the flame arrester and its accessories. In case no special tools are necessary for the offered target flow meters, vendor must certify in their offer.

1.2.3 All items, as offered, shall be field proven and should have completed trouble free satisfactory operation for a period of minimum 4000 hours on the bid due date in the similar application with process conditions similar to those as specified in the purchaser's datasheet. Items with proto-type design or items not meeting provenness criteria specified above shall not be offered.

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

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. The required number of prints and soft copies should be dispatched to the address mentioned, adhering to the time limits indicated.

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

- a) Specification sheet for each flame arrester and its accessories along with design criteria, basis of selection and sizing sheet (with or without combination of other tank protection devices as applicable).
- b) Certified drawings for each flame arrester and its accessories, which shall provide dimensional details, internal constructional details with part numbers/part description

Digitally signed by Bivek Kumar

Singh

Date: 2026.09.03 19:02:02 IST

and material of construction etc.

- c) Copy of type test certificate for specified gas group and capacity.
- d) Test certificates for all the test carried out as per clause 4.0 of this specification.
- e) Installation procedure for flame arrester and its accessories with or without other tank protection devices.
- f) Maintenance procedure for flame arresters and its accessories including removal of flame arrester bank and its cleaning procedure.

2.0 DESIGN AND CONSTRUCTION

2.1 The design of flame arrester shall be as per IS016852 standards in general.

2.2 Design by other standards shall also be acceptable provided these exceed the requirements specified in IS016852 standards. The design of the flame arrester shall be selected by vendor to prevent flame break-through under process conditions specified in the respective datasheets and provide maximum safety in case of deflagration (explosion) and detonation. In general following shall apply:

- a) All ends of the line flame arrestors shall be deflagration type suitable for continuous burning situation. A temperature sensor (K-type thermocouple) shall be provided in the flame arrester body to detect long burning situation.
- b) For all inline applications, vendor shall evaluate each installation to select proper type of flame arrester.
- c) Inline flame arresters where source of ignition is always present like burners / heaters shall always incorporate a temperature sensor (K-type thermocouple) in the flame arrester body to indicate occurrence of continuous burning.

2.3 All flame arrester body shall be of non-fragmentation type design and shall withstand the resultant pressure and temperature resulted out of detonation, deflagration or continuous burning depending upon the type of flame arrester selected.

2.4 All flame arresters in Inline application shall have a multiple flame arrester elements design with minimum two flame arresting banks covered by metal side plates. The gap between the banks shall be sized by the vendor to provide minimal pressure loss but with maximum safety.

2.5 Unless otherwise specified in datasheet, the flame arrester element material shall be 316 Stainless Steel, as a minimum. The element shall be manufactured with width of the passage way determined based on the MESG of the Gas group specified in the datasheet. Vendor shall ensure that the net free area available for flow through the flame arrester element shall be greater than the corresponding area of the connecting pipe size.

However, the actual element design and size shall be worked out by the vendor based on process data specified in the datasheet.

- 2.6** The design shall ensure minimal pressure drop across the flame arrester, which shall not exceed the pressure drop indicated in the datasheets or 10% of the inlet pressure at its maximum flow whichever is lower. While considering pressure drop, vendor shall also ensure safety against deflagration and detonation.
- 2.7** The flame arrester banks shall be removable type to ensure inspection and cleaning of banks against clogging. The design shall allow disassembly of banks by disengaging the side plates without any special tool.
- 2.8** Temperature element, when required, shall be provided with weatherproof terminal box with terminals clearly identified. 1/2" NPT (F) connections shall be provided on the terminal box for purchaser's cable entry.
- 2.9** Flame arrester assembly shall not utilise asbestos or asbestos based gasket.
- 2.10** The direction of installation with side to be protected shall be clearly marked on the flame arrester body.
- 2.11** Unless otherwise mentioned, end connection details shall be as below: -
- a) Flanged end connections shall be as per ASME B 16.5
 - b) Flanged face finish shall be as per ASME B 16.5. The face finish shall be as follows:

125 AARH	125 to 250	microinchAARH
63 AARH	32 to 63	microinchAARH

3.0 NAME PLATE

Each flame arrester shall have a stainless steel nameplate attached firmly to it at a visible place, furnishing the following information:

- a) Tag number as per purchaser's datasheet.
- b) Manufacturers serial number or model number.
- c) Type of flame arrester
- d) Gas group for which the flame arrester is certified.
- e) Manufacturer's name/trade mark.
- f) Capacity in Standard m³/h of free air.

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

6.0 REJECTION

6.1 Vendor shall prepare their offer strictly as per clause 1.2 of this specification and attach only those documents, which are specifically indicated in the material requisition.

6.2 Any offer not conforming to the above requirements, shall be summarily rejected.



ENERGISING QUALITY

VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION FOR QUALITY MANAGEMENT SYSTEM REQUIREMENT FROM VENDORS

VCS – SS – PP - 2044

					
01	30.07.2022	RKP	MC	HK	GW
00	20.07.2020	MB	MC	AD	SK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

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REVISION RECORD

Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	20.07.2020					
		MB	MC	AD	SK	
01	30.07.2022					VCS QMS Integration
		RKP	MC	HK	GW	

Abbreviations:

CV	:	Curriculum Vitae
ISO	:	International Organization for Standardization
MR	:	Material Requisition
PO	:	Purchase Order
PR	:	Purchase Requisition
QA	:	Quality Assurance
QMS	:	Quality Management System

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1.0 SCOPE

This specification establishes the Quality Management System requirements to be met by BIDDER for following purpose:

- QMS requirements to be met by suppliers/contractors after award of work/ during contract execution.

2.0 DEFINITIONS

2.1 Bidder

For the purpose of this specification, the word "BIDDER" means the person(s), firm, company or organization who is under the process of being contracted by Owner for delivery of some products (including service). The word is considered synonymous to supplier, contractor or vendor.

2.2 Project Quality Plan

Document tailored from Standard Quality Management System Manual of BIDDER, specifying how the quality requirements of the project will be met.

2.3 Owner

Owner means the owner of the project for which services / products are being purchased and includes their representatives, successors and assignees.

3.0 REFERENCE DOCUMENTS

VCS-SS-PP-2043 Standard Specification for Documentation Requirements from Suppliers

4.0 QUALITY MANAGEMENT SYSTEM — GENERAL

Unless otherwise agreed with PMC / Owner, the BIDDER proposed quality system shall fully satisfy all relevant requirements of ISO 9001 "Quality Management Systems - Requirements." Evidence of compliance shall be current certificate of quality system registration to ISO 9001 or a recent compliance audit recommending registration from a certification agency. The quality system shall provide the planned and systematic control of all quality related activities for execution of contract. Implementation of the system shall be in accordance with BIDDER'S Quality Manual and PROJECT specific Quality Plan.

5.0 QUALITY SYSTEM REQUIREMENTS

- 5.1 BIDDER shall prepare and submit for review / record, Project Quality Plan / Quality Assurance Plan for contracted scope / job. The BIDDER'S Quality Plan shall address all of the applicable elements of ISO 9001, identify responsible parties within BIDDER'S organization, for the implementation / control of each area, reference the applicable procedures used to control / assure each area, and verify the documents produced for

each area. The Project Quality Plan shall necessarily define control or make reference to the relevant procedures, for design and engineering, purchase, documentation, record control, bid evaluation, inspection, production/manufacturing, preservation, packaging and storage, quality control at construction site, pre-commissioning, commissioning and handing over (as applicable) in line with contract requirement and scope of work.

- 5.2 BIDDER shall identify all specified or implied statutory and regulatory requirements and communicate the same to all concerned in his organization and his sub contractor's organization for compliance.
- 5.3 BIDDER shall deploy competent and trained personnel for various activities for fulfilment of PO / contract. BIDDER shall arrange adequate infrastructure and work environment to ensure that the specification and quality of the deliverable are maintained.
- 5.4 BIDDER shall do the quality planning for all activities involved in delivery of order. The quality planning shall cover as minimum the following:
- Resources
 - Product / deliverable characteristics to be controlled.
 - Process characteristics to ensure the identified product characteristics are realized
 - Identification of any measurement requirements, acceptance criteria
 - Records to be generated
 - Need for any documented procedure

The quality planning shall result into the quality assurance plan, inspection and test plans (ITPs) and job procedures for the project activities in the scope of bidder.

These documents shall be submitted to PMC/Owner for review/approval, before commencement of work.

- 5.5 Requirements for sub-contracting / purchasing of services specified in contract / tender shall be adhered to. In general, all outsourced items will be from approved vendors of OWNER. Wherever requirements are not specified, or approved sub vendors do not exist, the sub-contractor shall establish and maintain a system for purchasing / sub-contracting to ensure that purchased product / service conforms to specified requirements. Criteria for selection of sub-contractor, evaluation, re-evaluation, maintenance of purchasing data and verification of purchased product (subcontractor services), constitute important components of this requirement.
- 5.6 BIDDER shall plan and carry production and service provision under controlled conditions. Controlled conditions shall include, as applicable the availability of information that describes the characteristics of the product the availability of work instructions the use of suitable equipment the availability and use of monitoring and measuring devices the implementation of monitoring and measurement the implementation of release, delivery and post-delivery activities.

- 5.7 BIDDER shall validate any processes for production and service provision where resulting output cannot be verified by subsequent monitoring and measurement. This includes any process where deficiencies become apparent only after the product is in use or service has been delivered.
- 5.8 BIDDER shall establish a system for identification and traceability of product /deliverable throughout product realization. Product status with respect to inspection and testing requirements shall be identified.
- 5.9 BIDDER shall identify, verify, protect and safeguard PMC / Owner property (material / document) provided for use or incorporation into the product. If any OWNER/ PMC property is lost, damaged or otherwise found to be unsuitable for use, this shall be reported to the OWNER/ PMC.
- 5.10 BIDDER shall ensure the conformity of product / deliverable during internal processing and delivery to the intended destination. Requirements mentioned in the tender shall be adhered to.
- 5.11 BIDDER shall establish system to ensure that inspection and testing activities are carried out in line with requirements. Where necessary, measuring equipment's shall be calibrated at specified frequency, against national or international measurement standards; where no such standard exists, the basis used for calibration shall be recorded. The measuring equipment's shall be protected from damage during handling, maintenance and storage.
- 5.12 BIDDER shall ensure effective monitoring, using suitable methods, of the processes involved in production and other related processes for delivery of the scope of contract.
- 5.13 BIDDER shall monitor and measure the characteristics of the product/deliverable to verify that product requirement has been met. The inspection (stage as well as final) by BIDDER and OWNER / Owner personnel shall be carried out strictly as per the ITPs forming part of the contract. Product release or service delivery shall not proceed until the planned arrangements have been satisfactorily completed, unless otherwise approved by relevant authority and where applicable by Owner / PMC.
- 5.14 BIDDER shall establish and maintain a documented procedure to ensure that the product which does not conform to requirements is identified and controlled to prevent its unintended use or delivery.
- 5.15 All non-conformities (NCs) / deficiencies found by the BIDDER'S inspection /surveillance staff shall be duly recorded, including their disposal action shall be recorded and resolved suitably. Effective corrective and preventive action shall be implemented by the BIDDER so that similar NCs including deficiencies do not recur.
- 5.16 All deficiencies noticed and reported by PMC / OWNER shall be analysed by the BIDDER and appropriate corrective and preventive actions shall be implemented. BIDDER shall intimate PMC / OWNER of all such corrective and preventive action implemented by him.

- 5.17 BIDDER should follow the standards, specifications and approved drawings. Concessions/Deviations shall be allowed only in case of unavoidable circumstances. In such situations Concession/deviation request must be made by the BIDDER through online system of OWNER/ PMCs eDMS.
- 5.18 BIDDER shall have documented procedure for control of documents.
- 5.19 All project records shall be carefully kept, maintained and protected for any damage or loss until the project completion, then handed over to PMC / Owner as per contract requirement (VCS-SS-PL-0047 Specification for Documentation Requirements from Suppliers), or disposed as per relevant project procedure.

6.0 AUDITS

BIDDER shall plan and carry out the QMS audit for the job. Quality audit programme shall cover design, procurement, construction management and commissioning as applicable including activities carried out by sub-vendors and sub-contractors. This shall be additional to the certification body surveillance audits carried out under BIDDER'S own ISO 9001 certification scheme.

The audit programmes and audit reports shall be available with bidder for scrutiny by PMC / OWNER. PMC or OWNER representative reserves the right to attend, as a witness, any audit conducted during the execution of the WORKS.

In addition to above OWNER, PMC and third party appointed by PMC/Owner may also perform Quality and Technical compliance audits. BIDDER shall provide assistance and access to their systems and sub-contractor / vendor systems as required for this purpose. Any deficiencies noted shall be immediately rectified by BIDDER.

7.0 DOCUMENTATION REQUIREMENTS

BIDDER shall submit following QMS documents immediately after award of work (Within one week) for record / review by PMC/ Owner.

- Organization chart (for complete organization structure and for the project)
- Project Quality Plan/Quality Assurance Plan
- Job specific Inspection Test Plans, if not attached with PR
- Job Procedures
- Inspection/Test Formats

In addition to above QMS documents, following documentation shall be maintained by the BIDDER for submission to PMC / Owner on demand at any point of time during execution of the project.

- Quality Manual
- Certificate of approval for compliance to ISO: 9001 standards
- Procedure for Control of Non-conforming Product

- Procedure for Control of Documents
- Sample audit report of the QMS internal and external audits conducted during last one year
- Customer satisfaction reports from at least 2 customers, during the last one year
- Project QMS audit report
- Technical audit reports for the project
- Corrective action report on the audits

Documents as specified above are minimum requirements. BIDDER shall submit any other document/data required for completion of the job as per PMC/Owner instructions.



VCS QUALITY SERVICES PVT. LTD.

**STANDARD SPECIFICATION
FOR
THIRD PARTY INSPECTION AGENCY (TPIA)**

VCS – SS – PP - 2031

					
01	25.11.2022	AY	MC	HK	GW
00	28.01.2020	MB	MD	AD	SK
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		AY	MC	HK	GW	

ABBREVIATIONS:

TPIA	THIRD PARTY INSPECTION AGENCY
QA	Quality Assurance
QC	Quality Control
LOI	Letter of Indent
QAP	Quality Assurance Procedure
ISS	International Standard Space
UPS	Uninterruptible Power Supply

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4.0	CO-ORDINATION WITH TPIA.....	5
5.0	INVOLVEMENT OF TPIA	5

1.0 INTRODUCTION

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

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

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

2.0 SCOPE OF WORK

2.1 Role of TPIA for Supply Items

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

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

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

2.3 Role of TPIA for Construction Activity

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

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

2.4

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

necessary calibration of such equipment/Instruments during visit to contractor's works.

3.0 ROLE OF CONTRACTOR

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

4.0 CO-ORDINATION WITH TPIA

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

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

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

5.0 INVOLVEMENT OF TPIA

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

5.2 Civil

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

- It should be of reputed make having proven record of being successfully used in similar works earlier and as per approval by Owner / Owner's Representative.
- All materials shall be of standard quality and shall be procured from renowned sources / manufacturers approved by Owner/ Owner's representative.
- All tests of the materials as specified by the relevant codes should be carried out by the contractor in an approved laboratory and the test reports should be

duly authenticated by the laboratory and should be submitted to TPIA for his approval. If so desired by Owner/ Owner's representative, tests shall be conducted in his presence or in presence of his authorized nominee.

- Quality and acceptance of materials not covered under general technical specifications shall be governed by relevant codes.
- The Contractor shall submit manufacturer's test reports on quality and suitability of any material procured from them and their recommendations on storages/ application/ workmanship etc. for the intended use. Submission of manufacturer's test reports does not restrict Owner/ representative from asking fresh test results from an approved laboratory of the actual materials supplied even from an approved manufacturer.
- Contractor shall furnish the QAP for all supply and construction works.

5.3 Electrical

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

- Contractor shall furnish the QAP for Panels, Cables, UPS etc. for Owner's review.
- QA Plan will commence at the instigation of the requisition and follow through to equipment acceptance thus ensuring total conformity to the specifications.
- Type test certificates of similar equipment shall be provided.
- Routine tests shall be carried out on the panels, Cables, UPS, Flame proof equipment and other items as per ISS.
- Owner/Owner's Representative reserve the right to witness routine acceptance tests at the manufacturer works as indicated in QAP & ISS.
- Owner/Owner's Representative will witness the routine tests on Panels, UPS at the manufacturer works prior to despatch, to prove compliance with specifications.
- Owner/Owner's Representative shall carry out the inspection of the erection of equipment and witness the testing & commissioning of the equipment at site and approve the test certificates.

5.4 Instrumentation

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

- Contractor shall furnish the quality assurance procedure for field instruments and cables for review of Owner/ Owner's representative.
- QAP will commence at the instigation of the requisition and follows through to

equipment acceptance. Thus, ensuring total conformity to the specifications.

- Type test certificates of similar equipment shall be provided.
- Owner/Owner's Representative shall carryout the inspection of erection of the equipment and witness the testing and commissioning and approve the certificates.



ENERGISING QUALITY

VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION FOR INSPECTION, FLUSHING & TESTING OF PIPING SYSTEM

VCS – SS – PP - 2501

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		SR	MC	HK	GW	

ABBREVIATIONS:

ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing of Materials
API	American Petroleum Institute
LPG	Liquefied Petroleum Gas

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1.0 SCOPE

This specification covers the general requirements for inspection, flushing and testing of piping systems.

Flushing and testing of all piping systems shall be witnessed by the Company Representative.

2.0 REFERENCE CODES, STANDARDS AND SPECIFICATIONS

Reference has been made in this specification to the latest edition (edition in force at the time of floating the enquiry) of the following codes.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

B31.4 : Pipeline Transportation system for liquids
and Slurries
B31.8 : Gas Transmission and Distribution Piping
Systems. B31.3
: Process piping

3.0 INSPECTION

During various stages and after completion of fabrication and erection, the piping system shall be inspected by the Company representative to ensure that:

- Proper piping material has been used.
- Piping has been erected as per drawings and instructions.
- All supports have been installed correctly.
- Test preparations mentioned in this specification have been carried out.

4.0 FLUSHING

- Flushing of all lines shall be done before pressure testing.
- Flushing shall be done by 'fresh potable water' or by dry compressed air wherever water flushing is not desirable to clean the pipe of all dirt, debris or loose foreign material.
- Required pressure for water flushing shall meet the fire hydrant pressure or utility water pressure. For air flushing, the line/ system shall be pressurized by compressed air at the required pressure which shall be 50 psi maximum. The pressure shall then be released by quick opening of a valve, already in line or installed temporarily for this purpose. This procedure shall be repeated as many times as required till the inside of the pipe is fully cleaned.
- In line instruments like control valves, orifice plates, rotameters, safety valves and other instruments like thermowells which may interfere with flushing shall not be included in flushing circuit.
- The screens/ meshes shall be removed from all permanent strainers before flushing. Screens/ meshes shall be reinstalled after flushing but before testing.
- During flushing temporary strainers shall be retained. These shall be removed, cleaned and reinstalled after flushing, but, before testing.
- In case any equipment such as Filter, Scrubbers column, vessel etc. form part of

piping circuit during flushing, this shall be done with the approval of Company representative. However, equipments thus included in the circuit shall be completely drained and dried with compressed air after flushing is completed.

- During flushing discharged water/ air shall be drained to the place directed by the
- Company representative. If necessary, proper temporary drainage shall be provided by the contractor.
- Care shall be taken during flushing so as not to damage/ spoil work of other agencies. Precautions shall also be taken to prevent entry of water/ foreign matter into equipment's, electric motors, instruments, electrical installations etc. in the vicinity of lines being flushed.
- The contractor shall carry out all the activities required before, during and after the flushing operation, arising because of flushing requirements, such as but not limited to the following:
- Dropping of valves, specials, distance pieces, inline instruments and any other piping part before flushing. The flanges to be disengaged for this purpose shall be envisaged by the contractor and approved by the Company representative. These flanges shall be provided with temporary gaskets at the time of flushing.
- After flushing is completed and approved, the valve distance pieces, piping specials etc. shall be reinstalled by the contractor with permanent gaskets. However, flanges at equipment nozzles and other places where isolation is required during testing, only temporary gaskets shall be provided.

5.0 EXTENT OF TESTING

- With the exclusion of instrumentation, piping systems fabricated or assembled in the field shall be tested irrespective of whether or not they have been pressure tested prior to site welding or fabrication.
- To facilitate the testing of piping systems, vessels and other equipments may be included in the system with the prior approval of Company representative if the test pressure specified is equal to or less than that for the vessels and other equipments.
- Pumps, compressors and other rotary equipments shall not be subjected to field test pressure. Lines which are directly open to atmosphere such as vents, drains, safety valves discharge need not be tested, but all joints shall be visually inspected. Wherever necessary, such lines shall be tested by continuous flow of fluid to eliminate the possibility of blockage.
- However, such lines if provided with block valve shall be pressure tested up to the last block valve.
- Seats of all valves shall not be subjected to a pressure in excess of the maximum cold working pressure of the valve. Test pressure applied to valves shall not be greater than the manufacturer's recommendation nor less than that required by the applicable code. Where allowable seat pressure is less than test pressure, test shall be made through an open valve.

- Instruments in the system to be tested shall be excluded from the test by isolation or removals, unless approved otherwise by the Company representative. Restrictions which interfere with filling, venting, draining such as orifice plates etc. shall not be installed unless testing is complete.
- Control valves shall not be included in the test system. Where bypasses are provided test shall be performed through the bypass and/ or necessary spool shall be used in place of the control valve.
- Pressure gauges which are part of the finished system, but cannot withstand test pressure shall not be installed until the system has been tested. Where piping systems to be tested are directly connected at the battery limits to piping for which the responsibility-rests with other agencies, the piping to be tested shall be isolated from such piping by physical disconnection such as valve or blinds.

5.1 GENERAL REQUIREMENTS / TEST-PREPARATION FOR TESTING

- Testing shall be carried out with permanent gaskets installed unless specified otherwise or instructed by the Company representative.
- No pressure test shall be carried out against closed valve unless approved by the Company representative.
- The Company representative shall be notified in advance by the Contractor, of the testing sequence and programme, to enable him to be present for witnessing the test.
- Before testing, all piping shall be cleaned by flushing to make it free from dirt, loose scale, debris and other loose foreign materials.
- All piping systems to be hydrostatically tested shall be vented at the high points and the systems purged of air before the test pressure is applied.
- Wherever in the line any void exists due to any reasons, like absence of control valves, safety valves, check valves etc. it shall be fitted with temporary spools.
- All joints welded, screwed or flanged shall be left exposed for examination during the test. Before pressurizing the lines, each weld joint shall be cleaned by wire brush to free it from -rust and any other foreign matter.
- Where a system is to be isolated at a pair of companion flanges, a blank shall be inserted between the companion flanges. Minimum thickness of the blank shall be designed in accordance with applicable design code.
- Open ends of piping system where blanks cannot be used, such as pumps, compressors, turbines or wherever equipment or pipe spools have been recovered or disconnected prior to hydrostatic testing, shall be blinded off by using standard blind flanges of same rating as the piping system being tested.
- Pressure gauges used in testing shall be installed as close as possible to the lowest point in the piping system to be tested, to avoid overstressing of any of the lower portions of the system.

- For longer lines and vertical lines, two or more pressure gauges shall be installed at locations decided by the Company representative.
- For lines containing check valves any of the following alternatives shall be adopted for pressure testing:
 - Whenever possible pressurize up-stream side of valve.
 - Replace the valve by a temporary spool and reinstall the valve after testing.
- Provide blind on valve flanges and test the upstream and downstream of the line separately and remove the blind after testing. At these flanges, temporary gaskets shall be provided during testing and shall be replaced by-permanent gaskets subsequently.
- For check valves in lines 1 1/2" and below flapper or seat shall be removed during testing (if possible). After completion of testing the flapper/ seat shall be refitted.
- Gas lines when hydrostatically tested shall be provided with additional temporary supports during testing as directed by the Company representative.
- Piping which is spring or counter-weight supported shall be temporarily supported, where the weight of the fluid would overload the support. Retaining pins for spring supports shall be removed only after testing is completed and test fluid is completely drained.
- When testing any piping system, air or steam of approximately 2 kg/ cm²g may be used as preliminary test to detect missing gaskets etc. as this avoids the necessity of draining the line to make repairs. However, steam shall not be used for this purpose, if the steam temperature is more than the design temperature of the line.
- For jacketed pipes testing of core pipes shall be done on individual pieces where the pipe is continuously jacketed, before it is jacketed. The outer jacket shall be tested separately as a system. For piping with discontinuous jacketing, the core pipe and the jacket shall be tested as separate continuous systems.

5.2 TESTING MEDIA, TEST PRESSURE AND TEST PRESSURE GAUGES

5.2.1 TESTING MEDIA

In general, all pressure tests shall be hydrostatic using iron free water, which is clean and free of silt. Maximum chloride content in water for hydrostatic testing for SS piping shall be 15-20 ppm.

Air shall be used for testing only if water would cause corrosion of the system or overloading of supports etc. in special cases as directed by Company representative.

If operating fluid in the line is much lighter than testing fluid, the additional weight of testing fluid may render piping supports (as designed) inadequate. This will call for additional temporary supports. The typical examples are flare and vapour lines. It is preferable that hydrostatic testing is avoided in such systems and instead pneumatic testing may be specified.

Where air/ water tests are undesirable, substitute fluids such as gas oil, kerosene, methanol etc. shall be used as the testing medium, with due consideration to the hazards

involved. These test fluids shall be specified in the line list given to the contractor.

5.2.2 TEST PRESSURE

The hydrostatic/ pneumatic test. pressure shall be as indicated in the line list or as per the instruction of Company representative.

The selection of the piping system for one individual test shall be based on the following:

- Test pressure required as per line list. Maximum allowable pressure for the material of construction of piping.
- Depending upon the above-requirements and based on construction progress, maximum length of piping shall be included in each test.

5.2.3 TEST PRESSURE GAUGE

All gauges used for field; testing shall have suitable range so that the test pressure of various systems falls in 35% to 65% of gauge scale range. Pressure gage dial shall be minimum of 150 mm. Size of Bourdon shall not be less than 75% of nominal diameter of dial range. Gauge shall be of a good quality and in first class working condition.

Prior to the start of any test or periodically during the field test programme, all test gauges shall be calibrated using a standard dead weight gauge tester or other suitable approved testing apparatus. Any gauge showing an incorrect zero reading or error of more than $\pm 2\%$ of full-scale range shall be discarded. The Company representative shall check the accuracy of master pressure gauge used for calibration. Calibration certificate shall be furnished for the pressure gauges.

5.3 TESTING PROCEDURE

5.3.1 HYDROSTATIC TEST

All vents and other connections used as vents shall be left open while filling the line with test fluid for complete removal of air. In all lines for pressurizing and depressurizing the system, temporary isolation valves shall be provided if valved vents, drains do not exist in the system.

Pressure shall be applied only after the system/ line is ready and approved by the Company representative.

Pressure shall be applied by means of a suitable test pump or other-pressure source which shall be isolated from the system as soon as test pressure is reached and stabilized in the system.

A pressure gauge shall be provided at the pump discharge for guidance in bringing the system to the required pressure.

The pump shall be attended constantly during the test by an authorized person. The pump shall be isolated from the system whenever the pump is to be left unattended.

Test pressure shall be maintained for a sufficient length of time to permit thorough inspection of all joints for leakage or signs of failure. Any joint found leaking during a

pressure test shall be retested to the specified pressure after repair. Test period shall be maintained for a minimum of four hours.

The pump and the piping system to be tested are to be provided with separate pressure indicating test gauges.

Care shall be taken to avoid increase in the pressure due to temperature variation during the test.

5.3.2 PNEUMATIC TEST

When testing with air, pressure shall be supplied by means of a compressor. The compressor shall be portable type with a receiver, after cooler and oil separator.

Piping to be tested by air shall have joints covered with a soap and water solution so that the joints can be examined for leaks.

All other details shall be same as per hydrostatic testing procedure (specified above).

5.4 COMPLETION OF TESTING

After the hydrostatic test has been completed, pressure shall be released by opening the vents, in a manner and at a rate so as not to endanger personnel or damage equipments. All vents shall be opened before the system is to be drained and shall remain open till all draining is complete, so as to prevent formation of vacuum in the system. After draining, lines/ systems shall be dried by air. In services like dry air, ethylene etc., small traces of water can cause problem. For such lines hot air drying is to be done after hydro test.

After testing is completed the test blinds shall be removed and equipment/ piping isolated during testing shall be connected using the specified gaskets, bolts and nuts. These connections shall be checked for tightness in subsequent pneumatic tests to be carried out by the contractor for complete loop/ circuit including equipments (except rotary equipments).

Pressure test shall be considered complete only after approved by the Company representative. Defects, if any, noticed during testing shall be rectified immediately and retesting of the system/ line shall be done by the contractor at his cost.

5.5 TEST RECORDS

Records in triplicate shall be prepared and submitted by the contractor for each piping system, for the pressure test done in the Performa provided/ approved by the Company representative.



VCS QUALITY SERVICES PVT. LTD.

DESIGN GUIDE FOR RADIOGRAPHY REQUIREMENTS

VCS-SS-PP-2506

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Abbreviations:

API	:	American Petroleum Institute
ASME	:	American Society of Mechanical Engineers
AWS	:	American Welding Society
BS	:	British Standards
IQI	:	Image Quality Indicator

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1.0 GENERAL

Gamma-ray techniques in general are less sensitive compared to X-ray techniques for penetrated thicknesses of less than 50 mm. For the thinner material, the larger is the difference in sensitivity between radiographs taken with X-ray and Gamma-rays. The "flaw sensitivity" with use of Gamma-rays will be inferior to that of good X-ray techniques. The guidelines have been prepared to specify and implement the radiography requirements at design stage and later on, at fabrication & inspection stages.

2.0 SCOPE

This guide describes the radiography requirements covering the following:

- Design Requirements

- Type of Radiography film

- Material of construction for Image Quality Indicator (IQI)

- Placement of (IQI)

3.0 RADIOGRAPHY REQUIREMENTS

3.1 Design Requirements

The quality of radiographs for the job shall be as per the requirements of the design code and shall be judged by placement of the type of IQI as identified by the same code. The radiographs shall be taken with the help of X-rays source. The use of Gamma-rays (Ir-192) can be considered, wherever it is possible to get the required "Radiography Sensitivity" as per the requirements by the technique adopted for the purpose.

In order to permit the use of Gamma-rays for radiography in place of X-rays, it is necessary that the radiography procedure gives details of the following:

- Type of film

- Diameter/Thickness of the material

- Type of intensifying screens

- Source to Film Distance (SFD) and others (such as film density), which are desired in establishing the required sensitivity level as per the design code

- Type of source and source size

Radiography sensitivity is primarily influenced by factors such as:

- Film selection

- Intensifying screen selection

- Geometric Sharpness

- Film density

For critical services for effective thickness of 10 mm and below, radiography shall be carried out

with X-rays only. When X-ray is not feasible, Gamma radiography can be considered (ANNEXURE-I). The effective wall thickness shall be the actual pipe wall thickness for single wall exposure and twice the thickness for double wall exposure.

3.2 Type of Radiography Films

3.2.1 The type of description given regarding quality of films in different codes may not align with the description given by various film manufacturers. Therefore, for the purpose of this guide, the following is the examples of some of the film relating to various descriptions:

	Carestream (Kodak)	GE (Agfa Gevaert)
Ultra-fine-grain High contrast	Industrex DR50	D2
	Industrex MX125	D4
Fine grain	Industrex AA400	D7
High contrast	Industrex T200	-

3.2.2 Fuji films are also available in the Indian Market. Their equivalent can be worked out based on their literature and actual experiments.

3.2.3 When Gamma radiography is employed only ultra-fine grained high contrast film shall be used.

3.3 Material of Construction of IQI

In the case of low alloyed ferrous materials, IQI of low carbon steel is normally adequate. For highly alloyed ferrous materials which are usually referred to as steels, an IQI made of that particular special steel, for example stainless steel, may be used where there is extensive application of a particular alloy.

For aluminium or magnesium alloys, where there is insufficient application to justify the production of IQI from the same alloy the IQI of pure aluminium or pure magnesium respectively should be used.

For copper and its alloys, IQI of copper should be used.

Whenever it is considered impractical to get IQI of required material, the equivalent shall be established at site based on actual experiments.

In addition to the above, reference also shall be made to ASME Sec.V for selection of IQI material and its identification.

3.4 Placement of IQI

3.4.1 In order to judge the quality of radiography, the IQI should be placed covering the area under examination as indicated in the enclosed Fig.1 (a) and 1(b) along with other details:

Area marker

Date of radiograph

Thickness

Joint number

Welder number

Job number

And additionally, if desired, contractor mark may also be placed.

The IQI shall be so placed, that the smallest hole (wire of the lowest diameter) is towards the outer end of the film away from the centre.

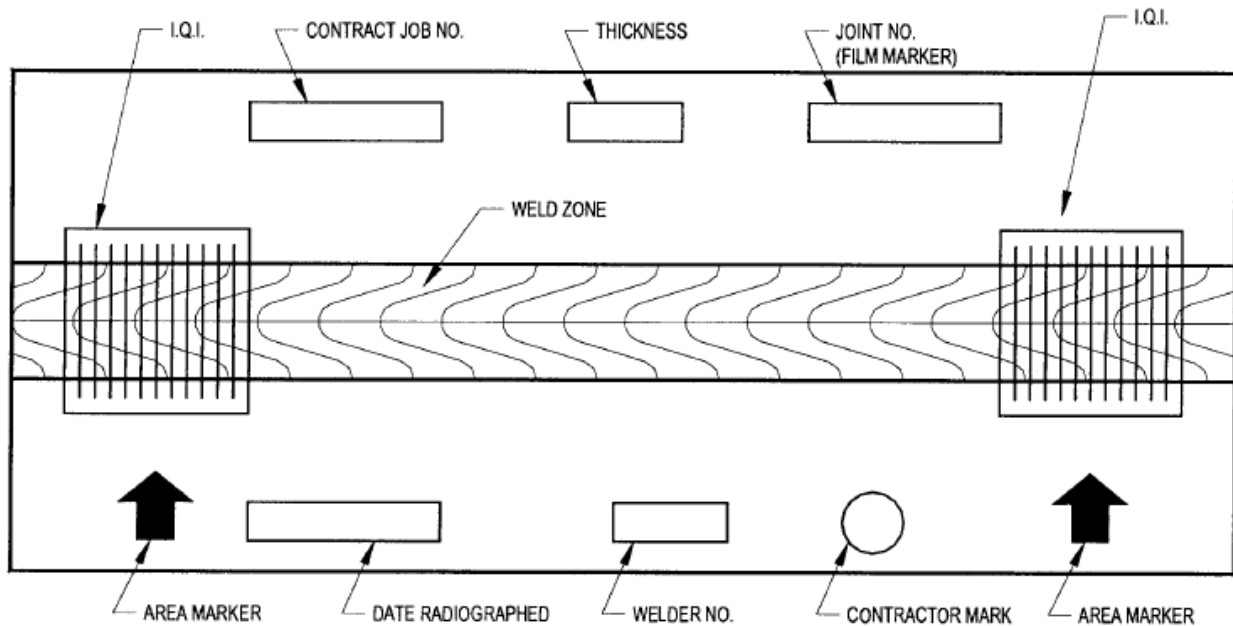


FIG.1 (a): FILM IDENTIFICATION AND PLACEMENT OF PENETRIMETERS

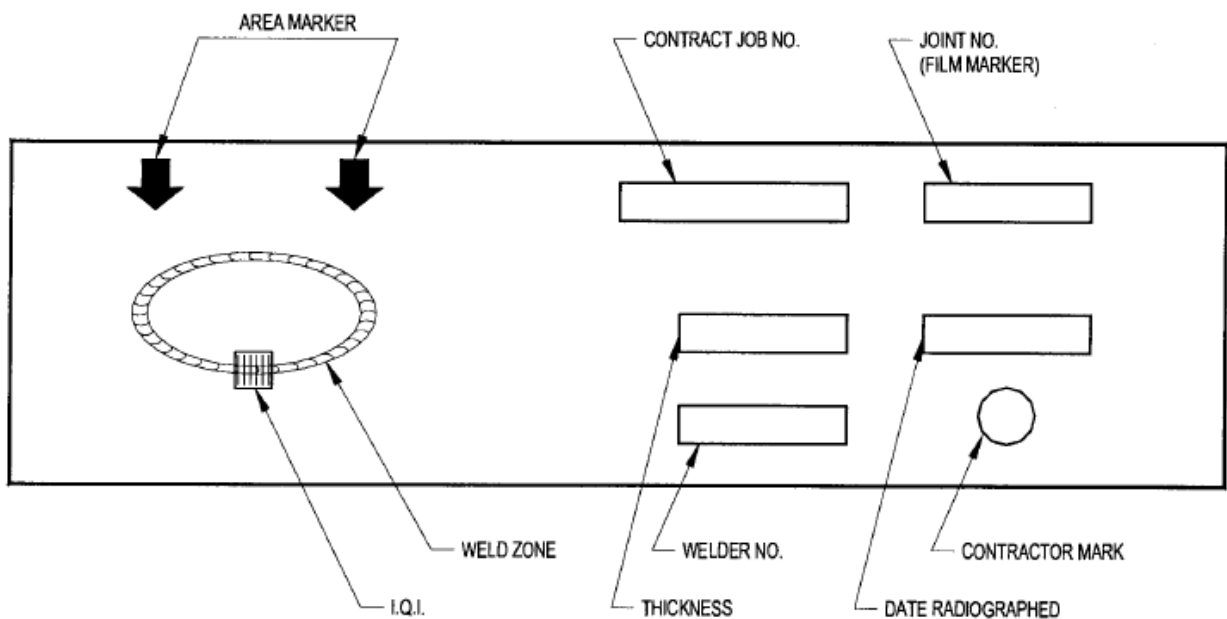


FIG.1 (b): FILM IDENTIFICATION AND PLACEMENT OF PENETRIMETERS
(DOUBLE WALL DOUBLE IMAGE)

ANNEXURE-1

Radiography of welds in pipes of wall thickness below 10 mm (When X-rays are not used)

For radiography of welds in pipes of wall thicknesses below 10 mm and upto 5 mm, the guidance for this work is given below in relation to the double wall single image method.

The requirements should be followed so far as possible with the following:

- A. Only Se-75 should be used.
- B. Only ultra-fine-grain or fine-grain films may be used, preferably the former one.
- C. The source should be placed on the side of the pipe remote from the film, so that the source to film distance is approximately the same as the pipe outside diameter. The source should normally be in the plane of the weld centre line and in contact with or close to the weld. By agreement between the contracting parties, the source may be placed in some other position, after due consideration has been taken of the effects of this on the image formation.
- D. The film should be curved around the pipe so as to ensure good contact with the weld.

The details of radiography procedure so established shall be recorded by the radiography agency and duly approved by Engineer-in-Charge.



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AREAS OF DIMAPUR, NAGALAND GA

Ref P&ID: C261162-00-PC-PID-1300
C261162-00-PC-PID-1400
C261162-00-PC-PID-1500

GENERAL DESIGN SPECIFICATIONS

SR. NO.	DESCRIPTION	Unit / UOM	DATA
1	FILTER SEPARATOR - TYPE	~	Cartridge Type
2	QUANTITY / TAG NO. / LOCATION	Nos.	12*2 QTY / F-1001A&B(1 working & 1 stand by)
3	VESSEL DESIGN CODE	~	ASME Section VIII, Div 1 (U-stamped)
4	TYPE OF FILTER ELEMENTS	~	Cartridge

FLUID PROPERTIES

5	SERVICE FLUID	~	Natural Gas (Dry)
6	LIQUID TO BE REMOVED	~	Particulate matters+ Iron sulphides + pipe scales
7	VAPOUR SPACE MEDIUM	~	Hydrocarbon Gas
8	MOLECULAR WEIGHT OF GAS	kg/k-mol.	17.96 ~ 19
9	GAS COMPRESSIBILITY @ P, T(4.07 kg/cm ² , 48°C)	kg/cm ² & °C	Z= 0.886
10	GAS COMPRESSIBILITY @ P, T(2.03 kg/cm ² , 10°C)	kg/cm ² & °C	-
11	SPECIFIC ISOBAR HEAT CAPACITY(C _p)	KJ/ kg-k	-
12	SPECIFIC ISOCHOR HEAT CAPACITY(C _v)	KJ/ kg-k	1.52
13	GAS SPECIFIC GRAVITY @P,T & COMPOSITION		0.562
14	GAS DYNAMIC VISCOSITY @ P,T..	cP	-
15	GAS DENSITY @ P,T...	kg/m ³	0.25 ~ 4.0
16	LIQUID DENSITY @ P,T...	kg/m ³	995
17	LIQUID VISCOSITY @ P,T...	cP	.0144

DESIGN PARAMETERS

18	DESIGN GAS FLOW RATE	SCMH	1500,2500 & 5000
19	DESIGN TEMPERATURE (MIN. / MAX.)	°C	-29 to 65 °C
20	DESIGN PRESSURE	kg/cm ² g	49.0

OPERATING PARAMETERS

21	OPERATING FLOW RATE (MIN. / MAX)	SCMH	1500,2500 & 5000
22	OPERATING PRESSURE	Kg/cm ² g	45 to 15 Bar.g
23	OPERATING TEMPERATURE (MIN. / MAX.)	°C	0 ~ 45 °C
24	ALLOWABLE PRESSURE DROP (CLEAN/DIRTY)	Kg/cm ²	0.1 / 0.3
25	FILTRATION EFFICIENCY	%	99 % for <= 5 micron

MATERIAL OF CONSTRUCTION

SR. NO.	DESCRIPTION	UOM	MATERIAL GRADE
26	SHELL,TUBE SHEET,ELLIPSOIDAL HEAD	~	SA516 Gr.70N / SA 106 Gr. B
27	NOZZLE NECK	~	SA 106 GR.B
28	NOZZLE FLANGES	~	SA105 N
29	EXTERNAL BOLTINGS	~	SA193 GR.B7 & SA 194 GR.2H (HOT DIP GALVANISHED)
30	INTERNAL BOLTINGS	~	SS316
31	STUD WITH HEAVY HEX NUT FOR 2" NB NOZZLE	~	SA193 GR.B7 & SA 194 GR.2H (HOT DIP GALVANISHED)
32	PIPE FITTINGS	~	SA 234 GR.WPB
33	INTERNAL GASKET, IF ANY	~	# (Suitable for Natural Gas)
34	EXTERNAL GASKET / O-RING, IF ANY	~	SPIRAL WOUND GRAPHITE FILLED SS 316 METAL WINDING WITH SS304 INNER RING & CS OUTER
35	FILTER ELEMENT / MESH	~	BOROSILICATE FIBRE GLASS ,SINTERED POLYETHYLENE, SINTERED CERAMIC OR EQUIVALENT
36	OTHER INTERNAL ATTACHMENT, IF ANY	~	SAME AS PARENT MATERIAL
37	PIPE FOR DRAIN OPENING	~	SA106 GR. B
38	LIFTING LUGS	~	SA516 GR. 70N



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FILTER PARAMETERES

SR. NO.	DESCRIPTION	UOM	DATA
39	DESIGN CODE	~	ASME -SEC VIII DIV-1 (LATEST EDITION)
40	CODE STAMPING (ASME U-STAMP)	~	Required
41	CORROSION ALLOWANCE	mm	3.0
42	FILTER GROSS GAS VOLUMETRIC CAPACITY	m ³	#
43	HYDROSTATIC TEST PRESSURE	kg/cm ² g	1.5 x Design Press. Or As per Code Calculations (Whichever is higher)
44	LIQUID HOLDING CAPACITY	m ³	#
45	MAKE / MODEL OF FILTER ELEMENT	~	#
46	NO. OF FILTER CARTRIDGES REQUIRED	Nos.	#
47	FILTER ELEMENT DIMENSION (OD x WIDTH)	mm	#
48	NOZZLE MAX. ALLOWABLE FORCES	N	#
49	NOZZLE MAX. ALLOWABLE MOMENTS	N-mm	#
50	HOUSING (DIA. x LENGTH)	mm	#
51	TOTAL SOLID HOLDING CAPACITY	m ³	#
52	TOTAL NET / GROSS FILTRATION AREA	mm ²	#
53	MAX. WITHSTAND DIFFERENTIAL PRESSURE@ P , T	Kg/cm ² g	#
54	BETA RATIO	mm ²	#
55	PARTICLE / MESH SIZE	Micron	3 & Above
56	MOST PENETRATING PARTICLE SIZE(MPPS)	µm	#
57	NAME OF FILTER ELEMENT MANUFACTURER	~	#
58	FIXING DETAIL OF FILTER ELEMENT	~	#
59	PRESSURE RATING OF FLANGES	psi / class	300#
60	FINISHED SURFACE OF FLANGES	AARH	125
61	DESIGN WIND VELOCITY (AS PER IS-875 PART-III)-2020	m/s	47
62	SEISMIC ZONE (AS PER IS-1893-RSM)	~	As per respective GA
63	ELEMENTS & VESSEL WALL CLEARANCE	mm ²	#
64	PRESSURE DROP AT INLET DUE EXPANSION & CONTRACTION	kg/cm ² g	#
65	PRESSURE DROP AT OUTLET DUE EXPANSION & CONTRACTION	kg/cm ² g	#
66	FILTER CARTRIDGE BURSTING PRESSURE	kg/cm ² g	#
67	VELOCITY OF GAS AT INLET & OUTLET	m/sec.	#
68	VELOCITY OF GAS AT SHELL	m/sec.	#
69	FLOW VS INLET PRESSURE CURVE	~	#
70	FLOW VS PRESSURE DROP CURVE	~	#
71	DESIGN GAS FLOW RATE	SCMH	#
72	DESIGN LIFE	Years	30
73	ALL NOZZLE ORIENTAION	° / Radians	#



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**CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL
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NOZZLE DETAIL

SR. NO.	NOZZLE NO.	DESCRIPTION	UOM	FLANGE SIZE, PRESSURE RATING & FLANGE TYPE / DETAILS, PIPEING CLASS	END
74	N1	GAS INLET	Inch	2" NB, 300#, WNRF, 30HC	
75	N2	GAS OUTLET	Inch	2" NB, 300#, WNRF, 30HC	
76	N3	DRAIN	Inch	2" NB, 300# WNRF, 30HC	
77	N4	VENT	Inch	1" NB, 300#, WNRF, 30HC	
78	N5	PRESSURE SAFETY VALVE	Inch	1" NB, 300#, WNRF, 30HC	
79					

DIMENSION & WEIGHT

SR. NO.	DESCRIPTION	UOM	DATA
78	BOTTOM OF SADDLE SUPPORT TO TOP OF INLET FLANGE	mm	#
79	OVERALL LENGTH (INCLUDING HEAD)	mm	#
80	SHELL INSIDE DIA. & TOTAL LENGTH	mm	#
81	EMPTY WEIGHT	kg	#
82	OPERATING WEIGHT	kg	#
83	HYDROSTATIC TEST WEIGHT	kg	#
84	OVERALL FILTER WATER LITRE CAPACITY	Ltr.	#

ACCESSORIES

SR. NO.	DESCRIPTION	UOM	DATA
85	TYPE OF END CLOSURE	~	Blind frange with davitor
86	LIFTING LUGS	~	As Required
87	ANCHOR / FOUNDATION BOLTS & NUTS	~	#
88	BLIND FLANGES, BOLTS, NUTS & GASKETS AS PER NOZZLE DETAIL	~	Required
89	LADDER / PLATFORM	~	As applicable

INSPECTION & TESTING

SR. NO.	DESCRIPTION	UOM	DATA
90	RADIOGRAPHY	%	100
91	PWHT	~	As per Code
92	HYDROSTATIC TEST	~	Required
93	DP / MPI / UT / IMPACT TEST	~	Required
94	PAINTING	~	Required (As per VCS Doc. No. VPC-SS-PP-2502)
95	PNEUMATIC TEST PROCEDURE	~	#
96	HYDRO TEST PROCEDURE	~	#
97	PWHT PROCEDURE	~	#
98	PT & RT PROCEDURE	~	#
99	OPERATION & MAINTENANCE PROCEDURE	~	#



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NOTES :

i	VENDOR TO PROVIDE THE DATA AS MARKED "**".
ii	THIS DATA SHEET TO BE READ IN CONJUNCTION WITH THE P&ID & TENDER DOCUMENTS.
iii	FLANGES AND GASKETS SHALL CONFORM TO ASME B16.5 & ASME B16.20 RESPECTIVELY.
iv	FILTER ELEMENT MUST WITHSTAND A DIFFERENTIAL PRESSURE OF 1 KG/CM2 WITHOUT CRACKING AND FAILING.
v	BIDDER TO PROVIDE LOAD CALCULATIONS FOR NOZZLES MENTIONING ALLOWABLE FORCES AND MOMENTS.
vi	ALL GASKETS USED FOR HYDROSTATIC TESTING SHALL BE SAME AS SERVICE GASKETS.
vii	ALL NOZZLE BOLT HOLES SHALL STRADDLE VESSEL PRINCIPAL CENTRE LINES.
viii	ALL BUTT WELDED JOINTS SHALL BE FULL PENETRATION WELD & ROOT RUN SHALL BE CARRIED OUT BY TIG, IF ACCESSIBLE FROM OTHER SIDES SHALL BACK CHIPPED TO SOUND METAL & REWELD.
ix	FILLET WELDS SHALL BE EXAMINED BY MPI / DP METHOD.
x	EARTHING LUG SHALL NOT BE GALVANISED OR PAINTED.
xi	BIDDER TO SIZE AND PROVIDE COALESCER FILTER ELEMENT TO MEET FILTRATION EFFICIENCY.
xii	DESIGN LIFE OF CARTRIDGE FILTER SHALL BE 30 YEARS.
xiii	GAS IS NORMALLY DRY IN NATURE ,HOWEVER EVENTUAL MOISTURE PRESENCE IN GAS ,VENDOR SHALL TAKE CARE OF ITS REMOVAL.
xiv	VENDOR TO ENSURE THAT FILTER SHALL BE SIZED FOR MINIMUM FLOW FOR 10% OF DESIGN FLOW.(TURN DOWN RATIO 10:1)
xv	ALL FASTENERS SHALL BE HOT DIP GALVANISED AS PER ISO 10683 / ASTM A153.
xvi	ALL INSTRUMENTS SHOULD BE ACCESSIBLE i.e VISIBLE FOR OPERATORS & CAN BE OPEARTED AT REASONABLE ELEVATION.
xvii	EQUIPMENT NOZZLE & PIPING ORIENTATION TO BE CONFIRMED DURING DETAILED ENGINEERING
xviii	DURING FILTER SIZING CALCULATION THERMAL CONDITION TO BE CONSIDER ISOTHERMAL STEADY STATE CONDITION & PRESSURE DROP EXCLUDING ELEVATION
xix	FILTRATION FOULING TO BE CONSIDERED AT 0.0 %
xx	VENDOR SHALL CONFIRM CARTRIDGE FILTER ELEMENTS FLOW PATTERN DURING GAS FLOW FROM INLET TO OUTLET.
xxi	THE VENDOR SHALL REFER SOR FOR FILTER QUANTITY AS MARKED (**)



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		QUALITY ASSURANCE PLAN FOR SKIDS				Document No No.: 1007-00-IN-ITP-3006							
						DATE:							
CLIENT:		CONSULTANT:				PROJECT:							
FOA NO:									Sheet No. 1 / 1				
SR No	Description	Characteristic	Class	Type of Check	Quantam of Check	Reference Documents	Acceptance Norms	Format of Records	Inspection By				Remarks
									M	Bidder	TPIA	CLIENT /PMC	
1	Approval of documents i.e. P&ID, GAD, QAP , Design Calc, datasheets etc.	-	Major	Approval	100%	-	-	-	-	R	R	A	
2 Welding, NDT & Testing for Interconnecting Piping													
2.1	WPS / PQR	-	Major	Welders Qualification & Welding	100%	Approved WPS / PQR	As per ASME SEC. IX	WPS / PQR from Record	-	P	R	R	--
2.2	D P T of Non- Radiography weld joints	D.P.T. After Final Welding	Major	100% (Fillet weld)	100%	ASME SEC V /SEC VIII	ASME SEC.31.3 (table 341.3.2, Normal & Category M fluid)	Internal Inspection Report	-	P	R	R	--
2.3	Radiography Test	Radiography after Final Weld	Major	As per Standard	100% RT EXCLUDING DRAIN & VENT PIPING	ASME SEC V /SEC VIII	ASME SEC.31.3 (table 341.3.2, Normal & Category M fluid) ,	Interpretation Report	-	P	R	R	Review of report
2.4	Hydro Testing of Interconnecting Piping	28.5 kg/cm2g for 150 # & 73.5 kg/cm2g for 300# for 240 mins.	Major	Strength	100%	Approved P&ID & GAD	As per ASME SEC.31.8 & IGE/TD/13	Inspection Report	-	P	W	W	--
3 Final Inspection of Skid Assembly													
3.1	Final Dimensional / Visual Inspection	Complete Skid L XBX H	Major	Inspection	100%	GAD	Approved Data Sheet	Reports	--	P	W	W	--
3.2	Painting of Skid	Painting	Major	DFT - micron value	100%	Approved Painting Spec.	Approved Painting Spec.	Reports	--	P	R	R	--
3.3	Pneumatic Leak Test of Skid	Pneumatic Leak Test at 7 kg/cm2g	Major	Strength	100%	Approved P&ID & GAD	As per ASME SEC.31.8 & IGE/TD/13	Inspection Report	-	P	W	W	--
3.4	Factory Acceptance Test	Testing as per FAT Report	Major	Performance Test	100%	Approved FAT Procedure	Approved FAT Procedure	FAT Report	--	P	W	W	--
4 Final Documentation:													
4.1	Design & Calculation, Material TC, Calibration Certificate, In line process inspection & test records, As Built GAD & P & ID	History docket	Major	Verification of records	100%	Approved specification	As per approved specification	MDR,History Docket	-	R	R	R	--
#This is Typical QAP. Bidder to prepare the QAP specific to the project & submit for Review / Approval.		Legend:		M : Manufacturer			P : Performer W : Witness			Approved By:			
				TPI : Third Party Inspection Agency			R : Review ; A: Approval; RW: Random Witness						
				C : Client			V : Verification						
										For M/s. VCS QUALITY SERVICES PVT.LTD.			
NOTE: EN 10204, Type 3.2 certificates shall be provided for bought out items. Those shall be inspected by TPI appointed by Vendor.													

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**CITY GAS DISTRIBUTION PROJECT
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**MANDATORY SPARES FOR
DISTRICT REGULATING STATION**

TOTAL SHEETS

4

DOCUMENT NO

C261162

CGD

IN

MS

3009

HPOIL GAS PRIVATE LIMITED (HOGPL)

**CITY GAS DISTRIBUTION PROJECT
OF DIMAPUR, NAGALAND GA**

**MANDATORY SPARES FOR
DISTRICT REGULATING STATION**

C1	06-05-2026	ISSUED FOR INTERNAL REVIEW	AB	SA	AB
REV	DATE	DESCRIPTION	PREP	CHK	APPR

List of Mandatory spares for 1500 SCMH- DRS Skid

1	Pressure Gauges	10% or minimum 1 No. (whichever is higher) of Each Type & Range
2	Temperature Gauges	10% or minimum 1 No. (whichever is higher) of Each Range
3	Differential Pressure Gauge	10% or minimum 1 No. (whichever is higher) of Each Range
4	CRV	10% or minimum 1 No. (whichever is higher) of Each Range
5	PSV	10% or minimum 1 No. (whichever is higher) of Each Range
6	Control Valve / Regulator/ Monitor/ SSV a) Trim (Seat and Disc) b) Diaphragm c) Spring d) Limit Switch e) Any other item part of repair kit f) Plug	10% or min 2 Nos. (whichever is higher) for each type, if used & as applicable for each i.e. a), b), c), d), e) & f)
7	RPD Flow meter a) Local digital display b) HF sensor + box	10% or min 1 No. (whichever is higher) for each type used & as applicable for each i.e. a) & b)
8	EVC a) Lithium Battery b) EVC-GSM modem Communication cable c) EVC-Meter communication cable	10% or min. 1 No. (which-ever is higher) for each type, if used & as applicable for each i.e. a), b), c).
9	Filter: a) 2 Sets of cartridges & gaskets	2 Sets of cartridges & gaskets

Note : Vendor to provide additional spares if any other than the items mentioned in the above

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List of Mandatory spares for 2500 SCMH- DRS Skid

1	Pressure Gauges	10% or minimum 1 No. (whichever is higher) of Each Type & Range
2	Temperature Gauges	10% or minimum 1 No. (whichever is higher) of Each Range
3	Differential Pressure Gauge	10% or minimum 1 No. (whichever is higher) of Each Range
4	CRV	10% or minimum 1 No. (whichever is higher) of Each Range
5	PSV	10% or minimum 1 No. (whichever is higher) of Each Range
6	Control Valve / Regulator/ Monitor/ SSV a) Trim (Seat and Disc) b) Diaphragm c) Spring d) Limit Switch e) Any other item part of repair kit f) Plug	10% or min 2 Nos. (whichever is higher) for each type, if used & as applicable for each i.e. a), b), c), d), e) & f)
7	RPD Flow meter a) Local digital display b) HF sensor + box	10% or min 1 No. (whichever is higher) for each type used & as applicable for each i.e. a) & b)
8	EVC a) Lithium Battery b) EVC-GSM modem Communication cable c) EVC-Meter communication cable	10% or min. 1 No. (which-ever is higher) for each type, if used & as applicable for each i.e. a), b), c).
9	Filter: a) 2 Sets of cartridges & gaskets	2 Sets of cartridges & gaskets

Note : Vendor to provide additional spares if any other than the items mentioned in the above list

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List of Mandatory spares for 5000 SCMH- DRS Skid

1	Pressure Gauges	10% or minimum 1 No. (whichever is higher) of Each Type & Range
2	Temperature Gauges	10% or minimum 1 No. (whichever is higher) of Each Range
3	Differential Pressure Gauge	10% or minimum 1 No. (whichever is higher) of Each Range
4	CRV	10% or minimum 1 No. (whichever is higher) of Each Range
5	PSV	10% or minimum 1 No. (whichever is higher) of Each Range
6	Control Valve / Regulator/ Monitor/ SSV a) Trim (Seat and Disc) b) Diaphragm c) Spring d) Limit Switch e) Any other item part of repair kit f) Plug	10% or min 2 Nos. (whichever is higher) for each type, if used & as applicable for each i.e. a), b), c), d), e) & f)
7	RPD Flow meter a) Local digital display b) HF sensor + box	10% or min 1 No. (whichever is higher) for each type used & as applicable for each i.e. a) & b)
8	EVC a) Lithium Battery b) EVC-GSM modem Communication cable c) EVC-Meter communication cable	10% or min. 1 No. (which-ever is higher) for each type, if used & as applicable for each i.e. a), b), c).
9	Filter: a) 2 Sets of cartridges & gaskets	2 Sets of cartridges & gaskets

Note : Vendor to provide additional spares if any other than the items mentioned in the above

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REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	16/06/2017					
		GS	ADE	AD	SK	
01	20/01/2020					Formatting update, Doc Numbering change from VCS-SD-ITP-007 to VCS-ITP-PP-2007
		AG	MC	AD	SK	
02	19/05/2020					Revised as Marked
		AG	MC	AD	SK	
03	19/12/2021					Revised as Marked
		SR	MC	HK	HK	
04	27/05/2022	<i>Rajiv</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	Revised as Marked
		SR	MC	HK	HK	

ABBREVIATIONS:			
CE	Carbon Equivalent	NDT	Non-Destructive Testing
DCN	Dispatch Clearance Note	PO	Purchase Order
DFT	Dry Film Thickness	PQR	Procedure Qualification Record
DPT	Dye Penetrant Testing	PR	Purchase Requisition
HT	Heat Treatment	RT	Radiography Testing
ITP	Inspection and Test Plan	TC	Test Certificate
IC	Inspection Certificate	TPI or TPIA	Third Party Inspection Agency
IGC	Inter Granular Corrosion	UT	Ultrasonic Testing
IR	Inspection Report	VDR	Vendor Data Requirement
IRC	Inspection Release Certificate	WPQ	Welders Performance Qualification
MPT / MT	Magnetic Particle Testing	WPS	Welding Procedure Specification
MTC	Material Test Certificate		
LEGENDS:			
H - Hold (Do not proceed without approval)			
W - Witness (Give due notice, work may proceed after scheduled date)			
P - Perform			
R - Review			
RW - Random Witness [As specified or 10% (min.1 no. of each size and type of Bulk items)]			

1.0 SCOPE:

This Inspection and Test Plan covers the minimum testing requirements of Ball Valves.

2.0 REFERENCE DOCUMENTS:

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 VENDOR	VENDOR	TPIA
1.0	PROCEDURES							
1.1	Hydrostatic Test, 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	Forging / Casting:							
	1) Body	Visual & Dimension	100%	Material & Technical Specification	Inspection Report	H	H	-
	2) End Piece							
	3) Ball	Chemical: Chemical Analysis IGC (For SS component)	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
	4) Seat Ring							
	5) Pup Piece (as applicable)	Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	W (Note-1)

**INSPECTION AND TEST PLAN
FOR
BALL VALVE**

**DOC NO: VCS-ITP-PP-2007
Rev No : 04**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS / METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUB VENDOR	VENDOR	TPIA
		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	W (Note-1)
		Non-Destructive Examination (NDT): Radiography (100% Critical Area)	100%	Material & Technical Specification / ASME B 16.34	RT Report	H	R (RT-Film review)	R (RT-Film review)
		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
		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

**INSPECTION AND TEST PLAN
FOR
BALL VALVE**

**DOC NO: VCS-ITP-PP-2007
Rev No : 04**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS / METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUB VENDOR	VENDOR	TPIA
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 (RT-Film review)	R (RT-Film review)
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
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

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS / METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUB VENDOR	VENDOR	TPIA
6.8		Fire Safe Test	100%	API-6FA / ISO-10497	Fire safe type test report	-	H	R
6.9	Final Stamping	Stamping Of Accepted Valves	Stamping of Valves which are witnessed by VCS/TPIA	As per Tender Specification	Inspection Report	-	H	H
6.10	Strip Test	Component integrity, PMI of BOM	One per size per rating	-	Test report	H	H	H
7.0	PAINTING & PACKING	Surface examination & DFT Inspection: Visual & Measurement	100%	As per Tender Specification	Painting Record	-	H	R
8.0	DOCUMENTATION & INSPECTION CERTIFICATE(IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	As per Tender Specification	Vendor TC & IC	-	H	H
9.0	FINAL DOCUMENTATION & SUBMISSION OF REPORTS	Compilation of IR/IRC/DCN/MTC/DRGS./VDR	100%	EN 10204 type 3.2/3.1 certification as specified in valve datasheet (Note-1)	Compliance Certificate	-	H	-

NOTES (As applicable):

1. If the certification is specified as EN 10204 Type 3.1 in Data sheet / Material Requisition, then 'W' may be replaced with 'R' with Material Traceability.
2. ITP shall be submitted including but not limited to the item/activity covered above. Any item/activity identified and required for the completeness shall also be covered in the ITP submitted by the manufacturers.



ENERGISING QUALITY

VCS QUALITY SERVICES PVT. LTD.

INSPECTION AND TEST PLAN FOR GATE/GLOBE/CHECK VALVES VCS –ITP –PP –2008

02	27/05/2022	SR	MC	HK	GW
		<i>Rajiv Kumar</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>

Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

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CONTROLLED COPY	:	If in soft and signed

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	22/04/2020					Revised as Marked
		MB	MC	AD	SK	
01	19/12/2021					Revised as Marked
		SR	MC	HK	HK	
02	27/05/2022	<i>Rajiv</i>				Revised as Marked
		SR	MC	HK	GW	

ABBREVIATIONS:			
CE	Carbon Equivalent	NDT	Non-Destructive Testing
DCN	Dispatch Clearance Note	PO	Purchase Order
DFT	Dry Film Thickness	PQR	Procedure Qualification Record
DPT	Dye Penetrant Testing	PR	Purchase Requisition
HT	Heat Treatment	RT	Radiography Testing
IC	Inspection Certificate	TC	Test Certificate
IR	Inspection Report	TPI or TPIA	Third Party Inspection Agency
IRC	Inspection Release Certificate	UT	Ultrasonic Testing
ITP	Inspection and Test Plan	VDR	Vendor Data Requirement
MPT/MT	Magnetic Particle Testing	WPQ	Welders Performance Qualification
MTC	Material Test Certificate	WPS	Welding Procedure Specification
LEGENDS:			
H - Hold (Do not proceed without approval)			
W - Witness (Give due notice, work may proceed after scheduled date)			
P - Perform			
R - Review			
RW - Random Witness [As specified or 10% (min.1 no. of each size and type of Bulk items)]			



**INSPECTION AND TEST PLAN
FOR
GATE/GLOBE/CHECK VALVES**

**DOC NO: VCS-ITP-PP-2008
Rev No : 02**

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 VENDOR	VENDOR	TPIA
1.0	Procedure						
1.1	Hydrostatic Test, 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

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
2.0	Material Inspection						
2.1	Castings & Forgings (Body, Bonnet, Disc, Stem, Body ring)	Chemical, Mechanical, Heat Treatment, NDT & Other Properties as applicable	100%	Test Certificates	H	R	W (Note-1)
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 (RT-Film review)	R (RT-Film review) (Note-1)
2.4	Bars for Trim material	Chemical Analysis	Each Heat	Test Certificates& Lab Report	H	R	R
2.5	Gaskets, Gear units, Fasteners, Gland, Packings, etc.	Physical / Chemical Properties	100%	Test Certificates& Lab Report	H	R	R

**INSPECTION AND TEST PLAN
FOR
GATE/GLOBE/CHECK VALVES**

DOC NO: VCS-ITP-PP-2008
Rev No : 02

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	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	R
3.2	Machining of components	Visual / Dimension	100%	Inspection Reports	-	H	-
4.0	Final Inspection						
4.1	Hydrostatic / Pneumatic Test	Hydrostatic Test – Shell Pneumatic Test – Seat & Back Seat	As per PR / Purchase Specification	Test Report	-	H	RW
4.2	Visual / Dimension	Surface & Dimension Check	100%	Test Report	-	H	RW
4.3	Final Stamping	Stamping Of Accepted Valves	Stamping of Valves which are witnessed by TPIA.	Inspection Report	-	H	H

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
4.4	Strip Test	Component integrity, PMI of BOM	One per size per rating	Test report	H	H	H
5.0	Painting						
5.1	Painting and Colour coding as applicable	Visual / DFT Check	100%	Inspection Report	-	H	R
6.0	Documentation & IC						
6.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Vendor TC & IC	-	H	H
7.0	Final Documentation & Submission of Reports	Compilation of IR/IRC/DCN/MTC/DRGS. /VDR	100%	Compliance Certificate (Note-1)	-	H	-

NOTES (As applicable):

1. If the certification is specified as EN 10204 Type 3.1 in Data sheet / Material Requisition, then '**W**' may be replaced with '**R**' with Material Traceability.
2. ITP shall be submitted including but not limited to the item/activity covered above. Any item/activity identified and required for the completeness shall also be covered in the ITP submitted by the manufacturers.



ENERGISING QUALITY

VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION FOR PAINTING

VCS – SS – PP - 2502

					
04	30.06.2022	RP	MC	HK	GW
03	28.01.2020	MB	AK	AD	SK
02	19.02.2018	ADE	RNR	AD	SK
01	15.05.2017	ADE	RNR	AD	SK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY : If printed

CONTROLLED COPY : If in soft and signed

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	15.05.2017					
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		MB	AK	AD	SK	
04	30.06.2022					VCS QMS Integration
		RP	MC	HK	GW	

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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 VCS 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 ± 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 manufactures
- 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	Manual or hand tool cleaning Removal of loose rust, loose mill scale and loose paint, chipping, scrapping, standing and wire brushing. Surface should have a faint metallic sheen	ST.2	SSPC-SP-2	-	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.
2	Mechanical or power tool cleaning 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.	ST.3	SSPC-SP-3	-	
3	Dry abrasive Blast cleaning There are four common grades of blast cleaning				

3.1	White metal Blast cleaning to white metal cleanliness. Removal of all visible rust. Mill scale, paint & foreign matter 100% cleanliness with desired surface profile.	SA 3	SSPC-SP-5	NACE#1	Where extremely clean surface can be expected for prolong life of paint system.
3.2	Near white metal 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.	SA 2½	SSPC-SP-10	NACE#2	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.
3.3	Commercial Blast Blast cleaning until at least two-third of each element of surface area is free of all visible residues with desired surface profile.	SA 2	SSPC-SP-6	NO.3	For steel required to be painted with conventional paints for exposure to mildly corrosive atmosphere for longer life of the paint systems.
3.4	Brush-off Blast Blast cleaning to white metal cleanliness, removal of all visible rust, mill scale, paint & foreign matter. Surface profile is not so important.	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 alter 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
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	Duel 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 150°C.	
	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.

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 $+80^{\circ}\text{C}$.

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

SI. 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		

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
FINISH COATS / PAINTS	
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/coa t (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/coa t (min)	90	-
3	61 to 80	SSPC-SP-6	Two coats P-3, 50 microns/ coat (min)	Two coats of F-13, 25 microns/coa t (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)

SI. 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)

SI. 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-I0	-	- 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.

SI. 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 @ 65-75μ DFT/ coat	3 coats of F-7 @ 100μ 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 and they must 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 D 1186;
- The dry layer thickness of the film will be measured electronically, will complete statistical information. in accordance with, 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 be 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.



Energising Quality

VCS Quality Services Pvt. Ltd

STANDARD DATA SHEET FOR SOLAR ELECTRIC POWER SYSTEM

00	20.10.2022	SP	RD	AA	HK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY	:	If printed
CONTROLLED COPY	:	If in soft and signed

**STANDARD DATA SHEET FOR
SOLAR POWER SYSTEM**

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	20.10.2022	SP	RD	AA	HK	New revision system updated

STANDARD DATA SHEET FOR SOLAR POWER SYSTEM

1. AMBIENT CONDITIONS		
i.	Max. Temp.	: 50°C
ii.	Min. Temp.	: 2°C
iii.	Design Temp.	: 60°C
iv.	Relative Humidity	: 90%
v.	Location	:
2. TESTS		
Tests required		: Functional Test
3. SUPPLY, ERECTION, TESTING & COMMISSIONING		
i.	Photovoltaic solar cell array (solar panels)	
ii.	Module Mounting Structure	
iii.	Junction Box	
iv.	Solar Charge Controller	
v.	DC – DC Converter	
vi.	SMF Gel VRLA Battery	
vii.	Inter connecting cable	
viii.	Installation Kit	
ix.	Earthing Kit	
4. POWER SUPPLY PARAMETERS		
i.	Rated Power	: VTA
ii.	Voltage	: 12V/24V ± 1%
iii.	No. of phases and wire	: 2Ph & 2W
iv.	Solar Charger Efficiency	: > 95%
v.	Protections required	: Over Current
		: Over Voltage
		: Under Voltage
		: Short Circuit
		: Over Discharge
		: Under Voltage
		: Charging
		: Low Battery
		: Full Charge
5. BATTERY		
i.	Nominal system voltage	: 12V/24 V
ii.	Number of cells/battery	: To be furnished by vendor
iii.	Battery nominal voltage	: 12 Volts
iv.	Duty cycle	: Continuous
v.	Ampere Hour capacity at C10 rate	: To be furnished by vendor
vi.	End cell voltage	: 1.80 Volts
vii.	Mounting	: Pole mounted battery box
viii.	Area of battery room	: To be indicated by Vendor
ix.	Battery back up	: 72 Hours
6. PAINTING TYPE & SHADE	: Epoxy, 631 of IS.5	
7. SYSTEM EARTHING	: Yes	
8. SPECIFIC REQUIREMENTS		
i.	Each solar power system shall be sized for 100% full load continuously.	
ii.	SMF Gel VRLA battery shall have the backup of 72 Hours.	
iii.	Vendor to submit the detailed battery and charger sizing calculations.	
iv.	Contractor shall carry out the full load test of solar power system at works & site.	
v.	Supply of all interconnecting cables between main array junction box and solar charge controller, solar charge controller and battery, solar	

**STANDARD DATA SHEET FOR
SOLAR POWER SYSTEM**

- charge controller and DC-DC converter and DC-DC converter to DC distribution Board will be in contractor's scope.
- vi. Supply of RS-232 serial communication port for transfer of solar power system status to SCADA/AMR. Solar Charger controller shall be provided with RS 232 port for monitoring of solar System status i.e. fault, battery status etc.
 - vii. Solar Charger controller shall be provided with Digital Indicator i.e. LED status for charging, Hi current etc.
 - viii. Enclosure of the battery charger/battery /controller shall be weather proof protected by means of canopy.



LIST OF RECOMMENDED VENDORS FOR BOUGHT OUT ITEMS

**TOTAL
SHEETS**

61

DOCUMENT NO

VCS-00-00-VL-0001

LIST OF RECOMMENDED VENDORS FOR BOUGHT OUT ITEMS

17	01.04.2026	Issued as Standard	Durgesh Baghel	Rajesh Sharma	Ashwani Chandra
REV	DATE	DESCRIPTION	PREP	CHK	APPR

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A. MECHANICAL & PIPELINE

1.0 CARBON STEEL PIPES

1.1 PIPE CARBON STEEL TO INDIAN STANDARDS

- a. A.S.T. Pipes Pvt. Ltd. (AST Group)
- b. Advance Steel Tube Ltd.
- c. Apl Apollo Tubes Ltd. (Er. Bihar Tubes Ltd.)
- d. Asian Mills Pvt. Ltd.
- e. Asrani Tubes Limited
- f. Dadu Pipes (P) Ltd.
- g. Essar Steel Limited (Er Hazira Pipes Mill)
- h. Gaurang Products Pvt Ltd. (Ast Group)
- i. Goodluck Steel Tubes Ltd.
- j. Hi-Tech Pipes Limited
- k. Indus Tube Limited
- l. Jindal Industries Ltd
- m. Jindal Pipes Ltd.
- n. Jindal Saw Ltd (Kosi Works)
- o. Jotindra Steel & Tube Ltd
- p. Lalit Pipes And Pipes Ltd.
- q. Maharashtra Seamless Ltd.
- r. Man Industries (India) Ltd. – Pithampur
- s. Man Industries (India) Ltd. Anjar
- t. Mukat Tanks & Vessels Ltd.
- u. Nezone Tubes Limited
- v. North Eastern Tubes Limited



- w. Pratibha Industries Limited
- x. Pratibha Pipes & Structural Ltd.
- y. Psl Ltd (Chennai)
- z. Psl Ltd (V1, V2 & NC)
- aa. Rama Steel Tubes Ltd.
- bb. Ratnamani Metals And Tubes Ltd.
- cc. Ravindra Tubes Limited
- dd. Samshi Pipe Industries Limited
- ee. Surya Roshni Ltd.
- ff. Swastik Pipes Ltd.
- gg. Utkarsh Tubes & Pipes Ltd. (Formerly Bmw)
- hh. Welspun Corp. Limited (Dahej)
- ii. Zenith Birla (India) Limited

1.2 PIPE & TUBULARS TO A.P.I. STANDARDS

- a. Arcelormittal Tubular Products Roman Sa, Romania
- b. Bhel (Trichy), India
- c. Dalmine Spa (Enquiry To Tenaris), Uae
- d. Eewkorea Co. Ltd (Germany), Korea
- e. Eew Korea Co. Ltd. (Korea), Korea
- f. Eisenbau Kramer Gmbh, Germany
- g. Hyundai Rb Co. Ltd. South Korea
- h. Ilva Lamiere E Tubi Srl (Enq To Ilva Spa, Italy)
- i. Inox Tech. Spa, Italy
- j. ISMT Ltd. Ahmednagr, India
- k. TATA Steel, India
- l. PSL
- m. Jindal Pipes Ltd., India
- n. Jindal Saw Ltd. (Kosi Works), India
- o. Jindal Saw Ltd. (Nashik Works), India
- p. Lalit Pipes And Pipes Ltd. India
- q. Maharashtra Seamless Ltd., India
- r. Man Industries (I) Ltd. (Pithampur), India
- s. Mukat Tanks & Vessels Ltd., India
- t. Pratibha Industries Limited, India



- u. Ratnamani Metals And Tubes Ltd., India
- v. Siderca S.A.I.C (Enquiry Totenaris), Uae
- w. Sumitomo Metal Ind. Ltd., India
- x. Surya Roshni Ltd., India
- y. Swastik Pipes Ltd, India
- z. Tata Steel Uk Limited (Formerly C702)
- aa. Tubos De Acero De Mexico Sa (Enq. Tenaris), Uae
- bb. Tubos Reunidos Sa Spain
- cc. Umran Steel Pipe Inc (Turkey), Turkey
- dd. Valcovny Trub Chomutov, Czech Republic
- ee. Vallourec And Mannesmann Tubes, France
- ff. Welspun Corp Limited (Dahej), India

1.3 PIPE/TUBE CS (SEAMLESS) TO ASTM STANDARDS

- a. Arcelormittal Tubular Products Roman Sa, Romania
- b. Bhel (Trichy), India
- c. Changshu Seamless Steel Tube Co. Ltd., China
- d. Dalmine Spa (Enquiry To Tenaris, Uae
- e. Heavy Metals & Tubes Limited (Mehsana), India
- f. Ismt Ltd. Ahmednagr, India
- g. Ismt Ltd. Baramati India
- h. Jfe Steel Corporation, Uae
- i. Jindal Sdaw Ltd (Nashik Works) India
- j. Klt Automotive And Tubular Products Ltd., India
- k. Mahalaxmi Seamless Limited, India
- l. Maharashtra Seamless Ltd, India
- m. Products Tubulares S.A.U, Spain
- n. Ratnadeep Metal Tubes Ltd., India
- o. Staineest Tubes Pvt Ltd., India
- p. Sumitomo Metal Ind. Ltd., India
- q. Tubos Reunidos Sa Spain
- r. Valcovny Trub Chomutov, Czech Republic
- s. Vallourec Andmannesmann Tubes France
- t. Yangzhou Chengde Steel Pipe Co. Ltd Dubai (UAE)
- u. Jindal SAW Ltd Kosi Kalan Mathura

**1.4 PIPE CARBON STEEL (WELDED) TO ASTM STANDARDS**

- a. Eew Korea Co. Ltd. (Germany), Korea
- b. Eew Korea Co. Ltd. (Korea), Korea
- c. Eisenbau Kramer GmbH, Germany
- d. Hyundai Rb Co. Ltd., South Korea
- e. Inox Tech. Spa, Italy
- f. Jindal Saw Ltd (Kosi Works), India
- g. Lalit Pipes and Pipes Ltd., India
- h. Man Industries (I) Ltd.(Pithampur), India
- i. Man Industries (India) Ltd. Anjar, India
- j. Mukat Tanks & Vessels Ltd., India
- k. Ratnamani Metals And Tubes Ltd., India
- l. Sumitomo Metal India Ltd., India
- m. Tata Steel Uk Limited

2.0 VALVES**2.1 GLOBE VALVES**

- a. BDK (New Delhi)
- b. Datre Corpn (Calcutta)
- c. KSB Pumps (New Delhi)
- d. L&T (New Delhi)
- e. Neco Schuber & Salzer Ltd. (New Delhi)
- f. Niton Valve (Mumbai)
- g. Ornate Valves (Mumbai)
- h. Panchavati Valves (Mumbai)
- i. AV Valves Ltd.
- j. BHEL (Trichy), India
- k. Econo Valves Pvt Ltd, India
- l. Fouress Engg (I) Ltd (Aurangabad)
- m. Guru Industrial Valves Pvt Ltd
- n. Leader Valves Ltd, India
- o. NSSL Ltd. (Neco Schubert & Salzerltd)
- p. Oswal Industries Ltd, India
- q. Petrochemical Engineering Enterprises, India
- r. Sakhi Engineers Pvt Ltd



- s. Shalimar Valves Pvt Ltd
- t. Steel Strong Valves India Pvt Ltd, India
- u. Petro Valves Pvt. Limited, Ahmedabad
- v. Hawa Engineers Limited, Ahmedabad (Non API)
- w. G M Engineering PVT LTD (Non API)
- x. Libra Valves India Pvt. Ltd.

2.2 CHECK VALVES

- a. Advance Valves Pvt. Ltd., Noida
- b. Aksons & Mechanical Enterprises, Mumbai
- c. Larsen & Toubro Limited (Audco India Limited, Chennai)
- d. AV valves Ltd., Agra
- e. BDK engineering India Ltd., Hubli
- f. BHEL, OFE&OE Group, New Delhi
- g. Datre Coroportion Limited, Calcutta
- h. Leader Valves Ltd., Jalandhar
- i. Neco schubert & Salzer Ltd., New Delhi
- j. Niton Valves Industries (P) Ltd., Mumbai
- k. Precision Engg. Co., Mumbai
- l. Econo Valves Pvt Ltd, India
- m. Fouress Engg (I) Ltd (Aurangabad)
- n. KSB Pumps Ltd (Coimbatore), India
- o. NSSL Ltd. (Neco Schubert & Salzer Ltd)
- p. Oswal Industries Ltd, India
- q. Panchvati Valves & Flanges Pvt Ltd, India
- r. Petrochemical Engineering Enterprises, India
- s. Sakhi Engineers Pvt Ltd
- t. Shalimar Valves Pvt Ltd
- u. Steel Strong Valves India Pvt Ltd, India
- v. Shiv Shakti Engineering Works (Approved up to 06 inch)
- y. Hawa Engineers Limited, Ahmedabad
- z. G M Engineering PVT LTD (Non API)
- aa. Libra Valves India Pvt. Ltd.

**2.3 PLUG VALVES**

- a. Breda Energia Sesto Industria Spa, Italy
- b. Fisher Sanmar Ltd., Chennai
- c. Larsen & Toubro Ltd., New Delhi
- d. Nordstrom Valves, USA
- e. Serck Audco Valves, UK
- f. Sumitomo Corporation India Pvt. Ltd., New Delhi
- g. Z Corporation, Korea
- h. Hawa Valves (India) Pvt. Ltd., Mumbai
- i. Steel Strong Valves India Pvt. Ltd., Navi Mumbai
- j. Econo Valves
- k. Flow-Serve PTE (Mfr. SERCK), India
- l. Libra Valves India Pvt. Ltd.

2.4 BALL VALVES

- a. Hawa Valves (India) Pvt. Ltd, Navi Mumbai
- b. Larsen & Toubro, Delhi
- c. Microfinish Valves Pvt. Ltd., Noida
- d. Oswal Industries Ltd., Gandhi nagar
- e. Virgo Engineers Ltd., Delhi
- f. Boteli Valve Group Co. Ltd., China
- g. Cameron (Malaysia) SDN BHD, Malaysia
- h. Dafram S.P.A., Italy
- i. Fangyuan Valve Group Co. Ltd., China
- j. Franz Schuck GmbH, Germany
- k. O.M.S. Saleri (Italy)
- l. Pibi Viesse S.P.A (Italy)
- m. Nuovo Pignone (Italy)
- n. Perar S.P.A (Italy)
- o. Pietro Fiorentini (Italy)
- p. Cooper Cameron Valv Italy SRL-FRM, Italy
- q. Petrol Valves SRL
- r. Tormene Gas Technology S.P.A (VALVITALIA)
- s. Petro Valves Pvt. Limited, Ahmedabad
- t. Shiv Shakti Engineering Works (Approved up to 08 inch)



- u. Hawa Engineers Limited, Ahmedabad
- v. G M Engineering PVT LTD.
- w. DelVal Flow Controls Pvt. Ltd
- x. Libra Valves India Pvt. Ltd.

2.5 GATE VALVES

- a. Libra Valves India Pvt. Ltd.

3.0 TEE

3.1 FLOW TEE

- a. Coprosider SPA, Italy
- b. GEA Energy System India Limited, Chennai
- c. Multitex Filtration
- d. Pipeline Engineering, UK
- e. Scomark Engg. Limited (U.K.)
- f. Skeltonhall Limited, Engaland(U.K.)
- g. Technospecial SPA, Italy
- h. Tectubi SPA, Italy
- i. RMA Germany
- j. Pipefit Engineers Pvt. Ltd.
- k. Vee Kay Vikram & Co.
- l. United Forge Industries

3.2 SPLIT TEE

- a. IPSCO, Canda
- b. TD Willamsons, USA
- c. Plant-Tech Power Technical Services Pvt Ltd
- d. Teemans, UK
- e. Vee Kay Vikram & CO.

4.0 FLANGES

- a. Aditya Forge Ltd., Vadodara
- b. Amforge Industries Ltd., Mumbai
- c. CD Engineering Co., Ghaziabad
- d. Echjay Forgings Pvt. Ltd. (Bombay), Mumbai
- e. Echjay Industries Ltd., Rajkot
- f. Forge & Forge Pvt. Ltd., Rajkot



- g. Golden Iron & Steel Works, New Delhi
- h. JK Forgings, New Delhi
- i. Metal Forgings Pvt. Ltd., Mumbai
- j. Perfect Marketings Pvt. Ltd., New Delhi
- k. Sky Forge, Faridabad
- l. S&G, Faridabad
- m. Chaudhry Hammer Works Ltd, India
- n. JAV Forgings (P) Ltd, India
- o. Kunj Forgings Pvt Ltd, India
- p. MS Fittings
- q. R.N. Gupta & Co. Ltd, India
- r. R.P. Engineering Pvt Ltd, India
- s. Sanghvi Forgings & Engineering Ltd
- t. Shri Ganesh Forgings Ltd., India
- u. Uma Shankar Khandelwal & Co., India
- v. Sawan Engineers, Baroda
- w. Stewarts & Lloyds of India Ltd., Kolkata
- x. Engineering Services Enterprises
- y. Pipefit Engineers Pvt. Ltd.
- z. Jindal Forging
- aa. Vivial Forges
- bb. N J Engineers (Up to 12 Inch Class 600 Only)
- cc. United Forge Industries

5.0 FITTINGS

- a. Commercial Supplying Agency, Mumbai
- b. Dee Development Engineers Ltd.
- c. Eby Industries, Mumbai
- d. Flash Forge Pvt. Ltd., Vishakhapatnam
- e. Gujarat Infra Pipes Pvt. Ltd., Vadodara
- f. M.S. Fittings Mfg. Co. Pvt. Ltd., Kolkata
- g. Stewarts & Lloyds of India Ltd., Kolkata
- h. Teekay Tubes Pvt. Ltd., Mumbai
- i. Pipe Fit, Baroda
- j. Sky Forge, Faridabad



- k. S&G, Faridabad
- l. Sawan Engineers, Baroda
- m. Eby Fasteners, India
- n. Leader Valves Ltd, India
- o. R.N. Gupta & Co. Ltd, India
- p. Exten Engg Pvt Ltd
- q. Sivananda Pipe & Fittings Ltd
- r. Jindal Forging
- s. Vivial Forges
- t. PK Tubes Rajasthan
- u. CSA Fitting
- v. Gujarat Infrapipes pvt ltd, Vadodara
- w. KS Pipes Fitting Pvt Ltd, Palwal
- x. Tube Bend, Kolkata
- y. United Forge Industries

6.0 PIG LAUNCHERS/ RECEIVERS/ PIG SIGNALERS

- a. Bassi Luigi Fittings B.V., Holland
- b. BRAUN STAHL PIPE TEC, GERMANY
- c. FORAIN, ITALY
- d. Fluidel SRL, ITALY
- e. RMA Maschinen- und, GERMANY
- f. Siiritec Nigi, Itlay
- g. SCHUCK ARMATUREN, GERMANY
- h. T.D. Williamson Inc., USA
- i. Tectubi SPA, Italy
- j. Taylor Forge Engineering System INC, USA
- k. Tormene Americana S.A. (Argentina)
- l. Tormene Gas Technology S.p.A., Italy
- m. PIPELINE ENGINEERING, UNITED KINGDOM
- n. Krohne, Oil & Gas BV, Drive Houston,
- o. Multitex Filtration Engrs. Ltd, New Delhi
- p. BGR ENERGY SYSTEMS LIMITED New Delhi
- q. Glapwell Contracting Services Ltd. UK



- r. FULGOSI GIOVANNI S.n.c di Corrado & C, ITALY
- s. VEEKAY VIKRAM & CO, GUJRAT
- t. GBM S.R.L, ITALY
- u. Cardew Ltd., Alexeander
- v. Forain S.R.L.
- w. GD Engineering, India
- x. Pipeline Engineering, UK
- y. Siirtec Nigi SPA
- z. Control Plus
- aa. Oswal Infrastructure

7.0 LONG RADIUS BENDS

- a. Jindal Saw Ltd. (Kosi Works), India
- b. PSL Limited (Gandhidham – Mfrg), India
- c. BHEL, Trichy, Tamilnadu
- d. Welspun, Gujarat
- e. Sawan
- f. Gujarat Infra
- g. P K Tubes
- h. DEE Development
- i. Pipefit Engineers Pvt. Ltd.

8.0 CLEAN AGENT SYSTEM

- a. ADN Fire Safety Pvt Ltd (Vashi East, Thane)
- b. Chetan Corporation (Ahmedabad)
- c. Chetan Engineers (Ahmedabad)
- d. Mx Systems International Pvt. Ltd. (Mumbai)
- e. New Fire Engineers (P) Ltd (Sil Vassa)
- f. Nitin Fire Protection Industries Ltd (New Bombay)
- g. Nohmi Bosai (India) Private Limited
- h. Tyco Fire & Security India Pvt. Ltd (Bangalore)
- i. Vimal Fire Controls Pvt Ltd (Vadodara)

9.0 INSULATING JOINTS

- a. IGP Engineers
- b. V K Vikram



- c. Advance Electronics
- d. Nupros INC

10.0 GASKETS

- a. IGP Engineers (P) Ltd., Madras
- b. Madras Industrial Products, Madras
- c. Dikson & Company, Bombay
- d. Banco Products (P) Ltd., Vadodara
- e. Goodrich Gaskets Pvt Ltd
- f. Starflex Sealing India Pvt Ltd, India
- g. Teekay Meta Flex Pvt Ltd
- h. UNIKLINGER Ltd
- i. HEM Engg. Corp.
- j. Unique Industrial Packing Pvt. Ltd.

11.0 FASTENERS

- a. Nireka Engg. Co. (P) Ltd., Calcutta
- b. Precision Taps & Dies, Bombay
- c. AEP Company, Vithal Udyoug Nagar
- d. Fix Fit Fasteners, Calcutta
- e. Precision Engg. Industries, Baroda
- f. Echjay Forgings Pvt. Ltd., Bombay
- g. Capital Industries, Bombay
- h. Boltmaster India Pvt Ltd, India
- i. Deepak Fasteners Limited, India
- j. Fasteners & Allied Products Pvt Ltd, India
- k. Hardwin Fasteners Pvt Ltd, India
- l. J.J. Industries, India
- m. Multi Fasteners Pvt Ltd, India
- n. Nexo Industries, India
- o. Pacific Forging & Fasteners Pvt Ltd, India
- p. Pioneer Nuts & Bolts Pvt Ltd, India
- q. Precision Auto Engineers, India
- r. President Engineering Works, India
- s. Sandeep Engineering Works, India
- t. Syndicate Engineering Industries, India

**12.0 WELDING ELECTRODES FOR PIPELINE/PIPING WORK**

- a. For Mainline – Lincoln/ Bohler make
- b. For Terminal – For root pass –Lincoln/ Bohler make
For other passes – Lincoln, D&H or equivalent make Lincon
- c. D & H SECHERON ELECTRODE PVT. LTD. (For Mainline & Terminal- Root & Other pass)

13.0 STRAINERS

- a. Bombay Chemical Equipments
- b. Gujarat Auto filed
- c. Multitex Filtration Engineering Limited
- d. Grand Prix Engineering Limited

14.0 COLD APPLIED TAPES

- a. Denso GmbH
- b. Raychem

15.0 HEAT SHRINKABLE SLEEVE/ FIBREGLAS REINFORCED SLEEVE

- a. Covalence - Seal For Life India Pvt. Ltd. (Formerly Covalence Raychem- Berry Plastics Corporation)
- b. Canussa-CPS
- c. Rigil Techno India(Distributor for M/s CYG Changtong New Material Co Ltd,China)
- d. M/s Shri Narayan Impac-India LLP

16.0 STUD BOLTS WITH NUTS

- a. Multi Thread Fasteners, Baroda
- b. Darukhanwala
- c. Precision Engineers, Baroda
- d. Unbrako
- e. TVC

17.0 WARNING MAT

- a. Sparco Multiplast Pvt. Ltd., Ahmedabad
- b. Singhal Industries , Ahemdabad
- c. Puja Packing, Mumbai
- d. Bina Enterprises, Mumbai
- e. Shree Vijay Wire & Cable Industries

18.0 HDPE PIPES/DUCT



- a. Climax Synthetics (P) Ltd., Vadodra
- b. Indian Poly Pipes, Calcutta
- c. Jain Irrigation Systems Ltd., Jalgaon
- d. Kirti Industries (India) Ltd., Indore
- e. Ori Plast Limited, Calcutta
- f. Phoel Industries Limited, Delhi
- g. Sangir Plastics (P) Ltd., Mumbai
- h. Veekay Plast, Jaipur
- i. Kisan Irrigation
- j. Dutron Polymers Ltd.
- k. Manikya Plastichem (P) Ltd
- l. Himalyan Pipe Industries
- m. NorthEast Polypipes LLP
- n. Mukand Poly Products (for Duct)

19.0 DRY GAS FILTER & FILTER SEPERATOR

- a. Grand Prix Fab (Pvt.) Ltd. (New Delhi)
- b. Perry Equipment, USA
- c. Faudi Filter, Germany
- d. Forain S.r.l., Italy
- e. ABB, Faridabad
- f. Burgess Manning, USA
- g. Multitex Filtration Engineers India
- h. Triveni Plenty Engg. Ltd. (New Delhi)
- i. Siirtec International Contractor S.P.A (Italy)
- j. Flashpoint, Pune india
- k. Filtration Engineers (I) Pvt Ltd, India
- l. Gujarat Otofilt, India
- m. Tormene Gas Technology
- n. Ultrafilter (India) Pvt Ltd, India
- o. Ravi Techno Systems Pvt Ltd, India
- p. Siirtec Nigi S.P.A
- q. Filtan Filter Anlagenbau GmbH
- r. Fairley Arlon BV
- s. PECO Facet



- t. EPE Epenstenner GMBH
- u. Filtrex srl
- v. Petromar Engineered Soln
- w. Plenty Filter
- x. Eurofiltex
- y. PTI Technologies Inc
- z. R S Instrumentation and Services
- aa. Inel Gas Control Pvt Ltd

20.0 FILTER ELEMENT

- a. Peco – Facet
- b. Velcon
- c. Pall – Filterite
- d. Burgess Manning

21.0 NDT AGENCY

- a. NDT Services, Ahmedabad
- b. GEECY Industrial Services Pvt. Ltd., Mumbai
- c. Corrosion Control Services, Mumbai
- d. Perfect Metal Testing & Inspection Agency, Calcutta
- e. Inter Ocean Shipping Co., New Delhi
- f. RTD, Mumbai
- g. Sievert, Mumbai
- h. X-Tech, Vizag
- i. Industrial X Ray and Allied Radiographers (I) Pvt. Ltd.
- j. Inspection Technology
- k. IXAR
- l. Aditya NDT Services
- m. Riya NDT Engineers
- n. Star NDT Services
- o. Technical testing & Inspection Services
- p. PD Engineering Inspection Services
- q. Victor Engineering & Testing

22.0 Cold Applied Tapes

- a. Denso GmbH
- b. Polyken (Berry Plastics Corporation)

**22.1 End Seal Tape-PVC**

- a. MAASH Industries

23.0 PUR Coating

- a. Powercrete (Berry Plastics Corporation)

24.0 Casing End Closure

- a. Raci, Italy
- b. Raychem RPG Limited

25.0 Casing Insulators

- a. Raci, Italy
- b. Raychem RPG Limited
- c. VeekayVikram

26.0 FIRE FIGHTING EQUIPMENT**26.1 FIRE EXTINGUISHERS**

- a. Avon Services (Production & Agencies) Pvt. Ltd., Bombay
- b. Kooverji Devshi & Co., Bombay
- c. Reliable (Fire Protection) India Ltd., Bombay
- d. Zenith Fire Services, Bombay
- e. Safex Fire Services, Bombay
- f. Brij Basi Hi
- g. tech Udyog
- h. Bharat Engg Works, India
- i. Gunnebo India Ltd
- j. Nitin Fire Protection Industries Ltd, India
- k. Supremex Equipments, India
- l. Vimal Fire Controls Pvt Ltd., India

26.2 FIRE HYDRANTS, MONITORS, DELUGE VALVE, NOZZLES

- a. Zenith
- b. Minimax
- c. Newage
- d. HD Fire
- e. Vijay Fire



- f. Asco Strumech Pvt Ltd, India
- g. Brij Basi Hi
- h. tech Udyog
- i. Gunnebo India Ltd
- j. Nitin Fire Protection Pvt Ltd
- k. Shah Bhogilal Jethamal & Brothers
- l. Pumps & Engineering Works

26.3 FIRE & GAS DETECTION & ALARM

- a. Ambetronics Engineers PVT LTD.

26.4 RRL Hose

- a. Jayshree
- b. Newage

26.5 HOSES

- a. Ashit Sales Corporation, Bombay
- b. Royal India Corporation, Bombay
- c. Gayatri Industrial Corporation
- d. Simplex Rubber Products Ltd., Ahmedabad
- e. Zaverchand Marketing Pvt. Ltd., Baroda
- f. Presidency Rubber Mill, Calcutta
- g. The Cosmopolite, Calcutta
- h. Simplex Rubber Products, Thane

NOTE:

- 1) 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) The vendor / supplier should not be in the Holiday list of CLIENT / VCS / other PSU.
 - c) 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.
- 2) 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 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 / VCS.

- 3) The details of vendors indicated in this list are based on the information available with VCS, 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.

B. CIVIL AND STRUCTURAL

Sr. No.	Items/ Name of Products	Make/ Brands/ Manufactures
1.	Reinforcement Steel	TATA, SAIL, RINL, JSW.
2.	Cement	Ambuja, ACC, JK, Grasim, Ultratech, Birla, L&T, Cement Corporation of India
3.	Structural Steel	TATA, SAIL, RINL, IISCO, ESSAR
4.	Structural Steel Tubes ISI Marked	TATA, JINDAL, SURYA
5.	Mineral wool for thermal insulation of ceilings (Under deck insulation)	Rock wool (india) Ltd. Minwool Rock Fibres Ltd., Lloyd Insulation.
6.	Synthetic Enamel Paint (1st quality only)	ICI Paint (Dulux), Asian Paint (Apolite), Berger Paints (Luxol). Goodlass Nerolac Paints (Nerolac), Jenson & Nicholson Paints Ltd (Borolac)
7.	G.I SHEET	ESSAR, JSW, SAIL
8.	Sheeting Screw	Corroshield, Buildex,
9.	Chemical for Antitermite treatment	DE- NOCIL Bombay, Pest Control of India, Trishul
10.	Factory made Panelled Door shutter	Century; Godrej ; M/s Hindustan Housing factory Ltd., New Delhi ; M/s Delhi Construction Eqp, Sadar Bazar, Delhi ; M/s Joinery manufacturing Co., Calcutta;
11.	PVC Panel Door (Solid Core)	Rajshri Plastiwood Limited, Sintex, Hindopan, Marino
12.	Pressed steel door frames/ cupboard and window frames (manufacturers)	M/s SAIL, M/s TATA
13.	Pressed steel door frames/ cupboard and window frames (fabricators)	M/s Loyal safe works Mayapuri, N/Delhi M/s Multiwyn Industrial Corpn Calcutta M/s Metal Window Corpn N/Delhi



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		M/s Chhabra Steel Udyog, 260 Sadar Bazar, Meerut Cantt. M/s Delite safe works, Rani Jhansi Road, N/Delhi
14.	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 ; M/S Chhabra Steel Udyog 260, Sadar Bazar, Meerut Cantt ; Agent steel MFG Pvt Ltd, Ahmedabad ; Godrej ;
15.	AI Section for AI Door/ Window/ Partitions	Hindalco, Ajit India, Jindal
16.	AluminumI Door/ Window/ Glazing Fabricated and Anodized	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, M/s VR Associates, GH-14/242 Paschim Vihar, Delhi
17.	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, Bhole Nath Nagar, Shahadara, Delhi 110032. Mepro, Argent New Delhi, Classic, New Delhi. Jindal, Argent New Delhi, Golden Industries Pvt. Ltd. ECIE
18.	Aluminium Grill	Alu Grill, Arihant Aluminium Corporation, Decogrille
19.	Door Closer	Everite, Golden, Gandhi,
20.	Floor Spring	Prabhat, Everite
21.	Plywood for general purpose (IS-303)	National Plywood Inds Pvt Ltd, S Fancy lane, 8th floor, Calcutta-700001, Merino Plywood, Archid Ply, Ply, Swastik, Universal, Century, Greenply, National.
22.	Pre laminated Particle board	Kitply, Bhutan board, Ecoboard, Novapan, Archid ply, Merinova, Merino
23.	Laminated Sheets	Formica, Merino Lam, Greenlam, National, Century
24.	Modular Partitions	Godrej, Blowplast
25.	False Ceiling (Mineral Fibre Board)	Armstrong, Daiken, Luxalon, Llyods, Gypboard, Trac, Aerolite
26.	Aluminium False Ceiling	Lloyds, Armstrong, Luxlon, Trac
27.	Flooring Tiles (Mosaic / Terrazzo / PCC) (1st quality only)	Kajaria Ceramics, NITCO, Royal Tiles, Gem Tiles, Hindustan Tiles, M/S National Tiles & Industries, Ultra Tiles
28.	Glazed Ceramic Tiles, Non-Skid (Floor/Wall), (1st quality only)	Kajaria, Somany, NITCO. Murudeshwar Ceramic Ltd (Navin Diamond tile), Johnson (Marbonite),
29.	Vitrified/ Designer Vitrified Tiles (1st quality only)	Asian, Marbonite (Johnson), Kerrogres (Kajaria), NITCO, Orient
30.	PVC Tiles/Flooring (IS 3461) (1st quality only)	Marblex Tiles, Krishna Tiles, Polyfin, Armstrong, Wonder floor.



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31.	False Flooring	Godrej or equivalent
32.	Glass Mosaic Tiles (1st quality only)	Paladio, Coral, Accura, Bisazza, Italia, Mridul.
33.	Designer Paver Tiles/ Interlocking tiles ISI marked/ Grass-jointed Tiles. (1st quality only)	Pavit, Ultra, Hindustan, Eurocon, Vyara, National Tiles, Gem, Unistone, Konkrete, Unitile
34.	Wall care Putty for Base preparation (1st quality only)	Birla Wall care putty, Berger, Jenson & Nicholson, JK White
35.	White Cement (1st quality only)	Birla, JK
36.	Cement based Paints (1st quality only)	Super Snowcem, Duracem, Super Acrocem.
37.	Dry Distemper / Oil bound Distemper (1st quality only)	Goodlass Nerolac Paint, Shalimar Paint, Jenson & Nicholson, Asian Paint, Berger. ICI Dulux
38.	Acrylic Washable Distemper (1st quality only)	Asian, Berger, ICI Dulux, Jenson & Nicholson, Nerolac, Shalimar, Garware & Goodlass
39.	Plastic Emulsion Paint (1st quality only)	Asian, Berger, ICI, Nerolac, Jenson & Nicholson, Shalimar, Garware & Goodlass
40.	Exterior Acrylic Emulsion (1st quality only)	ICI (Weathercoat), Excel (Nerolac), Apex (Asian), Berger, Jenson & Nicholson, Shalimar, Garware & Goodlass
41.	Polymer based Paint	STP, CICO
42.	Textured Paint / Wall Tile (1st quality only)	Unitile, Heritage, Spectrum, Iokos, Acropaints, Asian
43.	Flexible board for Expansion joint	STP or equivalent
44.	Grout	Shrinkomp, Fosroc, Fairmate
45.	Integral water proofing compound	STP, Pidilite, Fosroc, CICO, Sika.
46.	Concrete Admixture	Pidilite, Fosroc, CICO, Sika.
47.	Water proofing for cementations surface IS- 2645	Acrocrete & Acrocote, CICO, Fosroc, STP
48.	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
49.	Hardeners	Ironite, Ferrok, Hardonate
50.	Construction Chemicals	Choksey, CICO, Forsroc, Sika



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51.	Stainless Steel Cladding	Jindal
52.	Punch Tape Concertina Coil	Global Technocrat, S.G. Engineers Delhi
53.	Stainless Steel Railing	Jindal
54.	FRP/ HDPE Garbage Bins	Sintex, Swift, Nutech, Sheetal
55.	Sanitary ware	Neycer Kermag (standard), Hindustan Sanitary Ware (Ist quality), Parryware (superfine), Cera (Ist quality), Classica (Ist / standard)
56.	WC seat cover ISI Marked	Parryware, Neycer Kermag (standard), Hindustan Sanitary Ware (Ist quality), Cera (Ist quality), Classica (Ist / standard)
57.	PVC Flushing Cistern IS: 774-1984 (ISI Certified)	Parryware, Hindustan Sanitary Wares, Cera.
58.	Faucets & Taps, Stop Valves & Pillar Taps, Surgical basin mixer, Shower rose etc.	Gem, Parko, Parryware, HSW, Jaquar
59.	Kitchen Stainless Steel Sink	Diamond, Nirali, Neel Kanth, Jayna
60.	Looking Mirror	Saint Gobain, Modi Float, Triveni Float Glass, Crown, Atul.
61.	Readymade Bathroom Cabinets	Commander Gratings (I) Pvt Ltd, Gratolite Cabinet, A- 4 Sector Viii Noida-202701, Alpina, Cera.
62.	Float Valve	Leader, Bombay Metal & Alloy Co, Bombay superflow.
63.	SGSW Pipes (IS-651) ISI Marked	Perfect Agra, Devraj Ind Gaziabad, Buran, RK, Prince,
64.	CI (Centrifugally Cast) Pipes for sewage disposal ISI marked	NICCO, SRIF, A-1 Singhal Casting Co Agra, Jindal Saw, Kesoram, NECO
65.	PVC rain water/sewage pipes (IS-4985)	Reliance, Finolex, Supreme, Kisan, Prince, Hindustan Plastic & machine corporation, Polypack industries (P) Ltd.
66.	HDPE Water storage tanks (Rotational Moulded)	Sintex, Swift, Nutech, Sheetal
67.	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
68.	RCC Pipes	Indian Hume Pipe Company, Delhi / Allahabad / Chandigarh / Lucknow; Hindustan Pressure Pipes, Kolhapur; Dhere Concrete Products, Pune or any other approved manufacturer conforming B.I.S. Standard
69.	Brass Fittings	Leader Engineering Works, Jalandhar; L & K Mathura; Luster Sanitary, Jalandhar; Annapurna Metal Works, Calcutta; Neta Metal Works, Jalandhar
70.	C.P. Fittings	Ego Metal Works, Ballabhgarh; Jaquar Industries, Delhi; Soma Plumbing Fixtures Limited, Calcutta; Gem Sanitary Appliances Pvt. Ltd., Delhi; Essco



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		Sanitations, Delhi.
71.	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.
72.	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.

List of Recommended Vender/Suppliers of Major Bought-Out Items: 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 RECOMMENDED list for structural items thereon.

Sl. No.	Items/Name of Products	Makes/Brands/Manufactures
1	Structural Steel	SAIL / TATA / RINL / IISCO / ESSAR / ISPAT
2	Structural Steel Tubes ISI Marked	TATA / JINDAL / SURYA / SWASTIK
3	Synthetic Enamel Paint 1st Quality only	ICI Paint (Deluxe), Asian Paint (Apolite), Shalimar Paint (Superlac), Goodlass, Nerolac Paint (Nerolac), Berger Paints

Any materials not fully specified in these specifications 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.

**C. ELECTRICAL****LIST OF SUPPLIERS OF MAJOR BOUGHT-OUT ITEMS****1.0 AIR CONDITIONER**

- a. Blue Star
- b. O General.
- c. Daikin.
- d. Carrier
- e. Hitachi.
- f. LG.
- g. Lloyds
- h. Mitsubishi
- i. Panasonic
- j. Sharp
- k. Samsung.
- l. Blue star.
- m. Haier.
- n. Voltas.
- o. Videocon.

2.0 BATTERIES (LEAD ACID)

- a. Amco Batteries Ltd.
- b. Exide Industries Ltd.
- c. HBL Power System Ltd.
- d. Amara Raja Batteries Ltd.
- e. Su-Kam Power Systems Ltd.
- f. Base Corporation Ltd.
- g. Okaya Power Ltd.
- h. Southern Batteries Pvt Ltd.
- i. True Power International Ltd.
- j. Evolute Solutions Pvt Ltd.
- k. Greenvision Technologies Pvt Ltd.
- l. Artheon Electronics Ltd.

**3.0 BATTERIES (NICKEL CADMIUM)**

- a. Amco Saft Batteries Ltd.
- b. HBL Power Systems Ltd.

4.0 BATTERIES (Lithium-ion)

- a. PROSTARM INFO SYSTEMS LTD.

5.0 BATTERY CHARGER/DC-DC CONVERTER

- a. Amara Raja Power System(P)Ltd.
- b. BCH.
- c. Chhabi Electricals Pvt. Ltd.
- d. Caldyne Automatics Limited.
- e. HBL Nife Power Systems Ltd..
- f. Universal Instrument Mfg. Co Pvt Ltd.
- g. Hitachi HI-REL Power Electronics P. Ltd
- h. Mass-Tech Controls Pvt Ltd
- i. Dubas Engineering Pvt Ltd
- j. Chloride Power Systems & Solutions Ltd
- k. Synergee
- l. Enertech
- m. Vertiv

6.0 CABLE – FIRE ALARM & COMMUNICATION CABLES

- a. Cords Cable Industries Ltd.
- b. CMI.
- c. Delton cables Ltd.
- d. ELKAY Telelinks.
- e. KEI Industries Ltd.
- f. Elkay Telelinks

7.0 CABLE – HT(XLPE)

- a. Universal Cable Ltd.
- b. KEI Industries Ltd.
- c. Industrial Cables.
- d. NICCO Corporation Ltd.



- e. Uniflex.
- f. Polycab.
- g. Torrent cables Ltd.

8.0 CABLE – LT / MV POWER AND CONTROL

- a. Cords Cable Industries Ltd.
- b. Universal Cable Ltd.
- c. KEI Industries Ltd.
- d. Havells.
- e. Delton.
- f. Elkay Telelinks.
- g. Evershine Electricals.
- h. Ecko.
- i. Ravin.
- j. Rallison.
- k. Suyog.
- l. Netco.
- m. Uniflex.
- n. Paramount.
- o. Gloster.
- p. Associated cables Pvt Ltd.
- q. CMI.
- r. Gemscab.
- s. Industrial cables.
- t. NICCO.
- u. Polycab.
- v. Torrent.

9.0 CABLE – GLAND

- a. Baliga.
- b. Comet.
- c. Flexpro.
- d. Flameproof.
- e. FCG.



- f. Electro Werke.
- g. Dowels.
- h. CCI.
- i. Sudhir Switchgear
- j. Keyson Techno Equipments,
- k. RAY Flameproof Pvt Ltd

10.0 CABLE – LUGS & TERMINAL BLOCKS

- a. Dowels.
- b. Jainson.
- c. Sharma Electrical
- d. Punitam
- e. Yamuna Powers
- f. Rapid Manufacturer
- g. Varun Controls.

11.0 CABLE – TRAY

- a. Ercon Composites.
- b. Yamuna Power & Infrastructure Ltd.
- c. MEM
- d. Bharti
- e. Profab.
- f. Ratan.
- g. Slotco.

12.0 CABLE TERMINATION AND JOINTING KIT

- a. CCI.
- b. Raychem.
- c. M-Seal.

13.0 CEILING/EXHAUST/PEDESTAL FANS & CIRCULATORS

- a. Bajaj Electricals Ltd.
- b. Crompton Greaves Ltd.
- c. Khaitan Electricals Ltd.



- d. Havell's.
- e. Philips
- f. Usha
- g. Orient

14.0 CONTRACTORS – AC POWER

- a. Andrew Yule.
- b. ABB.
- c. BHEL.
- d. C&S.
- e. Havell's.
- f. L&T.
- g. Schneider.
- h. Siemens Ltd.
- i. Telemecanique.
- j. GE India Industrial

15.0 CONTROL TRANSFORMER

- a. AE.
- b. Indushree.
- c. Intra Vidyut.
- d. Kalpa Electricals.
- e. Transpower Industries Ltd.
- f. Siemens.
- g. PROSTARM INFO SYSTEMS LTD.

16.0 GAS GENERATOR/DIESEL GENERATOR SET

- a. Sterling and Wilson.
- b. Jackson Limited.
- c. Sudhir Gensets.
- d. Power Engineering (India) Pvt Ltd.
- e. Prasha Technologies Limited.
- f. Kumar Generator house.
- g. Ashok Leyland Ltd.



- h. Powerica Limited.
- i. Supernova Engineers Limited.
- j. Bhaskar Power Products (P) Ltd.
- k. Caterpillar India (P) Ltd.
- l. Cummins India Ltd.
- m. Escorts Ltd.
- n. Greaves Cotton Ltd.
- o. Kirloskar Ltd.
- p. Mahindra & Mahindra Ltd.
- q. Honda.
- r. Perkins.
- s. Eicher.
- t. Tata Motors.
- u. Ashok Leyland.

17.0 FLAME PROOF LDB'S/ JB'S/CONTROL STATION/ SWITCHES

- a. FCG.
- b. Sudhir switchgears.
- c. Prompt Engineering Works
- d. Flame Proof equipments pvt. Ltd.
- e. Baliga Lighting Equipments Pvt. Ltd.
- f. Flexpro Electricals Pvt. Ltd.
- g. Exprotecta, Beroda.
- h. FFLP Control Gears.
- i. Sterling.
- j. Kaysons Techno Equipment
- k. Bajaj
- l. Phoenix Contact
- m. RAY Flameproof Pvt Ltd

18.0 HIGH MAST

- a. Bajaj Electricals Limited.
- b. Crompton Greaves Limited.
- c. Philips India Limited.



- d. Surya Roshani.
- e. Transrail

19.0 HIGH VOLTAGE PCC/ MCC PANELS

- a. BHEL.
- b. Control and Switchgear.
- c. Siemens.
- d. Tricolite Electrical Industries.
- e. Schneider.
- f. CGL.
- g. L&T.
- h. ABB.

20.0 INDICATING LAMPS

- a. Alstom Ltd.
- b. BCH.
- c. L&T Ltd.
- d. Siemens Ltd.
- e. Vaishno Electricals.
- f. Tecknik
- g. ABB

21.0 INDICATING METERS

- a. L&T
- b. ABB.
- c. AMCO.
- d. AE
- e. Alstom Ltd. (EE).
- f. Conzerv/Schneider
- g. Elecon Measurement Pvt. Ltd.
- h. HPL Electric & Power Pvt. Ltd.
- i. MECO Instruments Ltd.
- j. Minilec.



- k. Rishabh Instruments Pvt. Ltd.
- l. Trinity energy system.
- m. Kaycee.
- n. Salzer.
- o. Trinity
- p. Secure Meters Limited

22.0 LIGHTING FIXTURES

- a. GE Lighting Pvt. Ltd.
- b. Bajaj Electricals Ltd.
- c. Crompton Greaves Ltd.
- d. Philips India Ltd.
- e. Havells
- f. Wipro
- g. Osram
- h. Siska
- i. Halonix
- j. Surya
- k. Polycab
- l. Kawlity Photonix

23.0 LIGHTING FIXTURES – FLAMEPROOF

- a. Bajaj Electricals Ltd.
- b. Baliga Lighting Equipment Pvt. Ltd.
- c. Crompton Greaves Ltd.
- d. CEAG Flameproof Controlgear Pvt. Ltd.
- e. Flexpro Electricals Pvt. Ltd.
- f. Philips India Ltd.
- g. Sudhir Switchgears Pvt. Ltd.
- h. FCG.

24.0 MINIATURE CIRCUIT BREAKERS (MCBS) AND LIGHTING DB

- a. ABB.
- b. Hagger.
- c. Havell's India Ltd.



- d. Indo Asian Fusegear Ltd.
- e. Legrand.
- f. MDS Switchgear Ltd.
- g. Schneider.
- h. Siemens Ltd..
- i. HPL.
- j. L & T
- k. Siemens

25.0 MOULDED CASE CIRCUIT BREAKER (MCCBS)

- l. ABB.
- m. Andrew Yule.
- n. Larsen & Toubro.
- o. Schneider.
- p. Siemens.
- q. Control and Switchgear.
- r. Indo Asian,
- s. Hager.
- t. Merlin Gerin.
- u. Havell's India Ltd
- v. General Electric

26.0 PROTECTION RELAYS

- a. BCH.
- b. L&T Ltd.
- c. Siemens Ltd.
- d. Tele-mechanique & Controls (India) Ltd.
- e. Eaton
- f. Alstom
- g. ABB
- h. Ashida
- i. Novatek Electronics
- j. Cantronics
- k. Control & Switchgear
- l. Frick Electronics



- m. Indian Technologies
- n. Rao Electromechanical
- o. Kudam Corporation

27.0 LOW/MEDIUM VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB

- a. ABB.
- b. BCH.
- c. BHEL.
- d. C & S.
- e. Elecmech Switchgear & Instrumentation.
- f. KMG ATOZ.
- g. L&T.
- h. Pyrotech Electronics Pvt. Ltd.
- i. Risha Control Engineers Pvt. Ltd.
- j. UDKAM PROCESS EQUIPMENT INDIA PVT. LTD
- k. Tricolite Electrical Industries.
- l. Unilec Engineers Ltd.
- m. Vidyut Control India Pvt. Ltd.
- n. Control and Schematic.
- o. Zenith Engineering.
- p. Schneider Electric,
- q. AEG,
- r. HAVELL'S,
- s. MDS
- t. Synergy System
- u. Expert Engineers
- v. R K Engineering & Infrastructure

28.0 PUSH BUTTONS

- a. BCH.
- b. Alstom Ltd.
- c. L&T.
- d. Siemens Ltd.
- e. Tele-Menchanique & Controls (India) Ltd.



- f. Vaishno Electricals.

29.0 SWITCHES-CONTROL

- a. BCH.
- b. Easum Reyrolle Relays & Devices Ltd.
- c. Alstom.
- d. Kaycee Industries Ltd..
- e. L&T.
- f. Siemens Ltd.

30.0 SWITCHES – 5/15A PIANO/ PLATE, SWITCH SOCKET

- a. Anchor Electronics & Electricals Pvt. Ltd.
- b. Kingal Electricals Pvt. Ltd.
- c. North-West Switchgear Ltd.
- d. Schneider
- e. Havells
- f. Cona
- g. Orient
- h. Panasonic

31.0 SWITCH SOCKET OUTLETS (INDUSTRIAL)

- a. Alstom Ltd.
- b. Best & Crompton Engineering Ltd.
- c. BCH.
- d. Crompton Greaves Ltd.
- e. Essen Engineering Company Pvt. Ltd.

32.0 SOLAR POWER SYSTEM MODULES

- a. Tata Power Solar Systems Ltd
- b. REIL,
- c. CEIL,
- d. HBL Power.
- e. Vikram Solar.
- f. Waaree Solar.
- g. Solar Semiconductor.



- h. Sonali.
- i. Mundra Solar
- j. Vikram Solar
- k. Bharat Electronics Limited
- l. Waaree
- m. Lumipex
- n. Independent Qualitative Accessories
- o. Statcon Energy
- p. Volks Energy
- q. Green Engineering

33.0 SOLAR PCU/CHARGE CONTROLLER

- a. Statcon Energy
- b. Enertech UPS Pvt Ltd
- c. Consul Nowatt
- d. OPS India
- e. Schneider
- f. Delta Electronics
- g. ABB Ltd
- h. KACO
- i. SMA
- j. HBP Power
- k. Universal Instrument

34.0 TERMINALS BLOCKS

- a. Connectwell.
- b. Controls & Switchgear Co. Ltd.
- c. Elmex Controls Pvt. Ltd.
- d. Essen Engineering Co. Pvt. Ltd.
- e. Phoenix Contact

35.0 DISTRIBUTION TRANSFORMERS

- a. ABB.
- b. Andrew Yule.
- c. Areva.



- d. BHEL.
- e. Bharat Bijlee
- f. Crompton Greaves.
- g. EMCO Ltd.
- h. Intra Vidyut.
- i. Indushree.
- j. Indcoil
- k. Kirloskar.
- l. Skippers Electricals.
- m. Transformers & Rectifiers (I) Ltd.
- n. Voltamp.

36.0 UPS SYSTEM AND INVERTER

- a. DB Power.
- b. Keltron.
- c. Hi-Rel/HITACHI.
- d. Dubas.
- e. Toshiba Corporation.
- f. Fuzi Electric Co Ltd.
- g. Emerson.
- h. Synergy System.
- i. Eaton.
- j. Enertech
- k. PROSTARM INFO SYSTEMS LTD.

37.0 GI-OCTAGONAL POLE

- a. Bajaj.
- b. Transrail.
- c. Wipro.
- d. K.L. Industries.

38.0 ELECTRICAL MOTORS

- a. Siemens.
- b. Crompton Greaves.
- c. Kirloskar.
- d. BHEL.



- e. Bharat Bijlee.
- f. Hindustan motors.
- g. Alstom.
- h. Texmo.
- i. GE India.
- j. National Motors.
- k. ABB.

39.0 ELECTRICAL PROCESS HEATER

- a. Escorts Limited, Faridabad, Haryana.
- b. Spherehot / Kanti Lal Chuni Lal & Sons Appliances Pvt Ltd.Surat.
- c. Kerone, Bhayander(E), Thane – 401105.
- d. Excel Heaters, Andheri (West), Mumbai - 400 053, India.
- e. Nirmal Industrial Controls Pvt. Ltd., Mulund(W), Mumbai - 400 080.

40.0 CATHODIC PROTECTION AGENCIES/CONTRACTOR/ VENDERS

- a. CALTECH Engineering Service.
- b. Universal Corrosion Prevention India.
- c. Cathodic Technology Limited.
- d. Cathodic Control Company Pvt. Ltd.
- e. CORRTECH International Pvt Ltd.
- f. MITCORR Cathodic Protection Pvt Ltd.
- g. Underground Pipeline & NDTs Pvt. Ltd.
- h. JG Corrosion Solution.
- i. Mercury Cathodic Protection Service.
- j. UNDTs Corrosion Service.
- k. SARK EPC Projects Pvt. Ltd.

41.0 BACKUP AGENCY FOR INTERFERENCE SURVEY & MITIGATION

- a. PLE Germany
- b. Vendor Velde
- c. Nippon Japan
- d. SSS India CIPL / interference survey.
- e. Balslev Denmark, .
- f. SSS Germany



- g. Jef Techno Slutions Pvt. Ltd.
- h. SARK EPC Projects Pvt. Ltd.

42.0 PERMANENT REFERENCE CELL

- a. PERMACELL/ HARCO (USA)
- b. CORRTECH (ZULU), INDIA
- c. TINKER RASOR, USA
- d. SILVION, UK

43.0 CP CABLES

- a. Brooks Cables.
- b. Nicco Corporation Ltd.
- c. CCI Ltd.
- d. Delton Cables Ltd.
- e. KEI Industries.
- f. Torrent Cables.
- g. Universal cables.
- h. Victor Cables.
- i. Associated Flexible & Wires Pvt Ltd.
- j. Asain Cables (RPG Cables).
- k. Fort Gloster (Gloster Cables Ltd).
- l. Finolex Cable.
- m. Rediant Cables.
- n. NETCO Cables Pvt Ltd.
- o. Havells Ltd.

44.0 CP SACRIFICIAL ANODES

- a. Scientific Metals Engineers Pvt. Ltd., Karaikudi
- b. PSL Holding Pvt. Ltd., Mumbai.
- c. Cathodic Controls, Bangalore.
- d. BHEL, Bhopal.
- e. Nippon Corrosion, Japan.
- f. AFIC, KSA.
- g. Platt Bros. and Company, USA



- h. Wilson Walton International.
- i. Impalloy International.
- j. Corrpro International.
- k. HOCKWAY, UK
- l. NAKABOHEC, Japan .
- m. Cortech International
- n. Titanor Component
- o. Shakti Metals, Ahmedabad
- p. Shaktianodes Private Limited, Ahmedabad

45.0 CP PORTABLE /PERMANENT REFERENCE CELL

- a. M/S PERMACELL/HARCO, USA
- b. M/S BORIN MANUFACTURER, USA
- c. M/S M.C.MILLER, USA
- d. M/S TINKER RASOR

46.0 CPTR (AC OPERATED)

- a. Canara Electric
- b. CATHODIC CONTROL COMPANY PVT LTD.
- c. Kriston Systems

47.0 PIN BRAZING / THERMITWELD

- a. SAFETRACK, SWEDEN
- b. CadWeld
- c. BAC, UK
- d. ERICO, USA
- e. THERMOWELD, USA
- f. ERICO, EUROPE

48.0 CP SURGE DIVERTER/SPARK GAP ARRESTOR (EX-D)

- a. Dhen,
- b. OBO
- c. Corrpro system
- d. Sohne
- e. Dairyland

49.0 CP SOLID STATE POLARISATION CELL.

- a. Dairyland



- b. Metricorr
- c. Rustol
- d. Dhen
- e. Kriston Systems

50.0 PETROLEUM COKE BREEZE:

- a. M/S LORESCO, USA
- b. M/S ASBURY, USA
- c. M/S GOA CARBON, GOA
- d. M/S INDIA CARBON, CALCUTTA
- e. M/S PETROCARBON & CHEMICAL COMPANY, HALDIA

51.0 CP ANODE (MMO TYPE):

- a. Corrttech
- b. Scientific Metal Engineers Karaikudi
- c. Titanor Component Ltd., Goa, India.
- d. Denora Permelic S.P.A (Italy). .
- e. Oronzio De Nora S.A. Ingano Switzerland
- f. CER Anode Technologies International USA
- g. ACTEL, UK
- h. ELTECH System Corporation, Texas
- i. MAGNETO-CHEMIE, Netherlands
- j. MATCOR (USA)

52.0 HEAT SHRINK CAP FOR CP ANODE

- a. MATCOR (USA) To Cable Joint
- b. Seal For Life

**53.0 ER- PROBE (EXTERNAL CORROSION) ER- PROBE & CORROSION
COUPON ASSEMBLY**

- a. Rose Corrosion Services UK
- b. Metal Samples, USA. .
- c. Roharbak Cosasco USA
- d. Caproco UK
- e. Emetricorr, Denmark

54.0 HEAT SHRINK CAP FOR ANODE TO CABLE JOINT



- a. Raychem, USA
- b. Matcor (USA)

55.0 MMO WIRE ANODES (WITH FACTORY PRE-PACKED COKE BREEZE)

- a. Matcor (USA)
- b. Covalence (USA)
- c. Berry Plastics (USA) – (Seal for Life Industries)

56.0 MMO WIRE ANODES (WITHOUT FACTORY PRE-PACKED COKE BREEZE)

- a. GROUPPO DENORA, GOA, INDIA
- b. CERANODE TECHNOLOGIES, USA
- c. TELPRO, USA

57.0 MMO TUBULAR/ STRIP/ RIBBON ANODES

- a. GROUPPO DENORA, GOA, INDIA
- b. ORANZIO DE NORA, ITALY
- c. MAGNETOCHEMIE, HOLLAND
- d. ACTEL LTD., U.K.
- e. ELTECH SYSTEMS CORPORATION, USA
- f. CERANODE TECHNOLOGIES, USA
- g. MATCOR (USA)

Note: -

For any other brought out item(s) for which the vendor list is not provided in the tender , bidders can supply those item(s) from vendors/ suppliers who have earlier supplied similar item(s) for the intended services in earlier Oil and Gas projects and the item(s) offered is in their regular manufacturing/ supply range.

- 1) The vendor/supplier should not be in the Holiday list of OWNER/ CONSULTANT/other PSU
- 2) The bidder is not required to enclose documentary evidences (PO copies, Inspection & Completion with satisfactory working certificates etc.) along with their offer, however in case of successful bidder, these documents shall required to be submitted by them within 30 days from date of Placement of Order for approval to OWNER / CONSULTANT.

**D. INSTRUMENTATION****LIST OF RECOMMENDED VENDER/SUPPLIERS OF MAJOR BOUGHT-
OUT ITEMS****1.0 PRESSURE GAUGES**

- a. AN Instruments Pvt Ltd
- b. Badotherm Process Instruments B.V.
- c. Baumer Bourdon Haenni S.A.S
- d. British Rototherm Co Ltd
- e. Budenberg Gauge Co Ltd
- f. Dresser Inc
- g. Forbes Marshall (Hyd) Pvt Ltd
- h. General Instrument Consortium
- i. H. Guru Instruments (South India) Pvt Ltd
- j. Manometer (India) Pvt Ltd
- k. Nagano Keiki Seisakusho Ltd
- l. Hirlekar Precision, India
- m. Waaree Instruments Ltd
- n. Walchandnagar Industries Ltd (Tiwac Divn)
- o. Wika Alexander Wiegand & Co GmbH
- p. Wika Instruments India Pvt Ltd
- q. Ashcroft India Pvt Ltd.
- r. ITEC Measures Pvt Ltd

2.0 TEMPERATURE GAUGES

- a. AN Instruments Pvt Ltd.
- b. Badotherm Process Instruments B.V.
- c. Bourdon Haenni S.A.
- d. Dresser Inc.



- e. General Instruments Consortium
- f. H. Guru Instruments (South India) Pvt Ltd
- g. Nagano Keiki Seisakusho Ltd
- h. Solartron ISA
- i. Walchandnagar Industries Ltd (Tiwac Divn)
- j. Wika Alexander Wiegand & Co GmbH
- k. Wika Instruments India Pvt Ltd
- l. Pyro Electric, Goa
- m. Ashcroft India Pvt Ltd.
- n. ITEC Measures Pvt Ltd

3.0 TEMPERATURE ELEMENTS INCLUDING SKIN TYPE

- a. ABB Automation Ltd
- b. Altop Industries Ltd
- c. Bourdon Haenni S.A.
- d. Detriv Instrumentation & Electronics Ltd
- e. General Instruments Consortium
- f. Japan Thermowell Co Ltd
- g. Tecnomatic S.P.A
- h. Tempsen Instrument India Ltd
- i. Thermo Electric Co. Inc.
- j. Thermo-Couple Products Co
- k. Thermo-Electra B.V.
- l. Wika Alexander Wiegand & Co GmbH
- m. Altop Industries Ltd., Baroda
- n. Nagman Sensors (Pvt.) Ltd.
- o. Pyro Electric, Goa
- p. ITEC Measures Pvt Ltd

4.0 POSITIVE DISPLACEMENT FLOW METERS

- a. RMG (Germany)
- b. Elster Instromet
- c. Romet
- d. Dresser
- e. Itron



- f. FMG
- g. Common
- h. Metreg
- i. Raychem RPG
- j. Vemmtec

5.0 TURBINE FLOW METER

- a. Daniel
- b. Elster Instromet
- c. Itron
- d. RMG
- e. Rockwin

6.0 ELECTRONIC VOLUME CORRECTOR

- a. Elgas
- b. Itron
- c. Plum
- d. Pietro Fiorentini

7.0 ORIFICES (METER RUN, FLOW CONDITIONER, ORIFICE PLATE AND ASSEMBLY)

- a. Emerson
- b. FMC, USA
- c. Pietro Fiorentini S.P.A (Italy)
- d. Canalta Controls, Canada

8.0 ULTRASONIC FLOW METERS

- a. Daniel (USA)
- b. RMG (Germany)
- c. Instromet International (Belgium)
- d. Sick Maihak, Germany
- e. FMC, Germany

9.0 MASS FLOW METERS



- a. Daniel Measurement & Control Asia Pacific
- b. Endress + Hauser Instruments International
- c. FMC Measurements Solutions
- d. Heinrichs Messtechnik GMBH
- e. Rheonik MessGerate GMBH

10.0 FIELD INSTRUMENTS (P, DP, F, L, T)

- a. ABB Ltd
- b. Honeywell
- c. Fuji Electric Instruments Co Ltd
- d. Yokogawa
- e. Invensys India Pvt.Ltd

11.0 LEVEL GAUGES/ LEVEL INSTRUMENTS

- a. Bliss Anand
- b. Chemtrols
- c. V-Automat
- d. Levcon
- e. Nivo Controls
- f. Sbeletro Mechanicals
- g. TRAC

12.0 PRESSURE REGULATOR AND SLAM SHUT VALVE

- a. Pietro Fiorentini S.P.A. (Italy)
- b. Emerson
- c. RMG-Regel Messtechnik (Germany)
- d. Mokveld Valves BV (Netherlands)
- e. Schlumberger (USA)
- f. Gortter Controls B V (Netherlands)
- g. Instromet International NV



- h. Nirmal Industrial Controls Pvt Ltd. (up to 6" size only)
- i. ESME Valves Ltd
- j. Kaye & Macdonald Inc.
- k. Nuovo Pignone S.P.A (Italy) (GE Oil Co.)
- l. Richards Industries (Formerly Treloar)
- m. Samson AG Mess-und Regeltechnik
- n. Tormene Gas Technology
- o. Dresser Inc, USA (upto 8" size, 300# class only)

13.0 PRESSURE SAFETY VALVES

- a. Keystone Valves (India) Pvt. Ltd.
- b. Larson & Toubro Ltd.
- c. Lesser GmbH & Co KG
- d. Mekaster Engg Ltd..
- e. Tyco Sanmar Ltd. (New Delhi)
- f. Anderson Greenwood Crosby
- g. BHEL (Trichy)
- h. Curtiss Wright Flow Control Corporation
- i. Dresser Inc.
- j. Fukui Seisakusho Co. Ltd
- k. Nakakita Seisakusho Co Ltd
- l. Nuovo Pignone S.P.A (Italy) (GE Oil co)
- m. Parcol S.P.A
- n. Safety Systems UK Ltd
- o. Tai Milano S.P.A
- p. Weir Valves & Controls France
- q. Bliss Anand Pvt Ltd.

14.0 CONTROL PANEL & ACCESSORIES

- a. Keltron Controls Ltd., Kerala
- b. Elechmec Corporation Ltd., Mumbai
- c. Industrial Controls & Appliances Pvt. Ltd.,
- d. Alstom System Ltd., Noida
- e. Emerson Process Management (I) Pvt. Ltd.
- f. ABB Instruments Ltd., New Delhi
- g. Larsen & Toubro Ltd.



- h. Control & Automation, New Delhi
- i. GE Fanuc Systems Pvt. Ltd., New Delhi
- j. Rockwell Automation (I) Ltd., Ghaziabad
- k. Honeywell Automation Ltd.
- l. Rittal
- m. Pyrotech Elcronics Pvt Ltd.
- n. Positronics Pvt Ltd.
- o. Electronics Corporation of India Ltd.
- p. Phoenix Contact (I) Pvt. Ltd

15.0 JUNCTION BOXES AND CABLES GLANDS

- a. Ex-Protecta
- b. Flameproof Control Gears
- c. Baliga
- d. Flexpro Electricals
- e. RAY Flameproof Pvt Ltd (Flameproof Weatherproof)

16.0 CONTROL AND SIGNAL CABLES

- a. Associated Cables
- b. Brook
- c. Associated Flexibles & Wires (Pvt) Ltd
- d. Universal Cables Ltd, India
- e. Delton Cables Ltd, India
- f. KEI Industries Ltd INDIA
- g. CMI Limited
- h. Cords Cable Industries Ltd, India
- i. Elkay Telelinks (P) Ltd., India
- j. Udey Pyrocables Pvt Ltd, India
- k. Goyolene Fibres (I) Pvt Ltd, India
- l. Netco Cable Industries Pvt Ltd, India
- m. Nicco Corporation Ltd, India
- n. Paramount Communications Ltd, India
- o. Polycab Wires Pvt Ltd, India
- p. Radiant Cables Pvt Ltd, India
- q. Reliance Engineers Ltd., India
- r. Suyog Electricals Ltd, India



- s. Thermo Cables Ltd

17.0 GAS DETECTION SYSTEM

- a. Crowcon Detection Instruments Ltd
- b. Detection Instruments (I) Pvt Ltd
- c. Detector Electronics Corporation
- d. Drager Safety AG & Co. KGAA
- e. General Monitors Ireland Ltd
- f. Mine Safety Appliances Company
- g. MSA – Mines Safety Appliances(India) Ltd
- h. Industrial Scientific Oldham France S.A.
- i. Riken Keiki Co Ltd
- j. Simrad Optronics Icare
- k. Honeywell Analytics
- l. Net Safety Monitoring Inc.
- m. Simtronics SAS
- n. Pollution Protection Systems Mumbai Pvt Ltd

18.0 MOV ACTUATOR:

- a. Rotork- UK, USA & INDIA
- b. Limitorque
- c. Auma- India
- d. Biffi- Italy
- e. DelVal Flow Controls Pvt. Ltd

19.0 PNEUMATIC ACTUATOR (SOLENOID OPERATED ON-OFF TYPE)

- a. Metso Automation
- b. Tyco
- c. Samson Controls
- d. L&T
- e. Emerson
- f. Fisher
- g. Masoneilan Process Control
- h. Instrumentation Limited (IL)-Palghat



- i. Micro Finish
- j. Rotex

20.0 SOLENOID VALVES

- a. Avcon
- b. Festo
- c. DelVal Flow Controls Pvt. Ltd

21.0 ELECTRO – HYDRAULIC ACTUATOR

- a. Avcon Rotork controls (Deutschland Gmbh)
- b. Biffi Italia Srl
- c. Ledeen (Italy)
- d. Virgo Valves and Controls Ltd.-India
- e. Limittorque
- f. Reineke
- g. Voith
- h. Bettis
- i. Rotork- UK, USA & INDIA
- j. Rotex
- k. Schuck Group
- l. DelVal Flow Controls Pvt. Ltd

22.0 GAS OVER OIL ACTUATOR

- a. Biffi Italia Srl,
- b. Ledeen(Italy)
- c. Virgo Valves & Control Ltd.-India,
- d. Voith,
- e. Bettis,
- f. Rotork-UK, USA, India,
- g. Rotex,
- h. Schuck Group,
- i. Valve Italia.

23.0 OFC

Manufacture/ Procurement, Testing and supply of suitable OFC Joint closures including all necessary accessories of any of the following make:



- a. Raychem
- b. 3M
- c. Siemens
- d. Any other make from the approved vendor list of client with supporting paper.

24.0 FLOW CONTROL VALVES

- a. Fouress Engg. (New Delhi)
- b. Fisher Xomox (New Delhi)
- c. MIL Control Ltd. (Noida)
- d. KOSO India Pvt Ltd
- e. Samson Control (Thane)
- f. Dresser Valves India Pvt Ltd.
- g. Fisher Controls
- h. Valvitalia Italy
- i. CCI Valve technology
- j. Flowserve Pvt Ltd.
- k. Metso Singapore Pvt Ltd.
- l. Instrumentation Ltd Palghat
- m. Dresser Inc. USA

25.0 FLOW COMPUTERS

- a. Emerson
- b. Instromet International (Belgium)
- c. FMC Measurement Solutions (UK)
- d. RMG (Germany)
- e. OMNI Flow Computers Inc.
- f. Thermo Fisher, USA

26.0 INDICATORS & CONTROLLERS

- a. Yokogawa
- b. Eurotherm Chessel
- c. Honeywell
- d. Emerson

27.0 BARRIERS

- a. MTL
- b. STHAL



- c. P&F
- d. Phoenix Contact (I) Pvt. Ltd.

28.0 GAS CHROMATOGRAPH

- a. ABB
- b. Emerson
- c. Instromet International, NV
- d. RMG Regal+Messtechnik GmbH
- e. Yokogawa

29.0 I/P CONVERTERS

- a. ABB
- b. Emerson
- c. IMI Watson Smith Ltd.
- d. Moore Controls Ltd
- e. Shreyas Instruments Pvt Ltd, India
- f. Thermo Brandt Instruments

30.0 SS FITTINGS, INSTRUMENT VALVES & MANIFOLDS**30.1 FOR CNG WORK:**

- a. DK-LOK
- b. Swagelok Co.
- c. Parker
- d. Dawsons Tech Components LLP
- e. ASTEC Valves & Fittings Pvt Ltd
- f. Thomas & Brian Mfg. Pvt. Ltd
- g. Global Valves and fittings(India) Pvt Ltd

30.2 EXCEPT CNG WORK:

- a. Swagelok Co.
- b. Parker
- c. Aura INC.
- d. HOKE
- e. Excelsior Engineering works
- f. Swastik Engineering works India
- g. Comfit and valves pvt ltd
- h. Arya craft and engineering Pvt ltd



- i. DK lok
- j. ASTEC Valves & Fittings Pvt Ltd
- k. Dawsons Tech Components LLP
- l. DelVal Flow Controls Pvt. Ltd
- m. Thomas & Brian Mfg. Pvt. Ltd
- n. Global Valves and fittings(India) Pvt Ltd

31.0 SS TUBES

31.1 FOR CNG WORK:

- a. Swagelok Co.
- b. Parker
- c. Sandvik
- d. Jindal Saw
- e. Tubacex Tubes and Pipes Private Ltd
- f. Krystal Global Engineering Ltd.
- g. Maxim Tubes Company Pvt. Ltd.
- h. VENUS PIPES & TUBES LIMITED

31.2 EXCEPT CNG WORK:

- a. Swagelok Co.
- b. Parker
- c. Sandvik
- d. Heavy metal and tube limited
- e. Nuclear fuel complex India
- f. Scorodite
- g. Ratnamani Metals and Tubes
- h. Jindal Saw

**E. SHOP & FIELD PAINTING****LIST OF RECOMMENDED VENDER/SUPPLIERS OF MAJOR BOUGHT-
OUT ITEMS****1.0 INDIAN VENDORS**

- a. Asian Paints (I) Ltd.
- b. Berger Paints Ltd.
- c. Goodlass Nerlolac Paints Ltd.
- d. Jenson And Nicholson Paint Ltd & chokuGu Jenson & Nicholson Ltd.
- e. Shalimar Paints Ltd.
- f. Sigma Coating, Mumabai
- g. CDC Carboline Ltd.
- h. Premier Products Ltd.
- i. Coromandel Paints & Chemicals Ltd.
- j. Anupam Enterprises
- k. Grand Polycoats
- l. Bombay Paints Ltd.
- m. Vanaprabha Esters & Glycer, Mumbai
- n. Sunil Paints and Varnishes Pvt. Ltd.
- o. Courtaulds Coating & Sealants India (Pvt.) Ltd.
- p. Mark-chem Incorporated, Mumbai (for phosphating chemicals only)
- q. VCM Polyurethane Paint (for polyurethane Paint only)

2.0 FOREIGN VENDORS FOR OVERSEAS PRODUCTS

- a. Sigma Coating, Singapore
- b. Ameron, USA
- c. Kansai Paint, Japan
- d. Hempel Paint, USA
- e. Valspar Corporation, USA
- f. 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 client, 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.
3. Equipment / Instruments of any make which is offered by one bidder and acceptable to client 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.

**F. FOR PE & LMC WORK (GI/CU)****1.0 MDPE PIPE**

- a. Mukand Poly Products,
- b. Dewa Polymers Pvt. Ltd.
- c. Rungta Irrigation Ltd.

2.0 MDPE FITTINGS & MDPE VALVES

- d. Aliaxis,
- e. George Fischer,
- f. Al-Aziz,
- g. Kimplas,
- h. Banides,
- i. Agru,
- j. Friatech,
- k. Plasson

3.0 GI PIPE

- a. Swastik Pipe Ltd.
- b. Jindal Industries Ltd.
- c. Vishal Pipes Ltd.
- d. Indus Tubes Ltd
- e. Advance steel Tubes Ltd.
- f. Good Luck Tubes Ltd.
- g. Surya Roshni Limited
- h. APL Apollo Tubes Limited
- i. Jindal Pipes Limited
- j. RK Steel Manufacturing Company Private Limited
- k. PSL Tubes Limited

4.0 CASTING GI FITTINGS

- a. Sarin Industries Ltd.
- b. Jupiter Metal Industries Ltd.
- c. Jainsons Industries Ltd.
- d. Jinan Meide Casting Co. Ltd.
- e. Green Malleable Pvt. Ltd.
- f. Chandan Enterprises



- g. Unique Pipe Fitting Co

5.0 FORGED GI FITTING (FOR HIGH RISE SEGMENT)

- a. Jainsons Industries
b. B.M. Meters Pvt. Ltd.

6.0 COPPER TUBES & FITTINGS

- a. Jay Banas Mehta Tubes Limited- Trade Mark "MEXFLOW"
b. Rajco metal (Tubes & Fittings)
c. Paras Industries
d. MERCURE METAL & ALLOYS PVT LTD
e. Chandan Enterprises (Fittings only)

7.0 BRASS VALVES

- a. Universal srl, Italy
b. Tiemme Raccorderie Sede, Italy
c. Enolgas Bonimu s.a.s., Italy
d. Fratelli Fortis s.r.l, Italy
e. Giacomo Climbrio, Italy
f. Parker Hannifin S.P.A., USA
g. Singapore Valve & Amp; Fittings Pte Limited, Singapore /Bengaluru
h. Rubinetterie Utensilerie Bonomi (RUB), Italy
i. Zhegiang Valogin Technology Co. Ltd., China,
j. Ningbo Zhiqing Industrial Co. Ltd., China,
k. Zhegiang Dunan Valve Co. Ltd.,
l. Ningbo Huaping, China.
m. Chandan Enterprises

8.0 Isolation & Appliance valves

- a. Chandan Enterprises

9.0 BRASS FITTINGS

- a. Chandan Enterprises
b. Paras Industries Ltd.
c. Chokhawala Distributors – Brass Adaptor.

10.0 STEEL RE-INFORCED RUBBER HOSE (TYPE-4)



- a. Super Seal Flexible Hose Ltd.
- b. Suraksha Products Pvt. Ltd.
- c. Vansh Industries
- d. T & L Gases

11.0 CORRUGATED FLEXIBLE METAL HOSES (ANACONDA)

- a. KPC Flex Tubes
- b. Vestas Hose Division
- c. Alpha Flexi Tubes
- d. Chandan Enterprises

Note:

- 1. Vendor may procure material from any of approved vendors listed.
- 2. For equipment/components other than the above, vendor shall submit past track record for the proposed sub-vendors and obtain written approval from Owner / Consultant before placing order.
- 3. In case of exigencies like long delivery periods from approved vendors, the contractor shall list down the proposed suppliers/vendors for such items and submit the same for owner review/approval along with necessary documents/PTR.
- 4. Non-acceptance of a particular proposed vendor due to any reasons whatsoever shall not be a cause of schedule and cost implication. If equipment is sourced from outside India, vendor shall obtain prior approval for make of equipment before placement of order.

Above mentioned vendor list is tentative and further addition/deletion may be done as per discretion of Owner/VCS.



Energising Quality

LIST OF AUTHORIZED THIRD-PARTY INSPECTION AGENCY (TPIA)

DOC. NO.- VCS-C&P-TPIA-001

Rev No : 17

SL. NO.	NAME OF TPIA
1	Det Norske Veritas (DNV)
2	Germanischer Lloyd Industrial Services GmbH
3	Bureau Veritas (India) Pvt. Ltd.
4	Moody International (India) Pvt. Ltd. (Industry Services Division)
5	SGS India Pvt. Ltd.
6	Certification Engineer International Limited (CEIL)
7	TÜV SÜD South Asia Pvt. Ltd.
8	ABS Industrial Verification (India) Pvt. Ltd.
9	Lloyd Register of Industrial Services
10	IRCLASS Systems and Solutions Private Limited
11	Tata Projects Limited
12	International Certification Services Pvt. Ltd.
13	TUV India Pvt. Ltd., Industrial Services Division
14	Intertek India Pvt. Ltd. (Industry Services Division)
15	Quality Austria Central Asia Pvt. Ltd.
16	Edlipse Engineering Global Pvt. Ltd.
17	TUV-Rheinland
18	Hertz Inspection & Services Pvt Ltd
19	Alfred H Knight India Pvt Ltd (Formely known as Dr. Amin Controllers Pvt Ltd)

PART-B- DE- COMPRESSION UNIT (DCU) -100 SCMH,450 SCMH



**DE-COMPRESSION UNIT (DCU) DIMAPUR,
NAGALAND GA**



**MATERIAL REQUISITION FOR
DECOMPRESSION SKID**

TOTAL SHEETS

10

DOCUMENT NO

C261162

00

ME

MR

5002

HPOIL GAS PRIVATE LIMITED (HOGPL)

**DE-COMPRESSION UNIT (DCU) FOR
OF DIMAPUR, NAGALAND GA**

**MATERIAL REQUISITION FOR
DECOMPRESSION SKID (DCU)**

C1	07.05.2026	Issued for Client Review	AB	SA	AB
REV	DATE	DESCRIPTION	PREP	CHK	APPR

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1 INTRODUCTION

Hindustan Petroleum Corporation Limited (HPCL) is a Central Public Sector with a Navratna Status, and a Forbes 2000 and Global Fortune 500 company incorporated in 1974 engaged in refining and marketing of petroleum products with its headquarter in Mumbai, Maharashtra.

Oil India Limited (OIL) is a premier Indian National Oil Company engaged in the business of exploration, development and production of crude oil and natural gas, transportation of crude oil and production of LPG founded in 1959 with its headquarters in Duliajan, Assam.

A JVC has been incorporated in the name of HPOIL GAS PRIVATE LIMITED, which has received the authorization from PNGRB vide letter PNGRB/CGD/BID/8/2018/GA/Ambala-Kurukshetra District dated 22/02/2018 to Lay, Build and Operate City Gas Distribution networks in Ambala & Kurukshetra and vide letter PNGRB/CGD/BID/8/2017/BEC/GA-Kolhapur dated 06/03/2018 to Lay, Build and Operate City Gas Distribution networks in Kolhapur District.

HPOIL GAS PRIVATE LIMITED (HOGPL) has engaged M/s VCS Quality Services Private Limited (herein after referred as "VCS" or "VCSQSPL") as a consultant, for CGD project for Geographical Area (GA) of Ambala and Kolhapur District.

2 PURPOSE

This document describes in detail the scope of work, scope of supply and responsibilities of bidder for procurement of Decompression Skid.

The scope includes supply, design, engineering, manufacturing, fabrication, procurement of bought out items / components, testing and inspection, assembly at shop, integration, internal testing, packaging, shipping, documentation, and supervision for installation & commissioning of decompression skids.

The decompression skid shall consist of complete piping works with twin stream run, electrical heater water bath heater along with Local Control Panel (LCP), 600 VA UPS (for control system) with battery backup for 1 hours and all the required instrumentation. The decompression skid shall be complete in all respect, movable and ready to use.

3 ORDER OF PRECEDENCE

In the event of any conflict between these specifications, related standards and codes, any other attachment to this package, the Bidder shall follow the following documents in the order of their priority:

- Datasheets;
- Job Specifications for Decompression skids;
- National and International Codes & Standards.

In case of any conflict in various documents, same shall be referred to HOGPL for clarification. Most stringent one shall apply in case of conflict on various parts of bid documents / tender. Bidder shall not proceed further without getting written approval / clarification in such cases.

4 SCOPE OF SUPPLY

S.NO	DESCRIPTION	UNIT	QTY.	REMARKS
PART -B 1	CNG DE-COMPRESSION SKIDS Design, Engineering, Manufacturing, Inspection & Testing, Nameplate marking, Painting, Packaging, loading Forwarding, Transportation, Transit			

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DE-COMPRESSION UNIT (DCU) FOR DIMAPUR, NAGALAND GA

	Insurances, handling, Shipment, Unloading of skid at CLIENT store / designate place at site, Supply of CNG Decompression Skid comprising of filtration, pressure reduction, Twin stream with Induction heater, Heat exchanger, UPS , RPD Meter with EVC,Modem and all accessories, Gas detector, Consumables, supply of Commissioning and mandatory spares . It includes Calibration Configuration, Interfacing, as per Job specifications and Special Instructions enclosed. Supervision assistance during erection and hook up with existing connection and commissioning at site , performance testing and providing training at site for which payment shall be made as per SOR no.1.2			
1.1	Flow: 100 SCMH Design Pressure: 275/48/18 Barg Design Temperature: -29 Deg. C to 65 Deg. C Inlet Pressure: 35 to 250 Barg Outlet Pressure: 4 to 6 Barg Inlet Size: 3/4" x 2500# Outlet Size: 4" x 150#	Nos.	4	
1.2	Providing assistance during erection and hook up with existing connection and all other related work for commissioning of DCU, providing commissioning assistance & performance testing of CNG Decompression Skids. Providing on-site training to O&M personnel at site. Note: For this particular line item Payment will be released after acceptance of SAT (Site Acceptance Test) report.			
1.3	CNG Decompression-skid (100 SCMH)	Nos.	4	
2	CNG DE-COMPRESSION SKIDS Design, Engineering, Manufacturing, Inspection & Testing, Nameplate marking, Painting, Packaging, loading Forwarding, Transportation, Transit Insurances, handling, Shipment, Unloading of skid at CLIENT store / designate place at site, Supply of CNG Decompression Skid comprising of filtration, pressure reduction, Twin stream with Water Bath Heater, Heat exchanger, UPS , RPD Meter with EVC,Modem and all accessories, Gas detector, Consumables,supply of Commissioning and madnatory spares . It includes Calibration Configuration, Interfacing, as per Job specifications and Special Instructions enclosed. Supervision assistance during erection and hook up with existing connection and commissioning at site , performance testing and providing training at site for which payment shall be made as per SOR no.2.2			

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DE-COMPRESSION UNIT (DCU) FOR DIMAPUR, NAGALAND GA

2.1	Flow: 450 SCMH Design Pressure: 275/48/18 Barg Design Temperature: 0 Deg. C to 65 Deg. C Inlet Pressure: 35 to 250 Barg Outlet Pressure: 4 to 6 Barg Inlet Size: 3/4" x 2500# Outlet Size: 4" x 150#	Nos.	02	
2.2	Providing assistance during erection and hook up with existing connection and all other related work for commissioning of DCU, providing commissioning assistance & performance testing of CNG Decompression Skids. Providing on-site training to O&M personnel at site. Note: For this particular line item Payment will be released after acceptance of SAT (Site Acceptance Test) report.			
2.3	CNG Decompression-skid (450 SCMH)	Nos.	02	

5 SCOPE OF WORK

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

- Scope of work shall comprise of Supply, Design, Detail Engineering, Procurement of Materials, manufacturing or fabrication, Inspection & FAT of Decompression skid units' system, Packaging, forwarding, Insurance, Shipping, Inland Transportation to site, loading and unloading of material at HOGPL site / stores; and Supply of all related goods. Supply of all type of Erection Items, erection and installation, Pre-Commissioning, Testing, Commissioning, SAT, support, and Warranty & documentation of complete DCU system, testing certificates, calibration certificates of equipment required to complete in all respect.
- Rectification of any damage (if any) occurred during transportation/ unloading / observed on receipt of material at site;
- All required consumables i.e., Oil/water etc. for commissioning shall be in the bidder scope.
- Spares for maintenance and commissioning if required need to be considered;
- Supply of Mandatory spares as per enclosed Annexure for 100 SCMH & 450 SCMH
- Supply the flanges, with given size & rating along with mating flanges, required gasket & studs & bolts.
- Supply and laying of power, signals, communication cables, earthing cables, and cable glands. A tentative 100 Mtr. length of Power cable from HOGPL single point distribution board of 415 AC shall be consider and final length as per site requirement shall be in the scope of bidder.
- Supply, Design, Installation and Commissioning of the Electrical system i.e., UPS with battery and Water heater and Local Control Panel (LCP) etc. as per the P&ID.
- After Commissioning of DCU's, OEM shall operate the DCU with the HOGPL operation and Maintenance team for at least 4 weeks to prevent and take care of the initial hitches if any without any additional payment from the client.
- Compliance of Checklist points during FAT, SAT, Site, stores (if any);

5.1 Scope of Design and Engineering

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Scope of design and engineering is entirely responsibility of successful bidder. Documents and drawings are attached is minimum requirement. Successful bidder shall carry out detail engineering of the skid covering all design aspects shall follow as per applicable codes and standards.

Equipment's, instruments, and Valves shall be sized as per process condition. Sizing calculation are to be provided company / PMC for verification / validation. Similarly, all design documents and drawings are to be submitted to company / PMC for approval.

5.2 Scope of Residual Engineering

The bidder shall also be responsible for carrying out residual engineering in order to proceed with detailed engineering such equipment / instrument sizing, utility consumption, specifying derived data in process data sheets, type and material selection of instruments / equipment's wherever required.

6 POWER SUPPLY

Three phase 415 V AC Electrical power supply will be provided at one point inside the battery limit. Further distribution shall be in the scope of the bidder. If any other voltage levels are required, then all necessary conversions shall be in the scope of bidder.

7 BIDDER'S COMPLIANCE

Bidder shall submit his bid in full compliance with the requirements of this MR and attachments.

Bidder shall include the following statement in his bid:

We certify that our bid is fully complying with your enquiry dated and referenced,

Compliance with this Material Requisition in any instance shall not relieve the vendor of his Responsibility to meet the specified performance.

8 COMPLIANCE WITH SPECIFICATION

The bidder shall be completely responsible for the design, material selection, fabrication, testing, and inspection, preparation for shipment and transfer of above material to nominated delivery point strictly in accordance with the MR & all attachments therefor.

9 BIDDER'S SCOPE

Bidder's scope of work includes the equipment with all internals & accessories as indicated in P&ID attached and respective datasheets and specifications and all parts necessary for a satisfactory operation & testing except those which are indicated to be out of bidder's supply.

10 INSPECTION & TESTING

Bidder shall strictly follow QAP included in the Tender. Bidder shall provide FAT & SAT procedures for review and approval.

Refer to specifications attached for requirements on testing and inspection.

11 BIDDER'S DOCUMENTS

Bidder shall supply the documentation as listed of this Material Requisition.

All documents shall be supplied in English language.

12 DOCUMENTS & DATA REQUIREMENTS

The table hereunder specifies the quantities and nature of the documents to be submitted by the bidder to Company.

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The documents required at the inquiry stage to be included in the bid are listed under column A. The documents required after award of the agreement and subject to the written approval of the Company are listed under column B.

Any document even when preliminary shall be binding and therefore duly identified & signed by the bidder. It shall bear the company project reference, the MR number and identification number.

The documents are fully part of the supply which shall be complete only if and when the documents complying fully with the material requisition requirements are received by the Engineer.

S.no.	Documents and Data	A	B		C	
		Number of copies	Number of copies	Required time period	Number of copies	Required time period
1.	Drawing/data submittal list/schedule	-	3	2 weeks	3	2 weeks
2.	P&ID in compliance with the tender document	1	3	2 weeks	3	2 weeks
3.	Fabrication, test and delivery schedule (per item)	-	3	2 weeks	3	2 weeks
4.	Progress report	-	3	2 weeks	3	2 weeks
5.	Catalogues / References	1	3	2 weeks	3	With final tech. file
6.	Outline drawing + unit weight (per skid)	-	3	2 weeks	3	With final tech. file
7.	Detail drawing + material specification	-	3	2 weeks	3	With final tech. file
8.	Code compliance certificate	-	3	2 weeks	3	With final tech. file
9.	Welding procedure specification and records WPS/PQR	-	3	4 weeks	3	With final tech. file
10.	Inspection and test procedures compliance with the tender document	1	3	8 weeks	3	With final tech. file
11.	Test reports	-	3	3 weeks	3	With final tech. file

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12.	NDE reports	-	2	1 week after test	2	With final tech. file
13.	Heat treatment reports	-	2	1 week after test	2	With final tech. file
14.	Bill of materials (on drawings)	-	2	1 week after test	2	With final tech. file
15.	Installation instructions Site inspection procedure	-	2	4 weeks	2	With final tech. file
16.	Packing/shipping list with weights and dimensions	-	2	4 weeks before shipping	2	With final tech. file
17.	Material test certificate	-	2	4 weeks before shipping	2	With final tech. file
18.	Painting system description	-	2	1 week after test	2	With final tech. file
19.	List of subcontractors with their scope	-	2	2 weeks	2	With final tech. file
20.	Hydro test and air test report	-	2	4 weeks	2	With final tech. file
21.	Bill of materials (on drawings)	-	2	2 weeks	2	With final tech. file
22.	Installation instructions Site inspection procedure	-	2	2 weeks	2	With final tech. file
23.	Packing/shipping list with weights and dimensions	-	2	4 weeks	2	2 Weeks
24.	Material test certificate	-	2	4 weeks	2	2 Weeks
25.	Painting system description	-	2	4 weeks	2	2 Weeks
26.	List of subcontractors with their scope	-	2	4 weeks	2	2 Weeks
27.	Signed and stamped Datasheets in compliance with Tender	1	2	4 weeks	2	2 Weeks

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	Document					
28.	GA drawing of the skid and the Canopy of the skid	-	2	4 weeks	2	2 Weeks
29.	Completed Instrument Index	-	2	4 weeks	2	2 Weeks
30.	Bill of materials (on drawings)	-	2	4 weeks	2	2 Weeks
31.	Operating philosophy and detailed drawing for the stream changeover system of the Decompression skid including details of the set point adjustment system etc.	-	2	4 weeks	2	2 Weeks
32.	Completed data sheets for all instruments and electrical items, like instruments, regulating valves, shut down valves etc. with supporting calculations, GA drawings with part names and MOC, etc. for approval during detail engineering.	-	2	8 weeks	2	2 Weeks
33.	Functional Loop Drawing	-	2	4 weeks before shipping	2	With final tech. file
34.	Cable schedule	-	2	4 weeks before shipping	2	With final tech. file
35.	Earthing Drawing	-	2	4 weeks before shipping	2	With final tech. file
36.	Interface Descriptions	-			2	Before shipping
37.	Instrumentation hook-ups	-	3	2 weeks	3	2 weeks
38.	Power requirement calculation for skid	-	3	2 weeks	3	2 weeks

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39.	Statutory approvals / certificates etc. As applicable	1	3	2 weeks	3	2 weeks

Notes:

- FAT procedure document must include clause wise reference of tender specification for its compliance. This document shall be prepared in consultation with owner/ owner's representative.
- Durations in column B (Required date) are weeks after Purchase Order date. Durations in column C (Required date) are weeks before final dispatch.
- Final technical document file shall be supplied in hard copy as indicated and in electronic format (.pdf Acrobat files) on two (2 Nos.) CD-ROMs.



**DE-COMPRESSION UNIT (DCU) FOR
DIMAPUR, NAGALAND GA**



**TECHNICAL SPECIFICATION FOR
DECOMPRESSION SKID**

TOTAL SHEETS

20

DOCUMENT NO.

C261162

00

ME

TS

5002

HPOIL GAS PRIVATE LIMITED (HOGPL)

**DE-COMPRESSION UNIT (DCU) FOR
DIMAPUR, NAGALAND GA**

**TECHNICAL SPECIFICATION FOR
DECOMPRESSION SKID
(HIGH PRESSURE TO LOW PRESSURE)**

C1	07.05.2026	Issued for Client Review	AB	SA	AB
REV	DATE	DESCRIPTION	PREP	CHK	APPR

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1 INTRODUCTION

1.1 Purpose of Document

The Supply shall cover as a minimum the Design, Engineering, manufacturing, assembly, testing, supply and commissioning of the De-compression skids. The package shall also include all the necessary control equipment with enclosures suitable for the working environment.

2 DEFINITION

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

AGREEMENT	Designate the agreement concluded between the Client and the Contractor, under which the latter undertakes to the former the Goods and/or Services according to the stipulations which are agreed and specified in the form of an order.
CLIENT	Designates the purchaser of the Goods and/or Services which are the subject of the Agreement.
CONTRACTOR	Designates the individual or legal entity with whom the order has been concluded by the Client. The term "Contractor" may be used indifferently for a supplier a manufacturer an erection contractor, etc.
DAYS- WEEKS-MONTHS	Specify the number of calendar days, weeks or months and not of working days, weeks or months.
ENGINEER	Designates VCS quality services Pvt Ltd and its associates if any, to which the Client has entrusted various tasks in relation with the carrying out of his Project.
GOODS AND SERVICES	Designate, depending on the case, all or part of the drawings or documents, substances, materials material, equipment, structures, plant, tools, machinery, to be studied, designed, manufactured, supplied, erected, built, assembled, adapted arranged or put into service by the Contractor under the agreement including all the studies, tasks works and services by the order. The terms Goods or Services may be indifferently used one for the other as required by the context.

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PROJECT Designates the aggregate of Goods and/or Services to be provided by one or more Contractor.

3 ORDER OF 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:

- MR
- Data Sheets
- Specifications
- Basic Documents
- Codes and Standards

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.).

4 CODES & STANDARDS

The design shall be made in accordance with latest Codes & Standards and statutory requirements

In the event that there is no applicable Indian Standard, a corresponding International Standard may be applied to the design, as long as use of substitute standard is approved in writing by principal. Latest revisions of following standards are applicable for the package.

International Electro technical Commission Standards	
IEC 617-12	Graphical symbols for diagrams - Binary logic diagrams
IEC 751	Industrial platinum resistance thermometers sensors.
IEC 801	Electromagnetic Compatibility for Industrial Process
IEC-60529	Classification of Degrees of Protection Provided by Enclosures (IP code)
IEC-60079	Electrical Apparatus for Explosive Gas Atmosphere.
American Petroleum Institute Standards	
API RP 520	Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries
API RP 551	Process Measurement Instrumentation

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API 555	Process Analyzers
API 526	Flanged Steel Pressure Relief Valves
API 527	Seat Tightness of Pressure Relieving Valves
API 12 K	Indirect Water Bath Heater
ISA Standards	
ISA S5.1	Instrument Symbols and Identification
ANSI/ISA S75.01	Flow Equations for Sizing Control valves
ANSI/ISA S75.03	Face to Face Dimensions for Flanged Globe Valves
ANSI/ISA S75.04	Face-to-face dimensions for flangeless control valve bodies
OTHER CODES	
PNGRB	Petroleum and Natural Gas Regulatory Board
ASME PTC 19.3	Temperature Measurement Instruments and Apparatus
EN 12482	Gas meters — Rotary Displacement Gas Meters
EN 334	Gas Pressure Regulators for inlet pressures up to 100 Bar
EN 837	Part-1, 2, 3 for Pressure Gauges.
OISD-STD-226	Natural gas transmission Pipeline and City Gas Distribution Network
OISD-STD-220	Distribution of Piped Natural Gas

5 ENVIRONMENTAL CONDITION

The equipment considered and the complete installation shall be suitable for continuous operation under the following site conditions:

Description	Indoor (Air Conditioned)	Indoor (Non-Air conditioned)	Outdoor (Under shade)	Outdoor (Open to sky)
Operating Temperature	0 ~ 35 Deg C	-5 ~ 50 Deg C	-5 ~ 50 Deg C	-5 ~ 55 Deg C
Relative Humidity	20% ~ 80%	90%	95%	

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All field instruments shall be provided with FRP (UV protected) canopy. The instruments shall be suitable to the ambient conditions provided in the above table.

6 DESIGN CRITERIA

6.1 Operation & Design Life

Decompression skid shall be designed to operate in the site environmental conditions continuously. The life time of the plant is envisaged to be 25 years. However, optimum design life expectancy of a valve shall be 10 years and spare parts availability shall be for 10 years after cease of production.

6.2 Hazardous Area Classification

Electrical materials shall in general follow the IEC 60079-14 standards and shall be compliance with all applicable local regulations.

As per IEC, the material will be installed in hazardous area zone 1 and classified as "EExd" IIA/IIB T3.

Enclosure protection degree shall be min. IP65 as per IEC 60529.

6.3 Ingress Protection

All field instruments and outdoor equipment such as junction boxes and cabinets/panels shall have ingress protection to IP 65 / NEMA 4 or better in accordance with IEC 60529. Panels installed indoors shall have ingress protection of IP 42 as a minimum.

6.4 EMC Compliance

All valves shall be immune to Radio Frequency Interference (RFI) and Electro Magnetic Interference (EMI). The design and installation of all electrical / electronic equipment shall meet the RFI/EMI requirements according to IEC 61000, emission (IEC61000-6-4) and immunity (IEC-61000-6-2) requirements for an industrial environment. Power Supply.

6.5 Earthing

Instrument and systems shall be connected to the proper earthing system for the protection of personnel and instrument / equipment from fault currents (protective earth) and to minimize electrical interference in signal transmission circuits (instrument earth). The following separate earthing systems are to be provided:

- Protective Earth (PE) – Bonded to the site structure and utilized for electrical safety of metal enclosures and chassis on all instruments and electrical components. This earthing system is used for protection of personnel and equipment from fault currents;
- Instrument Clean Earth (IE) – Insulated from the site structure and other metal work utilized for instrument cable screens and bonded to the main electrical earthing system at a single point. Electronics in the instrument shall be insulated from the metal work.

Cable screens of signal cables shall be segregated from metallic structural earth in the field and earthed at one point only at the cable marshaling point. Cable shields must have a single, continuous path to earth. Earth loops and floating shields shall be avoided. Shield drain wires shall not be daisy-chained to the ground connection.

The purpose of instrument DC & shield earth bus bar is to reduce the effect of electrical interference upon the signal being transmitted. A DC & shield earth bus bar shall be provided within each cabinet for consolidating instrument signal commons and cable shield drain wires.

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This earth bus shall be isolated from the safety earth system and from the body of the cabinet except at the plant earthing reference point.

Each instrument signal common shall be connected to the isolated instrument DC & shield earth bus with copper wire sized to carry the expected fault current or 1.5 mm², whichever is larger. Two insulated copper conductors shall be connected from the instrument DC & shield earth bus within each cabinet to a single tie point on the master instrument earth bar within the control building in a closed loop configuration. The resistance from the isolated instrument DC & shield earth bus to the plant ground grid shall be less than 1 ohm.

Isolated instrument DC & shield earth bars from all cabinets shall be consolidated into a master instrument earth bus located within that building. The master instrument earth bar shall be connected to the master reference earth. The master reference earth should then be connected in a loop configuration to a single point on the plant earthing. Bonding cabinet AC or DC & shield earth bus bars in a daisy-chain connection is not acceptable.

The bidder shall be responsible for all earthing requirements within his scope of supply.

6.6 Material of Construction

The material of construction of the wetted parts and the body of all the individual instruments / equipment shall be suitable to the process fluid / conditions and the site ambient conditions.

All materials and equipment furnished shall be new and unused, of current manufacture and the highest grade and quality available for the required service and free of defects.

Process wetted parts shall be suitable for process fluid and conditions. Body / trim materials shall be selected based on the applicable pipe class as per Piping Material Specification. Wetted parts material shall be SS316 as a minimum. Tubing and tube / pipe fittings used to hook up instruments to piping / vessel shall be SS316. Material of construction of enclosures and junction boxes shall be cast aluminum (LM6 / LM25) or GRP.

Galvanic compatibility between dissimilar materials is to be ensured to prevent corrosion due to galvanic action.

6.7 Painting and Coating

Field instruments shall be epoxy coated as per Manufacturer's standard. The finish of junction boxes (Non IS) shall be light gray shade equivalent to RAL7035 and junction boxes (IS) shall be blue shade. Field mounted panel's surface and inside coating and finish shall be as per manufacturer's recommendation. Field stanchions shall be coated with corrosive resistant coating and finish shall be light gray shade.

Painting shall be carried out by application of one coat (DFT 35-50 microns) of zinc phosphate primer followed by two coats (DFT 60 microns each) of chloro-rubber high build paint of colour canary yellow. Before painting, surfaces shall be thoroughly cleaned by applying mechanical methods.

The following supplies shall be included in bidder's scope:

- The shop painting in accordance with Painting Table attached to Material Requisition;
- Spare parts for start-up/commissioning operations and pre-commissioning /compulsory spares;
- The engineering documents requested in the DDR attached to the Material Requisition;
- The material certificates.

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6.8 Identification & Tagging

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

In addition to the instruments and equipment nameplate, the structural skid (each part of skid) shall be supplied with a permanent, weather resistant, stainless steel nameplate affixed to the skid, with the following details, as a minimum;

- Project Title and SOR item number/ location;
- Owner's logo and Owner name;
- Equipment name and tag number;
- Manufacturer's name and skid serial number, skid capacity;
- Size, rating, flow capacity of individual component like Meter etc.
- Skid part number and overall dimension data;
- Skid weight data;

Each skid and each part thereof and all the instruments in the skid shall have a Stainless steel nameplate attached firmly to it at a visible place furnishing the following information:

- Tag number of the skid;
- Project Name with location: ", ----- (name of site / station)";
- PO No.-
- Inlet size (in inch) and Outlet Size (in inch) with class rating;
- Min/ Normal/ Max. Flow capacity in SM3/Hr. for each of the Decompression skid;
- Tag number of Instruments, JB as per purchaser's data sheets;
- Body sizes with class rating in inches and the Valve Cg value or flow meter G-Rating (as applicable);
- Rating for all the individual instruments;

All cable should have tag no. at JB / panel end and Instrument end. All wires terminated inside skid and JB should have identification mark, ferrules etc. (for the termination of supplied cables, Identification tag no, ferrule etc. shall be provided by bidder).

7 TECHNICAL REQUIREMENTS

The movable type decompression skid shall consist of filter, twin stream two stage regulators, Electric water bath heater as per attached typical P&ID, which shall be designed and supplied as a single compact skid.

The direction of flow of gas in the piping system of the skid shall be indicated on the pipes on both the streams.

The skid should be designed to allow the maximum gas flow rate at the minimum inlet and outlet pressure.

Gas velocities in pipe work should not exceed 30 meters / second, when the maximum flow rate occurs at the lowest expected inlet pressure. The allowable sound pressure values should not exceed 90dB and materials selected should be suitable to prevent erosion at such high velocities.

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All pipe work and equipment's shall be capable of withstanding the maximum pressure, minimum and maximum temperature from a fault condition.

Both the inlet and the outlet shall be provided with a tee with a valve on each branch in order to facilitate two connections at a time. An intermediate branch connection with valve shall be provided for obtaining a pressure tapping at 18 bar (g) as indicated in the schematic. There shall be an inlet and an outlet valve on the decompression skid.

Pressure test points, purge and vent points shall be provided as indicated in the typical PID attached for reference with minimum requirements, bidder to further develop and propose the PID based on their engineering, same shall be reviewed by HPOIL. Vendor shall provide suitable weatherproof cabinet for the skid. The thickness shall be minimum 16 SWG (1.6mm) SS304. The drawing for the same shall be submitted during detailed engineering for approval.

The cabinet should avert the ingress of water and should have adequate strength so that it does not get damaged / deformed during handling, transportation and installation. The cabinet should have free ventilation of at least 5% of the surface area. It should have full opening doors on both sides, rear doors lockable from inside, front doors lockable from outside by padlocks, which are to be supplied by the vendor.

Vents should protrude through the cabinet wall and terminate with flame arrestors. The constructional details of flame arrestors are to be provided for approval. Enclosure shall be such that there will be ease for operation and maintenance. Vents should protrude through the cabinet wall and terminate with flame arrestors. The constructional details of flame arrestors are to be provided for approval. Enclosure shall be such that there will be ease for operation and maintenance.

Two stage pressure reductions with option of gas withdrawal from both first and second stage of the decompression skid.

The general arrangement, size and weight of the skid such that it can be easily transported from site to site in TATA-407 vehicle. Suitable lifting lugs shall be provided on the top side of the skid.

Hole tight / leak tight should not be used on threaded / flange joints. Stud bolt/nuts only are to be provided on flange joints.

Flanges made of cast iron, ductile iron and non-ferrous materials (brass or bronze) shall not be used. For piping class 150 or above all the flanges shall be with raised face. All stud bolts and nuts used in CGD networks shall be hot dipped galvanized as per ASTM A153: 2009 or equivalent.

Skid Type	As per P&ID
Service	Natural Gas
Inlet pressure	As per P&ID and MR
Inlet temperature	As per P&ID and MR
First stage outlet pressure	Bidder to provide
Second stage outlet pressure	Bidder to provide
Outlet temperature	As per P&ID and MR
Flow	As per P&ID and MR

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Inlet/Outlet Connection	As per P&ID and MR
Hose pipe and accessories	a) Hose pipe (5 meters) – Nos. with required inter connectors (SS304) capable to bear 250 bar and 450 SCM/H flow rate. One end with QRC. b) High pressure valves (SS304) – 1 Nos. to be used along with hose pipes.
Heating System	Water bath heater type heating only
Local Control panel	Local control panel suitable for outdoor installation with required accessories for heating system.
Power consumption	The electrical load of the skid shall not be more than 250 watts and shall be supported by replaceable battery(s) with facility for charging of battery direct AC supply.
Tubing	The high pressure (250bar-g) tubing makes as per approved vendor list (refer technical specifications of high-pressure tube for details).
Tube fittings	All the high pressure (275 bar-g) as per approved vendor list.
Skid Footprint (LxWxH)	1350x1000x1500 mm (Approx.)
Noise level	<90dBA
Skid Size	4.5 Mtrs X 1.8 Mtrs (Approx.)

7.1 Mechanical Components

7.1.1 Filter

Design and construction shall meet the requirements of design pressure, Temperature and Flow requirement. Differential pressure indicator (clogging indicator) should be provided across strainer. The Strainer shall have drain connections with valve (with positive blind arrangement). Net opening area of strainer element shall be minimum 3 times of inlet pipe X sectional area and shall be suitable for 100-micron particle filtration with 99.99% efficiency and Clean / dirty pressure drop 0.1/0.5 bar.

7.1.2 Heater

Electric water bath heating system shall be used for heating the gas before depressurization to avoid hydrate formation. Water bath heater shall be designed and fabricated as per API 12 K. Vendor to furnish sizing and mechanical calculation along with data sheet for review.

7.2 Instrumentation Components

7.2.1 Pressure Instruments

Pressure transmitter shall be intrinsically safe electronic smart type transmitters compatible with Modbus / HART protocol of latest version. Pressure Transmitters and differential pressure transmitters shall be modern inherent motion-free type of the floating differential capacitance principle. All transmitters shall be 2-wire type with integral Local LCD type digital indicator.

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Enclosures shall be Weather proof to IP 65 minimum. Pressure transmitters and Differential Pressure Transmitter (if any) shall be capacitance / piezo-resistance type. Process entry and cable entry shall be 1/2" NPT (F). Accuracy of Pressure transmitter shall be + 0.075% of FSD or better. Transmitter's O/P shall be 4-20 mA. Surge protection device shall be provided with the transmitter to protect the instruments from lightning or any kind of hazardous surge. All the wetted parts shall be of SS316 minimum.

Pressure gauge dial shall be white, non-rusting plastic with black figures. The dial face shall be marked with pressure element material. Pointers shall have micrometer adjustment.

Pressure gauges shall be weatherproof with dial size of 150 mm and shall have features like screwed bezels, externally adjustable zero, over range protection and blowout discs. Pressure gauge sensing element shall be SS 316 and movement of SS 304, as a minimum.

Pressure gauges shall have an accuracy of + 1% of URV as a minimum. Differential pressure gauges may have an accuracy of + 2% of URV.

Over range protector and pulsation dampener, whenever used, shall be of SS 304, as a minimum. Pulsation dampener should be used for all pulsating services. It shall be floating pin type, externally mounted and externally adjustable.

Connection shall normally be 1/2" NPTM bottom.

Cases shall normally be cast aluminum alloy or black phenol and weatherproof to IP 65.

7.2.2 Temperature Instruments

Temp transmitters shall be intrinsically safe electronic smart type transmitters compatible with Modbus / HART protocol of latest version. All transmitters shall be 2-wire type with integral digital indicator. Transmitter shall have dual compartment housing. Enclosures shall be Weather proof to IP 65. Cable entry shall be 1" NPT (F). Accuracy of Temperature transmitter shall be +/- 0.2% of FSD. Transmitter's O/P shall be 4-20 mA DC. Calibration of temperature transmitters shall follow DIN 43760. Surge protection device shall be provided with the transmitter to protect the instruments from lightning or any kind of hazardous surge.

RTDs are 4 wire type and element shall be Pt100 as per DIN 43760 & accuracy class A and thermowell's immersion length shall be suitable for the line size. All RTDs shall have duplex elements. RTDs sheath OD shall be 8 min and material SS 316. Cable entry shall be 1/2" NPT (F). Enclosure shall be WP to IP-67. All RTD shall be supplied with flange type thermowell.

Thermowell material in general shall be of AISI 316 SS

RTD sheath material shall normally be SS 316 as a minimum. The gauge head of the Temperature elements (RTD's) shall be 80 mm, as a minimum to ensure maintenance ease.

Bidder to note that all thermowells except surface temperature instruments shall be of flanged type only.

The RTD shall be Class "A" type 4 wire PT100. The RTD & thermowell shall be designed in such a way that the insertion length inside the pipe shall be more than 60%.

7.2.3 Level Gauge

A magnetic level gauge includes a "floatable" device that can float both in high and low density fluids. Magnetic level gauges may also be designed to accommodate severe environmental conditions up to 210 bars at 370 °C.

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7.2.4 Level Switch

Level Switches shall be actuated mechanically for switch operation but shall not calibrated for level setting.

7.2.5 Solenoid Valves

A solenoid valve is an electromechanical device in which the solenoid uses an electric current to generate a magnetic field and thereby operate a mechanism which regulates the opening of fluid flow in a valve.

7.2.6 Pressure Safety Valves

Pressure safety valves (PSV) shall be direct acting, spring loaded; full nozzle / full lift, adjustable blow down high-capacity type.

PSV shall have flanged end connections, enclosed spring, bolted bonnet, screwed cap, and full one-piece nozzle. Flanges shall be in accordance with ANSI ASME B16.5 requirements.

Flanges shall be integral part of the body. Weld-on flanges shall not be allowed. Bodies and flanges shall be of the same material. Inlet flange shall be of sufficient rating to withstand the reaction force of the PSV.

PSV sizing shall be carried out based on API RP 520 Part 1. Orifice letter designation shall be in accordance with API STD 526. For blocked discharge case, overpressure shall be 10% above the set pressure. For fire relieving case overpressure shall be 21% above the set pressure.

All wetted parts of PSV shall be SS316. Safety valves shall be provided with test gags and manual test lever. Springs of safety valves shall be selected as per process conditions.

This specification with the attached datasheet covers the minimum of requirement design, material, testing, and marking etc. for the Pressure Safety Valves. It is BIDDER's responsibility to select suitable safety valve required.

7.2.7 SSV and Pressure Regulators

Set point of the Gas pressure regulators (PCV's) and Slam shut down valves (SDV's) shall be adjustable. Bidder shall furnish the adjustable range of the PCV's & SDV's.

Valve action on control signal or air failure shall be as indicated in P&ID.

Following are some general points shall be followed by the vendor: -

Valves shall have flanged end connections. The flange rating and facing shall be in accordance with piping class.

Connections for on-off valves shall be in accordance with piping class.

Pressure regulators shall be of flanged type.

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

It is intended to provide slam shut valves on upstream of the self-actuated pressure control valves at gas receiving points for tight shut off at increasing pressure beyond a preset limit to take care of self-actuated pressure control valves failure.

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

The materials selected for the regulators and SSV components shall be conform to the process requirements (minimum SS 316) and shall be specified in the data sheets. Vendor shall seek the approval from owner for the MOC of the parts of the valves prior to start the manufacturing.

Pressure regulators shall be pilot operated with regulation accuracy of better than $\pm 1\%$ of set point.

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

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

Slam shut valves shall be provided with limit switches for transmitting position status in FC (Flow Computer) / EVC (Electronic Volume Corrector).

Resetting of slam shut valves shall be only manual.

Slam shut valves shall be provided with a mechanical indicator to indicate valve open or close position.

Slam shut valve shall have a set point accuracy of $\pm 1\%$ over the whole operating range.

SSV shall have facility of over and under pressure shut off. Vendor shall mention the over pressure and under pressure set range for the SSV in the datasheet.

The Complete station shall be designed in such a way that the mean gas velocity remains within 20 m/s. Velocity in the piping upstream/downstream of Pressure Reduction Station shall be within 20 m/s. Maximum seat velocity of Pressure Regulator valves and SSV shall limited to 40 m/s.

Vendor shall install the pressure regulators & its sensing lines and SSVs with suitable upstream and downstream lengths required for safe and proper operation of the regulators.

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

Vendor shall submit the detailed sizing calculations of the regulators and SSV of all the streams in detail for review and approval during detail engineering, (Vendor to consider all the combinations such as Minimum Pressure and Maximum flow rate, maximum pressure and Minimum flow rate etc. for all the streams. The velocity, noise level shall comply in all combinations as specified in the tender document).

Provide ball valve in each of the sensing line for each of the active & monitor regulators and SSVs. Size of the valve shall be minimum 1/2" or higher. These ball valves shall have lock open facility.

For all Lock open type valves, Vendor shall provide the locks.

In case, if the size of the regulator and SSV is less than the size of the pipe, vendor shall use the reducer and expander at the inlet and outlet of each regulator and SSV. In no case the velocity in the pipe immediately after the regulator shall not be more than the velocity specified in the tender specification (20 m/s).

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

The Slam shut valve shall be designed as per EN 14382 or Pressure Equipment Directive PED 97/23/EC covering the production quality assurance

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Leakage class for pressure control valve & slum-shut valve shall be class-VI as per ANSI B16.4.

7.2.8 Cables

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

7.3 Pipe Work & Fittings

Decompression skid construction / fabrication, reinforcement pads, etc. shall meet the requirements of codes ASME B31.8: 2010 and or ASME BPV Code, Section VIII: 2010. The design and assembly of all the equipment's shall be such that there is no difficulty in the operation and maintenance of the same.

Pipe work and fittings shall be of seamless type and as per ASTM A106 Gr. B: 2010 / API 5L Gr. B: 2007 and ASTM A 234 Gr. WPB: 2011 & ASTM A105: 2010. All branch connections shall be of weld let type up to d/D ratio less than 0.3 and sweep let type up to d/D ratio less than 0.6. All valves for pressure / vent, pressure gauge and bleed should have positive blind arrangement.

Welders and welding procedures have to be qualified in accordance with ASME BPV Code Section IX: 2010 / API 1104: 2005. All the welded joints shall be radio graphically examined and acceptance criteria shall comply with ASME BPV Code, Section VIII: 2010 / API 1104: 2005.

8 QUALITY ASSURANCE, INSPECTION AND TESTING

8.1 Quality Assurance

The Bidder shall have in effect at all times, a QA / QC program that clearly establishes the authority and responsibility of those responsible for the quality system. Persons performing quality functions shall have sufficient and well-defined authority to enforce quality requirements, initiate, identify, recommend and provide solutions to quality problems and verify the effectiveness of the corrective action.

8.2 Quality Control

The Bidder shall submit certified reports of production tests as soon as the tests are completed satisfactorily.

The Company / PMC reserves the right to inspect materials and workmanship at all stages of manufacture and to witness any or all tests. The Bidder, after award but prior to the pre-inspection meeting, shall provide the Company / PMC with a signed and stamped copy of QAP included in this tender as compliance.

8.3 Inspection and Testing

Inspection and testing shall be performed in accordance with written procedures prepared by the Bidder and approved by the Company / PMC. Test procedures shall include a schematic of testing arrangement with details of instrumentation used during test.

Visual inspection shall be carried out by Bidder for all package Instrumentation, confirming that the package supplied meets the relevant specifications, design codes and data sheets.

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Inspection will be required on all aspects of the Bidder's documentation, including applicable certification and test / material certificates.

Calibration equipment (of an order of magnitude greater than the device being tested) shall be traceable to National Standards and shall have been calibrated within 6 months prior to tests.

The Bidder shall be responsible for the provision of all test and calibration equipment, utilities (e.g. power / air / water) supplies as applicable and the recording of all test results on approved test record sheets.

Inspection and witnessed tests by the Company / PMC and third parties shall not relieve the Bidder of any guarantees, responsibilities or obligations to provide satisfactory equipment.

The Bidder shall provide quality records appropriate to all inspection and test activities. The records shall be referenced against appropriate activities within the inspection and test plan.

Bidder shall collate all such quality records and certification for submission to the Company / PMC as a certification dossier. Note that, where necessary, certificates shall be stamped as approved by the third-party inspector.

Adequate data on capacity, range ability, lock-up, minimum and maximum operating pressure differentials, dynamic performance characteristics and predicted noise level emissions, set points of slam-shut valve, relief valve, etc., shall be given by the manufacturer in order to determine the performance of the regulators under various operating conditions. Results of such tests carried out by the manufacturer to determine operational performance and thereby confirm these design data and Manufacturing Test Certificates (MTC) for all components / parts, NDT results, Welding Procedure Specification (WPS), Welder's Performance Qualification Record (WPQR), Welding Procedure Qualification Record (PQR), etc., shall be made available prior to offering the complete skid for witnessing the performance testing by BGL / Third Party Inspection agency appointed by HPOIL.

The final performance test of complete skid shall be carried out in presence of Third-Party Inspecting agency / HPOIL representative before accepting the skid and giving clearance for dispatch. Inspection shall be carried out by HPOIL appointed TPI & charges will be borne by HPOIL. Inspection is to be carried out as per the inspection plan stated below.

8.4 Inspection and Test Plan

Inspection of the skid shall be carried out as per EN 10204, type 3.2:

- Review / checking of all test certificates;
- Visual inspection of skid assembly;
- Following tests shall be Witnessed:
 - a. Hydrostatic & pneumatic testing of the assembly, as per the parameters given in 'Specific requirements.
 - b. Performance testing of regulator: Outlet pressure v/s flow (for various inlet pressures), inlet pressure v/s flow (for various outlet pressures), checking of lock up pressure to be within limits, slam shut operation & its setting, regulator and relief valve operation & its setting.
 - c. Stage-wise inspection to be carried out for inspection of workmanship quality and for inspection of surface preparation and primer coat / intermediate coats to ensure proper adhesion / paint quality.

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8.5 Factory Acceptance Test (FAT)

Factory Acceptance Test (FAT) is an inspection procedure for verification which ensures the functionality of all equipment as per design intend and integrity of the skid. FAT shall be conducted according to the approved FAT procedure.

Prior to notification of FAT to Company / PMC, all the involved contractual documentation shall be approved by Company / PMC and internal testing reports shall be submitted for Company / PMC review. During FAT, all the equipment and components shall be assembled and installed. The system shall be ready in respect.

Bidder shall demonstrate all the functions of the system working properly during the FAT.

Each test shall be carried out on the procedure reviewed and accepted by Company / PMC after submitting Manufacturing Internal Test Certificate.

FAT certificate shall be issued by the bidder at the successful end of the test activities.

All the hardware and software failures and problems shall be documented. All the failures and problems shall be resolved before shipment to site; all series of actions shall be taken in accordance with the FAT procedure.

Range, calibration span, set points, reports etc. shall be modified as per Company / PMC requirement by the bidder during the FAT.

FAT shall include the following activities as minimum:

- Quantity of all the equipment and components;
- Installation of all the cabinets, equipment and components;
- Tagging of all the cabinets, equipment and components;
- Wiring of all the cabinets, equipment and components;
- Hardware Testing shall include the following activities as minimum;
- Redundancy of Power Supply on failure;
- Diagnostics of the main equipment;
- Redundancy of the main equipment on failure if any;
- Modem communication to data host check.

8.6 Hydrostatic Test

Hydrostatic test shall be carried out up to the test pressure as detailed in the specific requirements. Wherever necessary, regulators, relief valves and similar components that have been tested independently shall be removed from the line.

Blind flanges or double flange pipes shall be installed temporarily in their place. All small-bore connections and impulse lines shall be disconnected and suitable plugs or blank flanges shall be installed.

8.7 Leakage Testing

Pneumatic testing using air or an inert gas shall be undertaken on all installations and shall include all equipment and associated small bore pipe work.

Care must be taken to disconnect equipment, which might get damaged at the testing pressure. All joints, flanges and glands on valves and fittings shall be tested for leakage with a suitable foaming fluid.

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8.8 Package Test Panels

All testing shall be carried out at the Bidder's test facility. Test equipment shall be supplied by the Bidder and shall be calibrated within six months of the test date. The minimum scope of testing is summarized below. The Bidder shall supply an Inspection & Test Plan (ITP) with the Tender.

The Vendor shall provide the Company with at least 14 calendar days advance notice to witness tests performed in either the Vendor's shop or his sub-Vendor's shops.

8.8.1 Control Panel

Control Panels (as applicable) and associated equipment shall as a minimum be tested and checked upon completion as follows:

- The panel and its contents shall be inspected to ensure that it has been constructed to the specification and latest approved drawings.
- All labels, tags plates and ferrules shall be checked to verify correct text, location and secure attachment.
- All fuse ratings shall be checked and fuse holders shall be marked with rating and service as detailed in the latest drawings. The fuses and isolating switches shall be checked to ensure they are connected to the correct circuits.
- The circuits shall be checked for correct polarity.
- The total electrical load and power factor shall be measured.
- Electromagnetic interference shall be checked to ensure compliance with the relevant Standards.
- Earthing shall be checked so as to be in accordance with the Bidder's requirements and such additional requirements as may be specified by the Company.

8.8.2 Cables and Wiring

All cables / wiring shall be tested for continuity and inspected to verify installation is in accordance with the drawings. All cables shall be tested for insulation resistance. The test voltage shall be compatible with the cabling being tested. Equipment or devices shall not be connected during testing.

8.9 Test Certificates

A record of all hydrostatic testing and pneumatic testing carried out shall be prepared for every installation. A material test certificate for all components of skid shall be furnished at the time of inspection by third party / representative. HPOIL reserves the right to witness all the tests.

Records of all calibrations, tests and conformity checks shall be provided by the Bidder using the Company's acceptance certificates. The acceptance certificates shall be completed by the Vendor and attested by the Company's site engineer prior to commissioning. The procedure for site testing and witnessing shall be agreed in writing by the Company prior to commencement of work.

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8.10 Instrumentation Test

Skid-mounted instrumentation shall be tested as follows:

Bench calibration of instruments shall be carried out prior to installation, where applicable.

All skid wiring shall be tested for continuity and insulation; the test voltage shall be compatible with the wiring being tested. Equipment or devices shall be disconnected before wiring is tested.

Instrument air systems shall be tested for leakage using dry air at a pressure 110% of maximum working pressure.

Process impulse lines shall be disconnected from the process line and the instrument, and shall be hydraulically tested to 1.5 times line design pressure. All instrumentation equipment and piping shall be thoroughly flushed and dried out on completion of test. Instrument impulse lines on lube oil service shall be pneumatically tested, using air or nitrogen.

All test equipment shall be certified by a recognized calibration authority and be provided by the Vendor. Test equipment shall have an accuracy of 10 times better than that of the equipment to be tested.

Skid mounted instrumentation simulated tests shall be performed with the remote or local panel connected to field instruments.

All alarm, shutdown and control systems shall be tested under simulated operating conditions prior to machine test, after it has been demonstrated that the equipment has been fully installed, properly connected, pressure tested and is fully operable, as proved by support documentation.

Test procedures shall be submitted to the Company / PMC for approval, prior to test.

The test shall simulate, as near as possible, actual working conditions. The Bidder shall provide means whereby any process variable may be measured and adjusted to demonstrate correct functioning of the associated control system.

The Bidder shall provide any temporary cabling necessary for string testing, (i.e. temporary cabling between skid and off skid panel provided by the Bidder).

Acceptable evidence of the satisfactory condition of the test equipment, (e.g. current test certificates) shall be supplied by the Bidder.

8.10.1 Functional Tests

Each pneumatic instrument shall be tested by connecting an input signal of the correct range while monitoring the instrument output. The input signal shall be varied over the full range and each device checked for proper operation.

Temperature instrument input signals shall be simulated over the full range and each temperature instrument checked for proper operation.

8.10.2 Electronic Instrument and Instrument Loop Test

Electronic instruments and loops shall be tested from the junction box to the instrument concerned as all electronic instruments terminate at local skid junction boxes (cable installation from local skid junction boxes to the equipment room is by others).

8.10.3 Relief Valve Test Certificates

The Vendor shall issue a test certificate covering each valve fully compatible with the requirements of API RP 520.

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9 INSTALLATION / ERECTION, COMMISSIONING AND STARTUP

Package instrumentation shall be installed mostly in the erection phase and shall be tested for any further defects or leakages during the pre-commissioning phase of the instruments and equipment. Sufficient spares shall be maintained at site during commissioning and start-up phases to facilitate ready availability for replacement in case of failure.

10 PERFORMANCE GUARANTEE

Bidder shall provide performance guarantee for 18 months from the date of delivery of skid.

11 PACKAGING, PRESERVATION / STORAGE AND PREPARATION FOR SHIPMENT

11.1 Packing

Preparation for shipment shall be in accordance with the Bidder's standards and as noted herein. Bidder 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 / PMC. All costs occasioned by such rejection shall be to the account of the Vendor. After inspection and test, equipment shall be completely free of water and dry before start of preparation for shipment.

Instruments or parts, which can be damaged during shipment, shall be packed separately. Each package shall be identified with purchase order number and content list in a weatherproof envelope. All openings shall be sealed. Threaded connections shall be protected with forged steel or molded plastic screwed plugs.

11.2 Preservation / Storage

The Bidder shall be solely responsible for the adequacy of the preparation for shipment and shall also state in their offer his recommendations for long term storage (up to 12 months) for both indoors and open-air storage.

Instruments and their parts have to be stored in dust-free area at controlled temperature environment. Sensitive parts such as PCBs and chips are to be covered in anti-static sheets.

11.3 Marking

The Bidder shall attach a packing list along with all requisition details, in a waterproof enclosure, to the outside of the package.

12 DOCUMENTATION

Vendor shall furnish the complete set of documents in hard copy in English only. The minimum documents submitted by the bidder shall be as follows. Refer Material Requisition for detail documentation requirement.

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13 SPARES

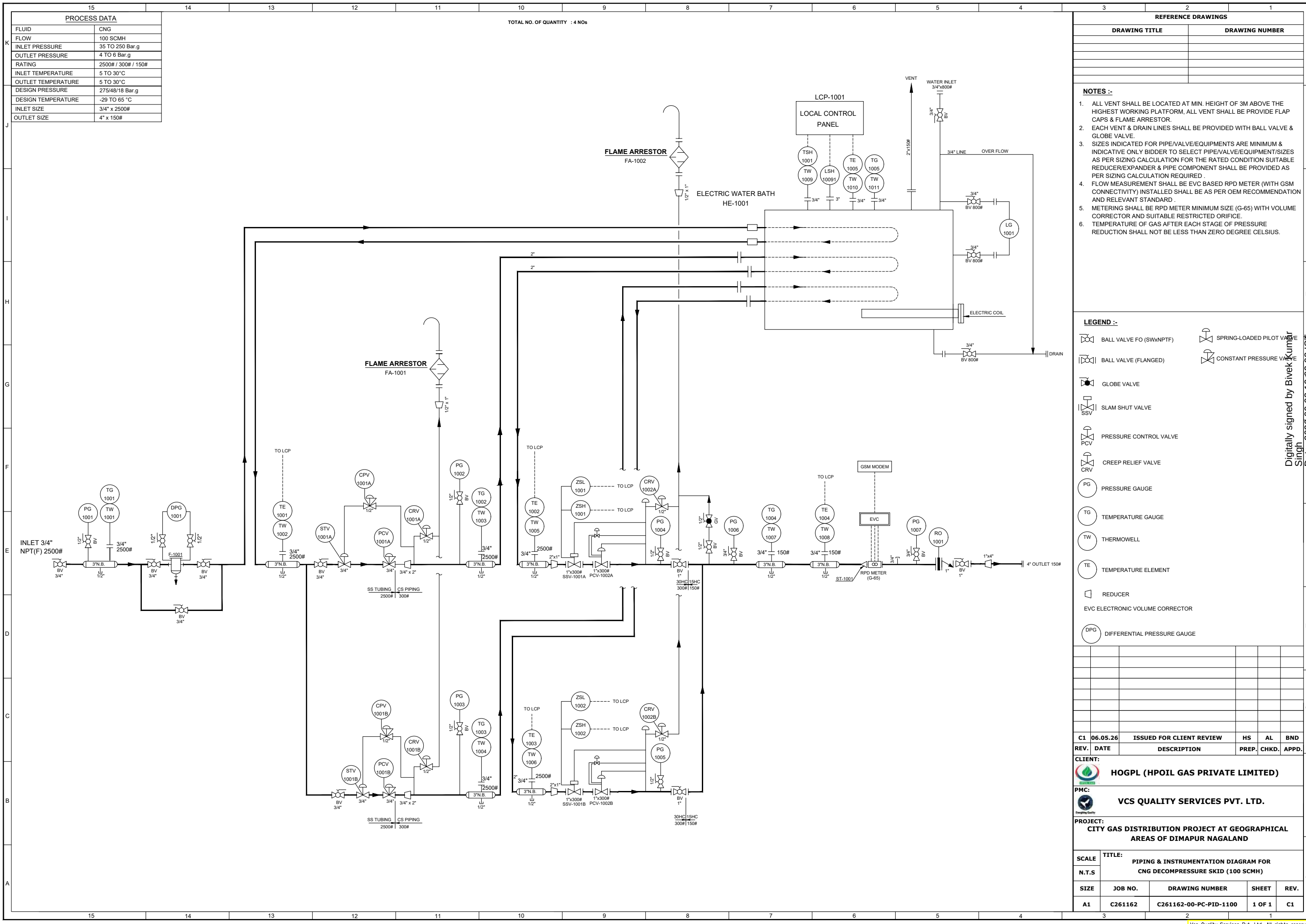
Bidder shall provide the following spare list for all items of skid:

- Spare parts for commissioning and start-up;
- O&M spare parts list.

Following Installed spare criteria shall be considered as a minimum in instrumentation and control system design:

- All pairs of multi-pair cables shall be terminated in the junction boxes as well as at panel side (including the unused spare pairs);
- Field junction boxes shall have 20% spare terminals and 20% cable entries for connecting future instrument cables;
- All multi-pair/multi-core instrument cables shall have 20% spare pairs;
- All Instrument cable trays and trenches shall have at least 20% spare capacity for future cables;
- Instrument cabinets shall have 20% spare space for I/O cards, marshaling terminals, cable entries etc. for future additions;
- I/O cards shall have 20% spares for future use (separate for each I/O card type i.e. AI/AO/DI/DO etc.).

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**SUPPLY FOR DE-COMPRESSSION UNIT (DCU)
OF NAGALAND GA's(HPOIL)**



INSTRUMENT DATASHEETS

TOTAL SHEETS

16

DOCUMENT No.

C261162

0

IN

DS

5003

HPOIL GAS PRIVATE LIMITED

**SUPPLY FOR DE-COMPRESSSION UNIT (DCU)
OF NAGALAND GA's(HPOIL)**

INSTRUMENT DATASHEETS (DCU)

C1	21.04.2026	ISSUED FOR CLIENT	PS	AS	PK
REV	DATE	DESCRIPTION	PREP	CHK	APPR

INDEX					Rev.
S.NO	ITEM DESCRIPTION	SHEET NUMBER	REMARKS		
1	PRESSURE GAUGE	3 of 16			C1
2	DIFFERENTIAL PRESSURE GAUGE	4 of 16			C1
3	TEMPERATURE ELEMENT (RTD)	5 of 16			C1
4	TEMPERATURE GAUGE	6 of 16			C1
5	SLAM SHUT OFF VALVE	7 of 16			C1
6	SELF ACTUATED PRESSURE CONTROL VALVE	8 of 16			C1
7	CREEP RELIEF VALVE	9 of 16			C1
8	LEVEL GAUGE	10 of 16			C1
9	LEVEL SWITCH	11 of 16			C1
10	RPD Flowmeter	12 of 16			C1
10	Electronic Volume Corrector with GSM MODEM	13 of 16			
11	RESTRICTION ORIFICE	14 of 16			C1
11	JUNCTION BOX	15 of 16			
12	PAIR ANALOG CABLE	16 of 16			
 ENERGISING QUALITY	CLIENT:	HPOIL GAS PRIVATE LIMITED			
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PRESSURE GAUGE						Rev.			
GENERAL	1	Tag Number	Quantity	Refer P&ID	Refer MR and P&ID				
	2	Line No	Equipment No.	Refer P&ID	N/A				
	3	P&ID Number	Vendor	Refer P&ID	*	C2			
	4	Manufacturer	Model No.	*	*				
GAUGE	5	Element		Bourdon					
	6	Case	Type	Direct					
	7		Material	SS 316					
	8		Mounting	Local					
	9		Bezel	Bayonet					
	10		Glass Type	Shatter Proof Glass					
	11		Blowout Device	Required					
	12	Gasket Material	*						
	13	Dial Size	Dial Color	150 mm	White with Black Marking				
	14	Enclosure Class		IP - 65 or better					
	15	Range		Refer P&ID					
	16								
	17								
ELEMENT	18	Type	Accuracy	C-type Bourdon	±1% FSD				
	19	Element Material	Socket Material	SS 316	SS 316				
	20	Movement Material		SS 304					
	21	Conn. Size/Type	Connection Location	1/2" NPTM	Bottom				
	22	Zero Adjustment		Micropointer					
	23	Blow Out Protection	Over-Rng Protection	Required	Required, 130% of Full Scale				
	24								
	25								
SEAL	26	Type	Model No.	N/A					
	27	Wetted Parts Mat'l	Seal Material						
	28	Housing Lower Mat'l	Housing Upper Mat'l						
	29	Conn. Size/Type	Connection Rating						
	30	Seal Flush Conn.	O-Ring Material						
	31	Seal Fill Fluid							
	32	Design Pressure							
	33								
MISC.	34								
	35	Snubber Type	Model No.	*	*				
	36	Siphon Type	Model No.	*	*				
	37	Pulsation Dampner	Model No.	*	*				
	38	Manifold	Model No.	2 valve 3-way Manifold	*				
39									
Notes:									
1	* By Bidder								
2	Calibration, material and hazardous area certificates shall be provided by the Vendor.								
3	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).								
4	Pressure gauge shall be selected in such a manner that normal operating pressure is approximately in the middle third of full scale (30% - 70% of range).								
5	Battery life shall be not less than 5 years if replaceable and if not replaceable then battery life shall be 10 years. Battery capacity shall be sufficient for 24 hr. continuous operation with all the equipment powered.								
6	All instrument tag numbering shall be pre-fixed in gauge dial.								
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DIFFERENTIAL PRESSURE GAUGE						Rev.	
GENERAL	1	Tag Number	Quantity	Refer P&ID	Refer P&ID		
	2	Line No	Equipment No.	Refer P&ID	Refer P&ID		
	3	P&ID Number	Vendor	Refer P&ID	*	C2	
	4	Manufacturer	Model No.	*	*		
PROCESS DATA	5	Service		Natural Gas			
	6	Design Temperature (DegC)		Refer P&ID			
	7	Design Pressure (barg)					
	8	Operating Pressure (Min./Nor/Max.)		Refer P&ID			
	9	Operating Temperature (DegC) (Min./Nor/Max.)					
	10	Flow(Min/Max)		Refer P&ID			
GAUGE	11	Element		Diaphragm/ Piston			
	12	Case	Type	Direct			
	13		Material	SS 316			
	14		Mounting	Local			
	15		Bezel	Bayonet			
	16		Glass Type	Shatter Proof Glass (3 mm)			
	17		Blowout Device	Required			
	18	Gasket Material	*				
	19	Dial Size	Dial Color	150 mm	White with Black Marking		
	20	Enclosure Class		IP - 65 or better			
	21	Range		*			
	22						
	23						
	ELEMENT	24	Type	Accuracy	Diaphragm/ Piston	±2% FSD	
25		Element Material	Socket Material	SS 316	SS 316		
26		Movement Material		SS 304			
27		Conn. Size/Type	Process Connection	1/2" NPTF	1/2" NPT		
28		Zero Adjustment		Micropointer			
29		Blow Out Protection	Over-Rng Protection	Required	Required, 130% of Full Scale		
30							
31							
SEAL		32	Type	Model No.	N/A		
		33	Wetted Parts Mat'l	Seal Material			
	34	Housing Lower Mat'l	Housing Upper Mat'l				
	35	Conn. Size/Type	Connection Rating				
	36	Seal Flush Conn.	O-Ring Material				
	37	Seal Fill Fluid					
	38	Design Pressure					
	39						
	40						
	MISC.	41	Snubber Type	Model No.	*	*	
42		Siphon Type	Model No.	*	*		
43		Pulsation Dampner	Model No.	*	*		
44		Manifold	Model No.	5-way Manifold	*		
45							
Notes:							
1	* By Vendor						
2	Calibration, material and certificates shall be provided by the Vendor.						
3	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).						
4	Differential Pressure gauge shall be selected in such a manner that normal operating pressure is approximately in the middle third of full scale (30% - 70% of range).						
5	Differential Pressure gauge shall be fitted with blow-out protection at back and shall have a over-range protection of 130% of max. reading.						
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TEMPERATURE ELEMENT (RTD)					Rev.		
GENERAL	1	Tag Number		Refer P&ID			
	2	P&ID Number	Quantity	Refer P&ID	Refer P&ID	C2	
	3	Line No	Equipment No.	Refer P&ID	Refer P&ID		
	4	Enclosure Type		IP-65 , Ex 'ia'			
	5	Hazardous Area Classification		Zone 1 Group IIA /IIB as per IEC, T3			
	6						
PROCESS DATA	7	Service fluid		NG			
	8	Fluid state	Phase	Gas	Single		
	9	Corrosive	Erosive	N/A	N/A		
	10	Flow (Min/Nor/Max)		Refer P&ID	SCMH		
	11	Pressure (Min/Nor/Max)		Refer P&ID			
	12	Temperature (Min/Nor/Max)		Refer P&ID	°C		
	13	Design Pressure(Barg)	Design Temperature (°C)	275 / 48 / 18	Refer P&ID		
	14	Viscosity (cP)	Specific Gravity	*	*		
	15	Velocity (m/s)		*			
	16						
ELEMENT	17	Type	Material	RTD-Pt100	SS 316		
	18	Simplex/Duplex	Grounded	Duplex	N/A		
	19	Cold Junction Comp.	Ice Point Resistance	*	*		
	20	Temperature Range		*	°C		
	21	Mounting Connection		1/2" NPTM			
	22	Sheath Material	Outside Diameter	*	*		
	23	No. of Lead Wires	Termination Type	*	*		
	24	Vibration Req.	Spring Loaded	*	*		
	25	Replacement Element Length		*			
	26						
HEAD	27	Type		Screwed Cap with SS chain			
	28	Material		Die Cast Aluminium			
	29	Mounting Connection	Conduit Connection	1/2" NPTF	1/2" NPT		
	30	Nipple	Union	*	*		
THERMOWELL	31	Nipple/Union/Nipple Length		To suit well and element			
	32	Type		Tapered			
	33	Construction	Material	Drilled Bar Stock	SS 316		
	34	Process Connection	Instrument Connection	Refer P&ID	1/2 " NPT F		
	35	Outside Dia (OD)	Bore	*	*		
	36	Tip Diameter	Tip Thickness	*	*		
	37	Lag Length	Insertion Length (U)	*	*		
	38	Maximum Allowable Insertion (U)		*			
TEMPERATURE CONTROLLER (IN LCP)	39	Type		2 Wire , SMART, HART			
	40	Output	Power Supply	4 - 20 mA HART	24 VDC loop powered		
	41	Instrument Range (°C)		*			
	42	Calibrated Range (°C)		*			
	43	Accuracy	Response Time	±0.1%	*		
	44	Damping	Failure Mode Output	*	*		
	45	Integral Indicator		Required			
	46	Electrical Connection Size		1/2" NPT x 2 entries			
	47	Ambient Temperature Rating		N/A			
MISC.	48	Mounting Location		Stanchion			
	49	Lightning Protection		N/A			
	50	Mounting Bracket		Required			
	51	Manufacturer	Model No.	*	*		
Notes:							
1	Battery life shall be not less than 5 years if replaceable and if not replaceable then battery life shall be 10 years. Battery capacity shall be sufficient for 24 hr. continuous operation with all the equipment powered.						
2	Calibration, material and hazardous area certificates shall be provided by the Vendor.						
3	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).						
4	Temperature gauge shall be selected in such a manner that normal operating temperature is approximately in the middle third of full scale (30% - 70% of range).						
5	Vendor to perform natural frequency and wake frequency calculations of thermowell as per ASME PTC 19.3.						
6	Thermowell Rating shall be one class higher than the pipeline class where it installed.						
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TEMPERATURE GAUGE										Rev.
GENERAL	1	Tag Number			Refer P&ID					C2
	2	P&ID Number		Quantity	Refer P&ID			Refer P&ID		
	3	Line No/Equipment No			Refer P&ID					
	4	Piping Class and Rating			Refer PMS					
PROCESS DATA	5	Manufacturer		Model No.	*			*		
	6	Service			Natural gas					
	7	Fluid		Phase	Gas			Single		
	8	Corrosive		Erosive	-			-		
	9	Operating Pressure (Min/Nor/Max) (Kg/Cm ² g)			Refer P&ID					
	10	Operating Temperature (Min/Nor/Max) (Deg.C)								
	11	Design Pressure (Kg/Cm2g)								
12	Viscosity (cP)									
13	Flow (Kg/hr)			NA						
GAUGE	14	Type		Thermowell	Bi-Mettalic			Required		
	15	Mounting			Direct					
	16	Case material			SS316			*		
	17	Cage ring type			Bayonet					
	18	Mounting Connection			1/2" NPTM					
	19	Dial Size		Scale Type	150 mm			All angle rotatable		
	20	Marking		Scale Color	White with black marking			Black		
	21	Dial material			Die Cast Aluminium / SS304 (Epoxy) painted					
	22	Lens / Window material			Shatter Proof Glass (3mm thickness)					
	23	Accuracy			Class 1 as per EN13190.					
	24	Over Range Protection			130 % of Range					
	25	Zero Adjustment			External Zero Adjustment					
	26	Enclosure Class			IP-65 or better					
	27	Dial adjustments			Rotatable at all angles					
	28	Instrument Range			*					
	BIMETAL ELEMENT	29	Type			Adjustable union				
30		Material			SS316					
FIELD SYSTEM	31	Connection Size			1/2" NPTM					
	32	Stem length (L Dim)		stem diameter	To suit insertion length (U)			To suit well		
	33	Zero Adjustment		Temp. Range	Micrometer pointer			*		
	34	Compensation			SEMA Class			N/A		
	35	Bulb Type			Bulb material					
	36	Bulb extension type			Bulb Dia.					
	37	Capillary length			Capillary material					
	38	Armour Flexible			Armour material					
THERMOWELL	39	Type			Tapered					
	40	Construction		Material	Drilled Bar Stock			SS 316		
	41	Process Connection		Instrument Connection	Refer P&ID			1/2 " NPTF		
	42	Outside Dia (OD)		Bore	*			*		
	43	Tip Diameter		Tip Thickness	*			*		
Notes:										
1	Battery life shall be not less than 5 years if replaceable and if not replaceable then battery life shall be 10 years. Battery capacity shall be sufficient for 24 hr. continuous operation with all the equipment powered.									
2	Calibration, material certificates shall be provided by the Vendor.									
3	Tagplate (SS316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).									
4	Temperature Gauge shall be selected in such a manner that normal operating temperature is approximately in the middle third of full scale (30% - 70% of range).									
5	Thermowell wake frequency calculation shall be provided along with datasheet									
6	Thermowell Rating shall be 150# class & 2500# class.									
	CLIENT:		HPOIL GAS PRIVATE LIMITED							
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SLAM SHUT OFF VALVE										Rev.
GENERAL	1	Tag Numbers			Refer P&ID					
	2	P&ID Number	Quantity		Refer P&ID			Refer P&ID		C2
	3	Service			Down stream pressure protection					
	4	Governing standard			BS EN 14382:2005+A1:2009					
	5	Inlet Line No.			Refer P&ID					
	6	Outlet Line No.			Refer P&ID					
	7	Line Size & Schedule			Refer P&ID					
	8									
PROCESS DATA	9	Fluid	State		Natural Gas		Gas			
	10	Flow Gas	Min.	Nor.	Max.	Refer P&ID				
	11	Inlet Pressure	Outlet Pressure		Refer P&ID			4 to 6 Bar.g		
	12	Pressure Drop at Various Flow Rates			*					
	13	Shut Off Pressure			*					
	14	Temp.	Oper.	Max.		Refer P&ID				
	15	Oper S.G	Mol Wt.		*					
	16	Cp/Cv	Compress. Factor		*					
BODY	17	Type of Valve			Slam Shut					
	18	Body Size	Port Size		*					
	19	End Conn: Flgd. Size & Rating			Refer P&ID					
	20	Facing & Finish			Refer P&ID, (i) RF Flanged (125 AARH) (ii) Butt Welded					
	21	Body Material			ASTM A 216 WCB or equivalent					
	22	Trim Material			SS 316					
	23	Other Wetted Parts			SS 316					
	24	Leakage Class			Class VI as per FCI 70.2					
OPTIONS	25	Closing Time			Less than 2 secs					
	26	Pilot Operated			Integral Pilot Required					
	27	Manual Reset			Required					
	28	Failure Position			Close					
	29	Limit Switch			2 Nos. (Open/Close)					
	30	Cable Entry			Required					
	31	Valve Position Indicator (Local)			Required					
	32	Radiography			Required					
	33	Charpy V-Notch			Required					
	34	Impulse Tubing/Fittings			Required					
	35	Pressure Indicator			*					
	36	Installation			Horizontal					
MISC.	37	Kg or Cg Min.	Kg or Cg Max.		*					
	38	Kg or Cg Selected			*					
	39	Predicted Sound Level (dBA)			less than 85 dBA					
	40	Inlet Velocity (meters/second)			As per PNGRB guidelines					
	41	Valve Setpoint	Adjustable Range		*					
	42	OPSO	UPSO		*					
	43	Model No.	Make		*					
	44									
45										
Notes:										
1	* By Bidder									
2	Calibration, material and certificates shall be provided by the Vendor.									
3	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire(1 mm).									
5	Vendor to provide over pressure shut off (OPSO) and under pressure shut off (UPSO) along with sizing calculations of slam shut off valve for review and approval.									
6	Vendor shall submit detailed GA drawing along with part names and MOC of the part along with MOC.									
7	Vendor shall submit detailed catalogue with model decodification with datasheet.									
 ENERGISING QUALITY	CLIENT:		HPOIL GAS PRIVATE LIMITED							
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SELF ACTUATED PRESSURE CONTROL VALVE										Rev.
GENERAL	1	Tag Numbers			Refer P&ID					
	2	Quantity			Refer P&ID					
	3	P&ID Number			Refer P&ID					C2
	4	Service			Down stream pressure protection					
	5	Governing standard			EN 334: 2005+A1:2009					
	6	Sensing Type			External					
	7	Line Size & Schedule			Refer P&ID					
	8									
PROCESS DATA	9	Fluid	State		Natural Gas		Gas			
	10	Flow Gas	Min.	Nor.	Max.	Refer P&ID				
	11	Inlet Pressure (Barg)			Refer P&ID					
	12	Pressure Drop at Various Flow Rates			*					
	13	Shut Off Pressure			*					
	14	Temp.	Oper.	Max.	Refer P&ID					
	15	Oper S.G	Mol Wt.		-		-			
	16	Cp/Cv	Compress. Factor		-		-			
17										
BODY	18	Type of Valve			Self Actuating Pressure Reduction					
	19	Body Size	Port Size		*					
	20	End Conn: Flgd. Size & Rating			Refer P&ID					
	21	Facing & Finish			Refer P&ID RF Flanged (125AARH) (ii) Butt Welded (i)					
	22	Body Material			ASTM A 216 WCB or equivalent					
	23	Trim Material			SS 316					
	24	Other Wetted Parts			SS 316					
	25	Leakage Class			Class VI as per FCI 70.2					
	26									
	27	Diaphragm			Synthetic rubber or equivalent					
OPTIONS	29	Pilot Operated			Self actuated Pilot Operated					
	30									
	31	Failure Position			FO					
	32	Limit Switch			N/A					
	33	Cable Entry			N/A					
	34	Valve Position Indicator (Local)			Required					
	35	Radiography			Required					
	36	Charpy V-Notch			Required					
	37	Impulse Tubing/Fittings			Required					
	38	Pressure Indicator			*					
MISC.	39	Installation			Horizontal					
	40									
	41	Kg or Cg Min.	Kg or Cg Max.		*					
	42	Kg or Cg Selected			*					
	43	Predicted Sound Level (dBA)			less than 85 dBA					
	44	Inlet Velocity (meters/second)			As per PNGRB guidelines					
	45	Valve Setpoint	Adjustable Range		*					
	46	Make	Model No.		*					
47										
Notes:										
1	* By Vendor									
2	Calibration, material and certificates shall be provided by the Vendor.									
3	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).									
4	Active Pressure regulator shall be fail to open type.									
5	Accuracy of pressure regulation shall be +/- 1% or better than of the set pressure for the entire inlet pressure and flow range.									
6	Pressure drop across the valve shall be selected by the Vendor considering the given set points (staggered set point of the two regulators and the Slam Shut valves) and the given inlet pressure conditions.									
7	Regulator shall be sized to deliver the maximum flow at minimum pressure condition and the minimum flow at the maximum pressure condition									
9	Vendor to provide sizing calculations of self actuated pressure control valve for review and approval.									
10	Vendor shall submit detailed GA drawing along with part name and MOC of the parts with datasheet.									
11	Vendor shall submit catalogue with model decodification sheet with datasheet.									
 ENERGISING QUALITY	CLIENT:	HPOIL GAS PRIVATE LIMITED								
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CREEP RELIEF VALVE										Rev.
GENERAL	1	Tag Number	Quantity		Refer P&ID		Refer P&ID			
	2	P&ID Number			Refer P&ID					C2
	3	Line No/Equipment No.			Refer P&ID					
	4	Inlet Line Size/Sch		Outlet Line Size/Sch		Refer P&ID				
	5	Inlet Line Material		Outlet Line Material		*				
	6	Corrosion Allowance			As per PMS					
	7									
PROCESS DATA	8	Service			Natural Gas					
	9	State		Phase		Gas		Single		
	10	Corrosive		Erosive		N/A		N/A		
	11	Flow (Min./Max.)	SCMH	Max. Oper Pressure	Barg	Refer P&ID		Refer P&ID		
	12	Set Pressure	Barg	%Allow Overpressure	*	Barg	10%			
	13				Constant					
	14	Back Pressure (barg)		Variable		*				
	15				Total					
	16	Oper Temperature	DegC	Relief Temperature	DegC	Refer P&ID		*	DegC	
	17	SG @ Relief		Visc @ Relief		*		*		
	18	MW @ Relief		Density @ Relief		*		*		
	19	Sp HT Ratio (Cp/Cv)		Compressibility (Z)		*		*		
	20	Design Pressure	Barg	Design Temperature	DegC	275 / 48 / 18		barg	Refer P&ID	DegC
	21	Latent Heat of Vap		Barometric Pressure		*		-		
	22	Wetted Surface Area (m2)			N/A					
23										
DESIGN BASIS	24	Nozzle			Full Nozzle					
	25	Type			Conventional					
	26	Bonnet Type			Closed					
	27	Basis of Selection			To meet the PNGRB requirement for Creep Relief					
	28	Sizing Basis			Creep Relief					
	29	Relieves To			Vent to Atmosphere					
	30	Calculated Area	Selected Area		*		*			
	31	Orifice Designation			*					
	32	Calculated Capacity			*					
	33	Code			API-520 & 526					
CONNECTOR	34	Size			*		*			
	35	Type			RF		RF			
	36	Rating			*		*			
	37									
	38									
	39									
	40									
MATERIAL	41	Body	Bonnet		ASTM A216 GR. WCB		ASTM A216 GR. WCB			
	42	Nozzle (Seat)	Nozzle Ring		SS 316		*			
	43	Spring	Disc		SS 304		SS 316			
	44	Bellows	Guide		N/A		*			
	45	Main Valve Seat / Seal			*					
	46									
MISC.	47	Cap			Bolted					
	48	Lever	Lever Type		N/A		-			
	49	Test Gag	Range		Required		-			
	50	Rupture Disc	Tag No		N/A		-			
	51	Manufacturer	Model No.		*		*			
	52									
Notes:										
1	* By Vendor									
2	Calibration, material and certificates shall be provided by the Vendor.									
3	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1mm).									
4	Creep Relief Valve shall be sized as per PNGRB requirements. Vendor to provide sizing calculations and select material as per detail engineering.									
5	Vendor shall submit detailed catalogue with model decodification sheet with datasheet.									
6	Vendor shall submit detailed GA drawing along with part names and MOC of the parts along with datasheets.									
 ENERGISING QUALITY	CLIENT:		HPOIL GAS PRIVATE LIMITED							
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LEVEL GAUGE						Rev.
GENERAL	1	Tag Number	Quantity	Refer P&ID	Refer P&ID	
	2	P&ID Number		Refer P&ID		C2
	3	Line No	Equipment No.	Refer P&ID	Refer P&ID	
	4	Enclosure Type		IP-65		
	5					
	6					
PROCESS DATA	7	Service		Natural Gas - Water Bath Heater		
	8	Fluid	Phase	Liquid (Water)	Single	
	9	Corrosive	Erosive	*	*	
	10	Oper Pressure	Max Pressure	*	*	
	11	Oper Temperature	Max Temperature	*	*	
	12	Design Pressure	Design Temperature	*	Refer P&ID	
	13	Viscosity (cP)	Specific Gravity	*	*	
	14	Steady / Pulsating	% Solids	*	*	
	15	Ambient Temperature		0-45 DegC		
	16					
	17					
GAUGE	18	Type		Magnetic Type		
	19	Distance from Center Line of Vessel (mm)		**		
	20	Sections Required		N/A		
	21	Connection Size	Rating	3/4"	800# RF	
	22	Connection Arrangement		Flanged		
	23	Body Material		SS 316		
	24	Cover Material		*		
	25	Gasket Material		*		
	26	Float Material		SS 316		
	27	Indicator Type		Bi-color Flapper		
	28	Illuminator	Power Supply	N/A	N/A	
	29	Jacket or Internal Tracer		N/A		
	30	Frost Extension	Length	N/A	N/A	
	31	Calibrated Scale		*		
32						
33						
34						
VALVES	35	Type		Ball Valves		
	36	Number Required		6		
	37	Body Material		ASTM A 216		
	38	Trim Material		SS 316		
	39	Packing Material		PTFE		
	40	Vessel Connection Size		3/4" 800# RF		
	41	Cage / Bridle Size		3/4" 800# RF		
	42	Drain Connection	Size	Required	1/2"	
	43	Vent Connection	Size	Required	1/2"	
	44					
MISC.	47	Manufacturer	Model No.	*	*	
	48					
	49					
	50					
	51					
NOTES:						
1	Battery life shall be not less than 5 years if replaceable and if not replaceable then battery life shall be 10 years. Battery capacity shall be sufficient for 24 hr. continuous operation with all the equipment powered.					
2	Calibration, material and hazardous area certificates shall be provided by the Vendor.					
3	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).					
4	Level gauge shall be provided with all accessories such as flanges, gaskets, nuts and bolts etc. to make the assembly complete in all respect for installation.					
5	Level gauge shall have drain / vent valve and drain pipe routed to the prevailing closed drain system.					
6	Level gauges shall be designed for pressure rating twice that of working pressure.					
7	Level gauges shall be directly mounted on vessel and shall have isolation valves. The reference zero point for the indication is the bottom of the tank.					
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LEVEL SWITCH						Rev.		
GENERAL	1	Tag Number	Quantity	Refer P&ID	Refer P&ID			
	2	P&ID Number		Refer P&ID		C2		
	3	Line No	Equipment No.	Refer P&ID	Refer P&ID			
	4	Enclosure Type		IP-65 , Ex 'ia'				
	5	Hazardous Area Classification		Zone 1 Group IIA /IIB as per IEC, T3				
	6							
PROCESS DATA	7	Service		Natural Gas - Water Bath Heater				
	8	Fluid	Phase	Liquid (Water)	Single			
	9	Corrosive	Erosive	*	*			
	10	Oper Pressure	Max Pressure	Refer P&ID	Refer P&ID			
	11	Oper Temperature	Max Temperature	Refer P&ID	Refer P&ID			
	12	Design Pressure	Design Temperature	*	*			
	13	Viscosity (cP)	Specific Gravity	*	*			
	14	Steady / Pulsating	% Solids	*	*			
	15	Ambient Temperature		0-45 DegC				
	16							
FLOAT	18	Type		Float Type				
	19	Length and Diameter (mm)		*				
	20	Insertion Length (mm)		N/A				
	21	Displacer Extension (mm)		N/A				
	22	Float Material		SS316				
	23	Spring / Torque Tube Material		SS316				
	24							
	25							
SWITCH	27	Function		Level Switch High				
	28	Inst. Gas Supply (Des./ Nor / Min.)		N/A				
	29	Switch Type		Electrical				
	30	Form	Quantity	*				
	31	Set Point Adjst.	External	*				
	32	Contact Rating	Load	*				
	33	High Level Set Point		*				
	34	Output (Normal)		Required				
	35	Output on High		Required				
	36	switch Housing Material		*				
MISC.	37	Enclosure		*				
	38							
	39	Filter Regulator with Gauge		*	*			
	40	Jacketing : Medium	Connection	*	*			
	41	Temp.	Pressure	*	*			
	42	Pneumatic Connection		N/A				
	43	Torque Tube Flushing Connection		N/A				
	44	Make	Model No.	*	*			
NOTES:								
1	* By Bidder							
2	Calibration, material and hazardous area certificates shall be provided by the Vendor.							
3	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).							
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RESTRICTION ORIFICE					Rev.
GENERAL	1	Tag Number		Refer P&ID	
	2	P&ID Number		Refer P&ID	
	3	Quantity		03	
	4	Line No		Refer P&ID	
	5	LineID (mm)		Refer P&ID	
	6	Line OD (mm)		Refer P&ID	
	7	Flange Rating		*	
	8	Line Size / Line Schedule		Refer P&ID	
	9	Line Class & Rating		Refer P&ID	
	10	Line Material		*	
	11	Connecting Flange Material		*	
PROCESS CONDITIONS		Fluid	State	Natural Gas	Gas
	13	Flammable /Toxic		Yes	No
	14	Liquid Density at WT (kg/m3)		-	
	15	Viscosity at WP & WT(Cp)		-	
	16	Allowable ΔP at above flow rate (barg)		*	
	17	Flow Rate (Min. / Nor. / Design)		Refer P&ID	
	18	Pressure (Inlet / Outlet)		Refer P&ID	
	19	Temperature (Inlet / Outlet)		Refer P&ID	
	20	Gas compressibility at WP & WT		-	
	21	Design Pressure (barg)		275/ 48 / 18	
	22	Design temperature (Min. / Max.)		Refer P&ID	
	23	Gas Specific Gravity (MW/29)		-	
	24	Ratio of Specific Heat (Cp/Cv)		-	
	25	Vapour Pressure at WT		-	
	26	Critical pressure		-	
	27	Critical temperature		-	
	28	Reynolds Number		-	
	ORIFICE PLATE	29	Plate Type		Concentric
30		Orifice bore type		Square Edge Orifice	
31		Plate material		SS316	
32		Plate thickness		*	
33		Plate outside diameter		*	
34		Plate Holder		Required	
35		Diameter ratio (Beta d/D)		*	
36		Orifice bore diameter (d) in mm		*	
ORIFICE FLANGE	37	Vent / Drain Hole	Size	Required	*
	38	Flange type		*	
	39	Flange size	Rating		
	40	Flange material			
	41	Flange Facing	Finish		
	42	Studs			
	43	Bolts & Nuts Material		*	
	44	Gasket material			
	45	Gasket Thickness			
	46	Pressure tap type	Number of Sets		
	47	Pressure tap size			
	48	Pressure tap orientation			
PHYSICAL DATA	49	Estimated weight		*	
	50	Removal clearance		*	
	51	Face-to-face Dimension		*	
	52				
	53				
Notes:					
1	Vendor to specify. *				
2	Vendor shall submit detailed GA drawing along with part names and MOC of the parts along with sizing calculation and datasheet.				
3	Restriction Orifice shall be designed in accordance with ISO 5167 part-2. Vendor to submit sizing calculation for approval.				
4	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm)				
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JUNCTION BOX						Rev.
GENERAL	1	Tag Number	Quantity	*	*	
	2	Application		For Termination Instrument IS Cables		
	3	Suitable for		*		
	4	Area Classification		Zone 1 Group IIA /IIB as per IEC, T3		
	5	Enclosure Rating		EEx'd' (Explosion Proof)		
	6	Ingress Protection		WP to IP-65 as per IEC-60529 / IS-2147		
	7	Material of Construction		Corrosion resistant , Cast Aluminum LM6 /25 or FRP		
	8	Overall Dimension		*		
	9	Cover		Bolted		
	10	Painting / Finish		Grey		
	11	Rating		Upto 500 VAC		
	12					
	13					
SINGLE CABLE	14	No. of Entry	Left Side	*		
	15		Right Side	*		
	16		Top Side	-		
	17		Bottom Side	*		
	18		Other	-		
	19	Cable Gland	Type	Ex'd', Double Compression Type, Brass with Zinc/ Nickel plated		
	20		Size	*		
	21		Qty	*		
	22	Plugs	Type	Ex'd', Brass with Zinc/ Nickel plated		
	23		Size	*		
	24		Qty	*		
	MULTI CABLE	25	No. of Entry	Left Side	-	
26		Right Side		-		
27		Top Side		-		
28		Bottom Side		*		
29		Other		-		
30		Cable Gland	Type	Ex'd', Double Compression Type, Brass with Zinc/ Nickel plated		
31			Size	*		
32			Qty	*		
33		Plugs	Type	Ex'd', Brass with Zinc/ Nickel plated		
34			Size	*		
35			Qty	*		
TERMINALS		36	Type	Spring Loaded, anti-loosening, vibration proof, screwless		
	37	Quantity	*			
	38	No. of Rows	*			
	39	Numbering System	Terminal strip and terminals shall be suitably numbered			
	40	Size	1.5 mm ²			
	41	Make	*			
	42					
ACCESSORIES	43	Earthing Busbar (Internal)	Required			
	44	Earthing Screw (External)	Required			
	45	Rail(s) for Terminals	Required			
	46	PVC Shroud along with Cable Gland	Required			
	47	Nameplate Fixture	Required			
	48	Gasket	Required			
	49	Mounting	Suitable for mounting on wall, column and steel structure			
	50					
OTHERS	51	Manufacturer	*			
	52	Model	*			
	10 yes	Certification	DGMS/PESO certified			
	54					
Notes:						
1	* By Vendor					
2	DGMS / PESO certificates shall be provided by the Vendor.					
3	Material certificates shall be provided by the Vendor.					
4	Vendor to provide general arrangement drawing of JB supplied , indicating dimensions , layout etc and hazardous area certificates .					
5	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm)					
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PAIR ANALOG CABLE					Rev.			
GENERAL	1	Cable Identification	Analog- PVC/OSCR-AL/INDSCR-AL/FRLS/PVC/SWA/PVC					
	2	Number of Pairs	1P (IS)					
	3	Cable Length	**					
	4	Number of Twists per Meter	10 minimum					
	5	Application	Underground and aboveground – heavy hydrocarbons					
	6	Voltage Grade	500 V					
	7							
CONDUCTOR	8	Type	7 Stranded, each strand of 0.53 mm dia					
	9	Conductor Size	1.5 Sq.mm					
	10	Material	Plain Annealed Electrolytic Copper Conductor,BS: 6360, Class 2,					
	11	Pair Identification	As per BS: 5308 (Table 11)					
	12							
INSULATION	13	Material	PVC Type TI1 (as per BS: 6746), as referred in BS: 5308					
	14	Nimnal Thickness of Insulation	As per table 1 OF BS: 5308					
	15	Operating Temperature	-5°C/ 85°C					
	16	Color of Conductor Insulation	As per BS: 5308 (Table 11)					
	17	Thickness (nominal)	As per table 1 OF BS: 5308					
INNER JACKET	18	Material	Extruded FRLS TM1 PVC to IS-5831, as per BS: 6746					
	19	Nominal Thickness (in mm)	As per table 10 & CL. 13.3 of BS 5308: Part 2: 1986					
	20	Lead Jacket Thickness	N/A					
	21	Color	Blue					
	22							
INDIVIDUAL SHIELD	23	Material	Aluminium backed by Mylar / Polyester tape					
	24	Nominal Thickness (in mm)	0.05 mm minimum					
	25	Binder Tape Material	Non-Hygroscopic Tape					
	26	Overlap	Min. 25% on either side					
	27	Coverage	100%					
	28	Drain Wire	Multi-strand bare tinned annealed Copper conductor					
	29	Drain Wire Cross section	0.5 mm² minimum					
	30							
OVERALL SHIELD	31	Material	Aluminium backed by Mylar / Polyester tape					
	32	Nominal Thickness (in mm)	0.05 mm minimum					
	33	Binder Tape Material	Non-Hygroscopic Tape					
	34	Overlap	Min. 25% on either side					
	35	Coverage	100%					
	36	Drain Wire	Multi-strand bare tinned annealed Copper conductor					
	37	Drain Wire Cross section	0.5 mm² minimum					
	38							
OUTER JACKET	39	Material	Extruded FRLS TM1 PVC to IS-5831, as per BS: 6746					
	40	Color	Blue					
	41	Nominal Thickness (in mm)	As per table 10 & CL. 13.3 of BS 5308: Part 2: 1986					
	42							
ARMOUR	43	Armour Material	Galvanised steel wire as per cl. 13.2.2 of BS 5308:Part2: 1986					
	44	Armour Wire Size	BS: 5308, (Table 10)					
	45							
	46							
OTHERS	47	Overall Outer Diameter (with Tolerance)	*					
	48	Under Armour Diamater	*					
	49	Over Armour Diamater	*					
	50	Weight (in Kg / Km)	*					
	51	Min. Bending Radius	*					
	52	Rip Cord	Non-metallic under inner jacket					
	53	Max. Recommended Pulley Tension	*					
	54	Oxygen Index	30 % minimum as per ASTM D 2863					
	55	Temperature Index	250 °C minimum as per ASTM D 2863					
	56	Sequential Marking on Outer Sheath	Length marking every meter					
	57	Drum Length	*					
	58	Tolerance	± 5%					
	59							
Notes: TBD **								
1	* By Bidder							
	CLIENT:	HPOIL GAS PRIVATE LIMITED						
	PROJECT:	SUPPLY FOR DE-COMPRESSION UNIT (DCU) OF NAGALAND GA's		C1	21.04.2026	PS	AS	PK
				REV.	DATE	PRPD	CHKD	APPD

Digitally signed by Bivek Kumar Singh
Date: 2026.09.03 19:02:02 IST

DATA SHEET FOR ELECTRONIC VOLUME CORRECTOR											Rev.
General	1	Type	Microprocessor based battery operated volume corrector with integral pressure transmitter and temperature sensor suitable for mounting in the field location and applicable for custody transfer								
	2	Service	Natural Gas								
	3	Site conditions	Temp.: 0 - 55 deg.C, Hot, Humid, tropical, Saline environment								
	4	Governing Standard	EN 12405-1+A1 or Latest								
	5	Approval	Type Approval Certificate as per Governing Standard								
	6	Area Classification	Zone 1 Group IIA /IIB T3 Ex ' d'								
	7	Enclosure Protection	IP 65								
	8	Quantity	As per P&ID								
	9	Function	To measure actual gas volume, pressure, temperature, and compressibility factors of the gas and based on which calculates standard volume of gas. The unit shall be complete in all respects to achieve functionality.								
	10	Accuracy	Typical accuracy better than ±0.5% as per governing standard								
Electronic Volume Corrector	12	Input	1.EVC input shall be either LF/ HF pulse from RPD meter								
	13		2.Temperature signal form RTD measured value PT100.All interconnecting cable shall be screened and armored								
			3.Pressure sensor shall be directly mounted on the meter and wired to EVC with a range in accordance with max. working pressure and design pressure								
	14		4. DI signal from Gas Detector, 1 tamper switch, 1 Spare								
		Output	1.Correct Flow rate in SCMH, standard cubic meter per hour								
	16		2.Correct Totalized volume (sm3)								
	17		3.Temperature								
	18		4.Pressure								
	19		5.Correction factor								
	20		6.Uncorrected flow rate								
			7.Uncorrected volume								
	21		8. Yesterday's Flow (SCM) and Today's Flow (SCM)								
	22	Isolation	All Inputs, Outputs and power supply shall be individually isolated using analog and digital barriers.								
	23	Display	2-line LCD with 16 characters / 1 Line LCD with 8 characters								
	24	Power Supply (Note 5)	Lithium battery along with mounting hardware as well as provision for External power up from Solar Panel. Any hardware required to have EVC work on battery as well external power , shall be included in scope. This includes GPRS modem polling to Client cloud server.								
	25	Calculations / Corrections	Compressibility: AGA8 latest (Detail method), NX-18,S-GERG								
	26	Features	Built in diagnostics to detect proper functioning								
	27		Data security to password / key-lock. Hardware and software seals required.								
	28		Parameters and programmed constants shall be stored in EEPROM / non- volatile memory								
	29		Conduit connection of 1/2" NPTF with plugs shall be provided for output.								
	30		Alarm output for unit malfunctioning.								
	31		EVC can store hourly data for 30 days								
	32		Large and configurable database and can store hourly, daily, monthly data with date & time stamp for pressure, temperature and corrected flow and consumption up to 1500 records or better.								
			EVC should be supplied with GSM Modem. Modem shall be powered from battery operated by Solar. Separate Junction box shall be provided to house this arrangement.								
	33		Facility for entry and accessing live and stored data through Keypad / Laptop / SCADA system.								
	34	Identification	Unique Addressing Facility								
	35	Communication Ports	1. RS 232/ 485 serial port for SCADA facility (configurable up to 9600 bps) along with required connector, convertor, and cable for USB output.								
			2. EVC shall have an inbuilt GSM modem. Separate battery shall be provided for GSM module which shall be charged by Solar Panel.								
	36	Software	Suitable communication protocol adaptor with 2.5 mtr of communication cable along with driver software to communicate with EVC and Windows 7 and Windows 10 based laptop shall be supplied with each EVC								
	37	Automatic Meter Reading (AMR)	Required, In built AMR with compatible technology for Data transmission								
	38	Mounting Accessories	EVC can be internal or external to the meter. Required mounting hardware ,clamps, fixtures shall be provided.								
	39	Fittings	1. Pressure sensor: 1/4"NPTM 2. Temperature Sensor: 1/4" NPTM (RTD Diameter Max.6mm)								
	40	Cable Entry	1/2" NPTF								
	41	Canopy	Prefabricated FRP canopy with required installation accessories								
	42	Communication Cable	Required, 2.5 mtrs length								
	Misc.	44	Make	*							
45		Model	*								
Notes:											
1	Vendor to specify. *										
2	EVC shall be certified for type test from NMI / PTB or equivalent independent international laboratories as per EN standards.										
3	The Calibration certificate for RTD, PT and EVC (original + soft copy) shall be provided to HPOIL. One copy of the certificate shall be provided within the packing box of each EVC.										
4	Vendor shall provide 5 sets of volume corrector documentation including product literature, software / hardware manual, operation manual, maintenance instruction, certificates etc.										
5	Battery life shall be not less than 5 years if replaceable if not replaceable battery life shall be 10 years. Battery capacity shall be sufficient for 24 hr. continuous operation with all the equipment powered.										
6	The communication protocol and message structure details to be used on the RS 232 / 485 serial communication port (for SCADA) shall be supplied after placement of order.										
		CLIENT:	HPOIL GAS PVT. LIMITED (HPOIL)								
		PROJECT:	DE-COMPRESSION DCU FOR HPOIL GA	C1	01.07.2024	AK	RA	SKN			
				B1	28.06.2024	AK	RA	SKN			
				A1	27.06.2024	AK	RA	SKN			
				REV.	DATE	PRPD	CHKD	APPD			

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Date: 2026.09.03 19:02:02 IST

RPD FLOWMETER						Rev.
General	1	Tag No.	Refer P&ID			
	2	Quantity	Refer P&ID			
	3	Line No.	*			
	4	Line Size & Schedule	Refer P&ID			
	5	P&ID Number				C1
	6	Service	Governing standard	Natural Gas EN 12480:2018 or Latest		
Flow Meter	7	End connection	Size and Rating	Flanged		
	8		Facing & Finish	*		
	9	Pulses / M3		LF & HF/LF		
	10	Flow Range		*		
	11	Enclosure		Weather proof IP65 as per IEC 60529 / IS 2147		
	12	Cable Entry		*		
	13	F-F Distance (mm)		*		
	14	Material	Body	Cast Aluminium alloy or equivalent		
	15		End Connections	Aluminium Flanged /ASTM A 105 Flanged or equivalent		
	16		Impeller & Shaft	*		
	17		Bearing	SS316 or equivalent		
	18		Other Wetted Parts	SS316		
	19	Accuracy		±2% (Qmin to 0.1Qmax) and ±1% (0.1Qmax to Qmax)		
	Pre-amplifier	20	Rangeability		1:100 or better	
21		Type - 2 wire/ 3 wire		2 wire		
22		Preamplifier location		Field		
23		Power supply		24 VDC loop powered from EVC		
24		Cable Entry		1/2" NPT(F)		
25		Enclosure		Weather proof IP65 as per IEC 60529 / IS 2147		
26		Intrinsic safe		Ex'ia'		
Pulser	27	Mounting	Accessories	Integral with RPD flow meter Required		
	28	Power supply	Cable Entry	*		
	29	Output		Pulses		
	30	Enclosure		Weather proof IP65 as per IEC 60529 / IS 2147		
	31	Intrinsic safe		Ex'ia'		
	32	Mounting		Integral with RPD flow meter		
Options	33	-		-		
	34	-		-		
	35	Local Counter		Required 8 Digit, Mechanical, non-resettable counter		
	36					
	37	Strainer	Size and Mesh	*		
	38	Temperature tap on meter body		Required, 1/4" NPT, Thermowell SS316 , RTD 6mm probe.		
	39	Pressure Tap on Meter Body		Required		
	39					
	40	Lubricator with accessories		Required		
	41	Radiography		100 % required for all welded joints (As applicable)		
Process Conditions	42	Fluid and State		Natural gas		
	43	Flow (min/max)SCMH		Refer P&ID		
	44	Design Temp(°c)		Refer P&ID		
	45	Design Pressure(barg)		275 / 48 / 18		
	46	Molecular Wt.		*		
	47	Viscosity (cP)		*		
	48	Cp/ Cv ratio		*		
	49	Max. allowable pressure drop		As per EN-12480 or latest		
	50	Compressibility Factor		*		
	51	Area Classification		Zone 1 Group IIA /IIB as per IEC, T3		
Misc	52	Model No.		*		
	53	Make		*		
Notes:						
1 Vendor to specify. *						
2 Vendor to submit proper sizing calculations as per process parameters for review and approval.						
3 Vendor to refer P&ID for more information about process data.						
4 Vendor shall provide detailed GA drawing along with all parts name and MOC for the RPD meter along with data sheet.						
5 In addition to first fill, lubricating oil (500 ml) along with feeding accessories shall be supplied with each meter.						
6 Type Approval Certificate and Weights & Measures Certificate along with Model & Make information shall be provided for meters supplied.						
7 Calibration certificate (original + soft copy) shall be provided to Client. One copy of the certificate shall be provided within the packing box of each meter.						
8 Pulse generators shall be provided with means of plugging and sealing arrangement against unauthorized interference. Maximum Velocity through the RPD meter shall be less than 30 m/sec.						
9 Meter casing shall be tamperproof, corrosion resistant suitable for indoor / outdoor installation.						
10 Pressure drop across complete meter assembly consisting of meter, NRV, RO and strainer shall be calculated and provided. Over flow protection shall be 120% of max. flow.						
11 Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm)						
 ENERGISING QUALITY	CLIENT:	HPOIL GAS PRIVATE LIMITED				
	PROJECT:	SUPPLY FOR DE-COMPRESSION UNIT (DCU) OF NAGALAND GA's		REV.	DATE	PRPD
				C1	09.06.2025	PS AS PK
				CHKD	APPD	
Document No.: C231104-CGD-IN-DS-5003						



Energising Quality

PROJECT NUMBER: C261162



MECHANICAL DATA SHEET – CARTRIDGE FILTER FOR CNG

Total Sheets

5

DOCUMENT NO

C281162

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ME

MR

3002

HPOIL GAS PRIVATE LIMITED

**SUPPLY OF DE-COMPRESSOR UNIT (DCU) -100 SCMH,450 SCMH IN
GEOGRAPHICAL AREAS OF DIMAPUR, NAGALAND FOR HPOIL**

**CARTRIDGE FILTER FOR CNG
DECOMPRESSION SKID (DCU)**

C1	12.05.2026	Issued for client Review	PT	DK	DK
REV	DATE	DESCRIPTION	PREP	CHKD	APPR

		PROCUREMENT OF CNG DE-COMPRESSION UNIT			
MECHANICAL DATA SHEET – CNG CARTRIDGE FILTER					
GENERAL DESIGN SPECIFICATIONS					
SR. NO.	DESCRIPTION	Unit / UOM	DATA		
1	FILTER SEPARATOR - TYPE / ORIENTATION	~	Cartridge Type / As per P&ID		
2	QUANTITY / TAG NO. / LOCATION	Nos.	As per P&ID		
3	VESSEL DESIGN CODE	~	ASME Section VIII, Div 2 (Latest code edition) / Other International Requirements		
4	TYPE OF FILTER ELEMENTS	~	Cartridge with SS MOC at center core of element		
SR. NO.	FLUID PROPERTIES				
5	SERVICE FLUID	~	Natural Gas (Dry)		
6	LIQUID TO BE REMOVED	~	Particulate matters+ Natural gas liquid		
7	VAPOUR SPACE MEDIUM	~	NA		
8	MOLECULAR WEIGHT OF GAS	kg/k-mol.	17.96 ~ 19		
9	GAS COMPRESSIBILITY @ P, T (50.98 kg/cm2, 48°C)	kg/cm2 & °C	#(VTC)		
10	GAS COMPRESSIBILITY @ P, T (96.873 kg/cm2, 55°C)	kg/cm2 & °C	#(VTC)		
11	SPECIFIC ISOBAR HEAT CAPACITY(Cp)	Kj/ kg-k	#(VTC)		
12	SPECIFIC ISOCHOR HEAT CAPACITY(Cv)	Kj/ kg-k	#(VTC)		
13	GAS SPECIFIC GRAVITY @P,T & COMPOSITION		#(VTC)		
14	GAS DYNAMIC VISCOSITY @ P,T..	cP	#(VTC)		
15	GAS DENSITY @ P,T...	kg/m³	#(VTC)		
16	LIQUID DENSITY @ P,T...	kg/m³	995		
17	LIQUID VISCOSITY @ P, T...	cP	#(VTC)		
SR. NO.	DESIGN PARAMETERS				
18	DESIGN GAS FLOW RATE	SCMH	100 and 450		
19	DESIGN TEMPERATURE (MIN. / MAX.)	°C	-29 to 65 °C		
20	DESIGN PRESSURE	kg/cm²g	49.96		
SR. NO.	OPERATING PARAMETERS				
21	OPERATING FLOW RATE (MIN. / MAX)	SCMH	100 & 450		
22	OPERATING PRESSURE	Kg/cm2 g	255 kg/cm2-g to 30.59 kg/cm2-g		
23	OPERATING TEMPERATURE (MIN. / MAX.)	°C	5 to 45 °C		
24	ALLOWABLE PRESSURE DROP (CLEAN/DIRTY)	Kg/cm2	0.1 at clear condition & 0.3 at dirty case		
25	FILTRATION EFFICIENCY	%	99.99 % upto 3 micron		
MATERIAL OF CONSTRUCTION					
SR. NO.	DESCRIPTION	UOM	MATERIAL GRADE		
26	SHELL, TUBE SHEET, ELLIPSOIDAL HEAD	~	ASTM A312 Gr. TP316		
27	NOZZLE NECK	~	ASTM A312 Gr. TP316		
28	NOZZLE FLANGES	~	ASTM A182 Gr. F316		
29	EXTERNAL BOLTINGS	~	ASTM A 193 Gr. B8/ASTM A194 Gr. B		
30	INTERNAL BOLTINGS	~	SS316		
31	INTERNAL GASKET, IF ANY	~	# (Suitable for Natural Gas)		
32	EXTERNAL GASKET / O-RING, IF ANY	~	SPIRAL WOUND GRAPHITE FILLED SS 316 METAL WINDING WITH SS304 INNER RING & CS OUTER		
33	FILTER ELEMENT / MESH	~	BOROSILICATE FIBRE GLASS, SINTERED POLYETHYLENE, SINTERED CERAMIC OR EQUIVALENT		
34	OTHER INTERNAL ATTACHMENT, IF ANY	~	SAME AS PARENT MATERIAL		
		MECHANICAL DATA SHEET – CARTRIDGE FILTER (100/450 SCMH)		DOCUMENT NO. C261162-00-ME-DS-3002	Rev C1
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Energising Quality

PROCUREMENT OF CNG DE-COMPRESSION UNIT



FILTER PARAMETERS

SR. NO.	DESCRIPTION	UOM	DATA
39	DESIGN CODE	~	ASME -SEC VIII DIV-2 (LATEST EDITION) / OTHER INTERNATIONAL CODE
40	CODE STAMPING (ASME U-STAMP)	~	NA
41	CORROSION ALLOWANCE	mm	NA
42	FILTER GROSS GAS VOLUMETRIC CAPACITY	m ³	#(VTC)
43	HYDROSTATIC TEST PRESSURE	kg/cm ² g	1.5 x Design Press. Or As per Code Calculations (Whichever is higher)
44	LIQUID HOLDING CAPACITY	m ³	#(VTC)
45	MAKE / MODEL OF FILTER ELEMENT	~	#(VTC)
46	NO. OF FILTER CARTRIDGES REQUIRED	Nos.	#(VTC)
47	FILTER ELEMENT DIMENSION (OD x WIDTH)	mm	#(VTC)
48	NOZZLE MAX. ALLOWABLE FORCES	N	#(VTC)
49	NOZZLE MAX. ALLOWABLE MOMENTS	N-mm	#(VTC)
50	HOUSING (DIA. x LENGTH)	mm	#(VTC)
51	TOTAL SOLID HOLDING CAPACITY	m ³	#(VTC)
52	TOTAL NET / GROSS FILTRATION AREA	mm ²	#(VTC)
53	MAX. WITHSTAND DIFFERENTIAL PRESSURE@ P , T	Kg/cm ² g	#(VTC)
54	BETA RATIO	mm ²	#(VTC)
55	PARTICLE / MESH SIZE	Micron	3 & Above
56	MOST PENETRATING PARTICLE SIZE(MPPS)	µm	#(VTC)
57	NAME OF FILTER ELEMENT MANUFACTURER	~	#(VTC)
58	FIXING DETAIL OF FILTER ELEMENT	~	#(VTC)
59	PRESSURE RATING OF FLANGES	psi / class	6000 #
60	FINISHED SURFACE OF FLANGES	AARH	150 / 125
61	DESIGN WIND VELOCITY (AS PER IS-875 PART-III)-2020	m/s	47
62	SEISMIC ZONE (AS PER IS-1893-RSM)	~	As per respective GA
63	ELEMENTS & VESSEL WALL CLEARANCE	mm ²	#(VTC)
64	PRESSURE DROP AT INLET DUE EXPANSION & CONTRACTION	kg/cm ² g	#(VTC)
65	PRESSURE DROP AT OUTLET DUE EXPANSION & CONTRACTION	kg/cm ² g	#(VTC)
66	FILTER CARTRIDGE BURSTING PRESSURE	kg/cm ² g	#(VTC)
67	VELOCITY OF GAS AT INLET & OUTLET	m/sec.	#(VTC)
68	VELOCITY OF GAS AT SHELL	m/sec.	#(VTC)
69	FLOW VS INLET PRESSURE CURVE	~	#(VTC)
70	FLOW VS PRESSURE DROP CURVE	~	#(VTC)
71	DESIGN GAS FLOW RATE	SCMH	#(VTC)
72	DESIGN LIFE	Years	25
73	ALL NOZZLE ORIENTATION	° / Radians	#(VTC)



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MECHANICAL DATA SHEET – CARTRIDGE FILTER (100/450 SCMH)

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 Energising Quality		PROCUREMENT OF CNG DE-COMPRESSION UNIT		 HPOIL GAS	
NOZZLE DETAIL					
SR. NO.	NOZZLE NO.	DESCRIPTION	UOM	FLANGE SIZE, PRESSURE RATING & FLANGE TYPE / END DETAILS, PIPEING CLASS	
74	N1	GAS INLET	Inch	Refer Latest P&ID For Nozzle size	
75	N2	GAS OUTLET	Inch		
76	N3	DRAIN	Inch		
77	N4A	DPG	Inch		
78	N4B	DPG	Inch		
79	N5	FILTER BYPASS	Inch		
DIMENSION & WEIGHT					
SR. NO.	DESCRIPTION		UOM	DATA	
81	BOTTOM OF SADDLE SUPPORT TO TOP OF INLET FLANGE		mm	# (VTC)	
82	OVERALL LENGTH (INCLUDING HEAD)		mm	# (VTC)	
83	SHELL INSIDE DIA. & TOTAL LENGTH		mm	# (VTC)	
84	EMPTY WEIGHT		kg	# (VTC)	
85	OPERATING WEIGHT		kg	# (VTC)	
86	HYDROSTATIC TEST WEIGHT		kg	# (VTC)	
87	OVERALL, FILTER WATER LITRE CAPACITY		Ltr.	# (VTC)	
ACCESSORIES					
SR. NO.	DESCRIPTION		UOM	DATA	
88	TYPE OF END CLOSURE		~	NA	
89	LIFTING LUGS		~	NA	
90	ANCHOR / FOUNDATION BOLTS & NUTS		~	# (VTC)	
91	BLIND FLANGES, BOLTS, NUTS & GASKETS AS PER NOZZLE DETAIL		~	Required	
92	LADDER / PLATFORM		~	As applicable	
INSPECTION & TESTING					
SR. NO.	DESCRIPTION		UOM	DATA	
93	RADIOGRAPHY		%	100	
94	PWHT		~	As per Code	
95	HYDROSTATIC TEST		~	Required	
96	DP / MPI / UT / IMPACT TEST		~	Required	
97	PAINTING		~	Required (As per VCS Doc. No. VCS-SS-PP-2502) # (VTC)	
98	PNEUMATIC TEST PROCEDURE		~	# (VTC)	
99	HYDRO TEST PROCEDURE		~	# (VTC)	
100	PWHT PROCEDURE		~	# (VTC)	
101	PT & RT PROCEDURE		~	# (VTC)	
102	OPERATION & MAINTENANCE PROCEDURE		~	# (VTC)	
 Energising Quality		MECHANICAL DATA SHEET – CARTRIDGE FILTER (100/450 SCMH)			DOCUMENT NO. C261162-00-ME-DS-3002
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PROCUREMENT OF CNG DE-COMPRESSION UNIT



NOTES :

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 ENERGISING QUALITY		SUPPLY FORDE-COMPRESSION UNIT FOR NAGALAND GA's (HPOIL)			
INSPECTION AND TEST PLAN (ITP) INSTRUMENTS				TOTAL SHEETS	3
DOCUMENT NO	C261162	00	IN	ITP	5003
DE-COMPRESSION SKID INSPECTION AND TEST PLAN (ITP) INSTRUMENTS					
C1	21.04.2026	ISSUED FOR CLIENT REVIEW	SA	AB	AB
REV	DATE	DESCRIPTION	PREPD	CHKD	APPRD

SUPPLY OF DE-COMPRESSION UNIT FOR NAGALAND GA's (HPOIL)

INSTRUCTIONS FOR FILLING UP:

- QAP shall be submitted for SKID and each equipment separately with breakup of assembly / sub-assembly & part/component or for group of equipment having same specification.
- 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 equipment's.
- Separate identification number with quantity for equipment shall be indicated wherever equipment having same specifications belonging to different facilities are grouped together.

ABBREVIATION USED:

CONTR: CONTRACTOR

MFR: MANUFACTURER

TPI: THRID PARTY INSPECTION AGENCY

* : Vendor / Bidder to provide

P / W / R : P : Performer , R : Review ; W : Witness

EN 10204, Type 3.1 certificates shall be provided for bought out items. Those shall be inspected by TPI appointed by Vendor.

CODES FOR EXTENT OF INSPECTION, TESTS, TEST CERTIFICATES & DOCUMENTS:

CODE DESCRIPTION	CODE DESCRIPTION	CODE DESCRIPTION	CODE DESCRIPTION
1. Visual 2. Dimensional 3. fitment & alignment 4. Physical Test (Sample) 5. Chemical test (Sample) 6. Ultrasonic test 7. Magnetic particle test (MPT) 8. Radiography test 9. Dye Penetrant test 10. Measurement of IR value a) Before HV test b) After HV test 11. High voltage test/Dielectric Test	12. Routine test as per relevant IS other standard 13. Type test as per relevant IS/ other standard 14. Impulse Test 15. Partial Discharge Test 16. Heat run risk test/temper 17. Enclosure protection test 18. Calibration 19. Noise & Vibration 20. Test certificate of bought out components 21. Tank pressure test 22. Paint shed vibration	23. Short time rating 24. Operational & functional test 25. Over speed test 26. Flame proof Test 27. Clearance and creep age distance 28. Acceptance test 29. Honing Test 30. Hydro test/ Shell leak test 31. Pneumatic Seat leak test 32. Impact test	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.

Equipment Details

Inspection & Test

Sr. No.	Item	Identification Number	Qty	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
						MFR	CONTR & TPI	CLIENT	MFR	CONTR & TPI	CLIENT			
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	1,2,3,18,20 ,24 – R	1,2,3,4,5, 18,20,24, D3, D6	D3,D6, Tech.	100%



INSPECTION AND TEST PLAN (ITP) INSTRUMENTS

Digitally signed by Bivek Kumar Singh

Date: 2026.09.03 19:02:02 IST

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C261162-00-IN-ITP-5003

Rev

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SUPPLY OF DE-COMPRESSION UNIT FOR NAGALAND GA's (HPOIL)

										,24 - W			spec	
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.	Level Switch	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.	SOV	As per P&ID	*	*	Client Approved	1,2,3,4 5,8,30, 32 – P	30 - W 32 – R	-	1,2,3,5,8, 20,18,24, 31 – P	1,2,3,5,8, 20,18,24, 30, 31,32 -R	1,2,3,5,8,2 0,18,24,30, 31,32 -R	1,2,3,5,8, 18,20, 24, 30, 31,32 D1, D3, D4,D6	D3,D6, Tech. spec	100%
7.	SSV	As per P&ID	*	*	Client Approved	1,2,3,4 5,8,30, 32 – P	30 - W 32 – R	-	1,2,3,5,8, 20,18,24, 31 – P	1,2,3,5,8, 20,18,24, 30, 31,32 -R	1,2,3,5,8,2 0,18,24,30, 31,32 -R	1,2,3,5,8, 18,20, 24, 30, 31,32 D1, D3, D4,D6	D3,D6, Tech. spec	100%
8.	PRV	As per P&ID	*	*	Client Approved	1,2,3,4 5,8,30, 32 – P	30 - W 32 – R	-	1,2,3,5,8, 20,18,24, 31 – P	1,2,3,5,8, 20,18,24, 30, 31,32 -R	1,2,3,5,8,2 0,18,24,30, 31,32 -R	1,2,3,5,8, 18,20, 24, 30, 31,32 D1, D3, D4,D6	D3,D6, Tech. spec	100%
9.	CRV	Refer P&ID	*	*	Client Approved	1,2,3,4 5,8,30, 32 – P	30 - W 32 – R	-	1,2,3,5,8, 20,18,24, 31 – P	1,2,3,5,8, 20,18,24, 30, 31,32 -R	1,2,3,5,8,2 0,18,24,30, 31,32 -R	1,2,3,5,8, 18,20, 24, 30, 31,32 D1, D3, D4,D6	D3,D6, Tech. spec	100%



**SUPPLY FOR DE-COMPRESSSION UNIT (DCU)
NAGALAND GA's (HPOIL)**



**MANDATORY SPARES FOR
DECOMPRESSURE SKID**

TOTAL SHEETS

3

DOCUMENT NO

C261162

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IN

MS

5003

HPOIL GAS PRIVATE LIMITED

**SUPPLY OF DE-COMPRESSSION UNIT (DCU) -100 SCMH,450 SCMH
IN GEOGRAPHICAL AREAS OF DIMAPUR, NAGALAND FOR HPOIL**

**MANDATORY SPARES FOR
DE-COMPRESSURE SKID**

C1	21.04.2026	Issued for Client Review	SA	AB	AB
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SUPPLY FOR DE-COMPRESSION UNIT (DCU) NAGALAND GA's (HPOIL)

Annexure – A

List of Mandatory spares for 450 SCMH- DCU Skid

1	Pressure Gauges	10% or minimum 1 No. (whichever is higher) of Each Type & Range
2	Temperature Gauges	10% or minimum 1 No. (whichever is higher) of Each Range
3	Differential Pressure Gauge	10% or minimum 1 No. (whichever is higher) of Each Range
4	CRV	10% or minimum 1 No. (whichever is higher) of Each Range
5	PSV	10% or minimum 1 No. (whichever is higher) of Each Range
6	Control Valve / Regulator/ Monitor/ SSV a) Trim (Seat and Disc) b) Diaphragm c) Spring d) Limit Switch e) Any other item part of repair kit f) Plug	10% or min 2 Nos. (whichever is higher) for each type, if used & as applicable for each i.e. a), b), c) , d) , e) & f)
7	RPD Flow meter a) Local digital display b) HF sensor + box	10% or min 1 No. (whichever is higher) for each type used & as applicable for each i.e. a) & b)
8	EVC a) Lithium Battery b) EVC-GSM modem Communication cable c) EVC-Meter communication cable	10% or min. 1 No. (which-ever is higher) for each type, if used & as applicable for each i.e. a), b), c).
9	Filter :	1 Sets of cartridges & gaskets

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SUPPLY FOR DE-COMPRESSION UNIT (DCU) NAGALAND GA's (HPOIL)

Annexure – B

List of Mandatory spares for 100 SCM- DCU Skid

1	Pressure Gauges	10% or minimum 1 No. (whichever is higher) of Each Type & Range
2	Temperature Gauges	10% or minimum 1 No. (whichever is higher) of Each Range
3	Differential Pressure Gauge	10% or minimum 1 No. (whichever is higher) of Each Range
4	CRV	10% or minimum 1 No. (whichever is higher) of Each Range
5	PSV	10% or minimum 1 No. (whichever is higher) of Each Range
6	Control Valve / Regulator/ Monitor/ SSV a) Trim (Seat and Disc) b) Diaphragm c) Spring d) Limit Switch e) Any other item part of repair kit f) Plug	10% or min 2 Nos. (whichever is higher) for each type, if used & as applicable for each i.e. a), b), c), d), e) & f)
7	RPD Flow meter a) Local digital display b) HF sensor + box	10% or min 1 No. (whichever is higher) for each type used & as applicable for each i.e. a) & b)
8	EVC a) Lithium Battery b) EVC-GSM modem Communication cable c) EVC-Meter communication cable	10% or min. 1 No. (which-ever is higher) for each type, if used & as applicable for each i.e. a), b), c).
9	Filter:	1 Sets of cartridges & gaskets



PROJECT NUMBER: C261162



PIPING MATERIAL SPECIFICATION

Total Sheets

51

Document No

C261162

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PP

PMS

2001

HOGPL (HPOIL GAS PVT. LTD.)

CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF
NAGALAND GA

C1	07.01.2026	ISSUED FOR CLIENT REVIEW	AS	PA	DK
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CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

ABBREVIATION

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AARH	Arithmetic Average Roughness Height
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
FF	Flat Face
PBE	Plain Both End
PE	Plain End
RF	Raised Face
SCRF	Screwed End - Female
SCRM	Screwed End - Male
CA	Corrosion Allowance
M	To Match Pipe

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CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

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CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

1.0 INTRODUCTION

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

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:

ASME 31.3	:	Process Piping
ASME 31.8	:	Gas Transmission and Distribution Piping Systems
OISD STD-226	:	Natural Gas Transmission Pipeline and City Gas Distribution Networks
PNGRB	:	Petroleum and Natural Gas Regulatory Board

All codes, standards and specifications referred herein shall be the latest edition of such documents.

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.

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.

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4.0 CLASS DESIGNATION CODE

The piping class designation shall generally consist of three digits made up of a letter, number & letter e.g. 15HC, 15HLT, 30HC, 30 HLT etc. as follows:

First two numerals letter indicates ASME class rating, e.g.

15 - 150 Class

30 - 300 Class

The first alphabet indicates differences in the Fluid Services within the same class rating and material, e. g. H stands for Hydrocarbon, W stands for Water, G stands for Galvanize etc.

The last one or two letter (as applicable) indicates type of material, e.g.

C - Carbon steel

LT - Low Temperature (Carbon Steel)

5.0 TECHNICAL REQUIREMENTS

5.1 General Notes

1. All piping materials selected under this specification shall be in compliance with the project specification.
2. Material selections shall comply with the maximum pressure and temperature limitation as specified in the service summary.
3. Substitution of equivalent materials is subject to approval of the Client /PMC. All requests for substitution shall be accompanied with sufficient data, drawings, and descriptive details to permit evaluation by the Client /PMC.
4. Cast iron, ductile or malleable iron, aluminum, plastic, or copper-bearing alloys shall not be used in hydrocarbon service.
5. Piping design pressure is based on flange maximum-allowable working pressure, unless otherwise noted in Job Specification.
6. When required, impact testing shall comply with applicable standards and material specifications.
7. All gaskets shall be asbestos free.
8. Aluminum jumper shall be provided across the flanged joint and length of the bolt shall be taken such that at least two threads remain exposed after the nut for fixing the continuity jumper.

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5.2 Units

1. All units are expressed in SI system with the exception of nominal pipe sizes (NPS) and bolting diameters, which are in inches.
2. Pressures are gauge pressures (in Kg/cm²g) and temperatures are in deg. Celsius (°C).
3. Pressures and Temperatures ratings are based ASME 16.5.

6.0 PIPELINE

- Line pipe material grade and wall thickness details are indicated in PMS.

7.0 PIPES

- 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.
- 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.
- All pipe threads shall conform to American Standard taper as per ASME B 1.20.1 NPT, unless otherwise specified.
- For butt weld end, bevel shall be in accordance with API specification 5L or ASME B16.25 as applicable.
- Where difference in thickness of matching pipe ends exist, bevels for such matching pairs shall be prepared in accordance with ASME B 31.8.
- Pipes shall be supplied with beveled end. Beveling shall be in accordance with ASME B16.25. Where plain end pipes are specified, as for small bore pipes for socket welded piping, the pipes shall be supplied with square cut ends.
- All pipe threads shall conform to American Standard taper as per ASME B 1.20.1 NPT, unless otherwise specified.
- Dimensions of socket weld ends shall confirm to ASME B 16.11. Bore shall match pipe OD and pipe ID.
- Pipe to pipe joints shall be made as follows:

For sizes up to & including DN40

Socket weld/ As per Piping Class

For size DN50 and above

Butt Welded

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8.0 FITTINGS

- 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.
- Threaded joints, if used, shall conform to American Standard taper as per ASME B1.20.1 NPT.
- Dimensions of socket welded/screwed fittings shall conform to ASME B 16.11. Swage shall be as per BS 3799.
- Dimensions of steel butt welded fittings shall be as per ASME B 16.9.
- Bore of socket welded fittings shall suit outside diameter (OD) of pipe and its thickness.
- 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.
- 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.
- Fittings thickness tolerances shall match pipe thickness tolerance.

9.0 BENDS

- Unless otherwise specified for process piping, elbow of radius $R = 1.5 D$ shall only be used.
- In order to accommodate changes in vertical and horizontal alignment in piggable section of pipeline, Elastic bends/ Cold field bends/ Hot formed long radius bends shall be used. Radius of bend shall be as per Design Basis.

D = Specified Outside Diameter

- Miters shall not be used.

10.0 FLANGES

- Pressure Temperature rating of flanges shall conform to B16.5/ MSS-SP44/ B16.47 Series A, as applicable.
- Dimensions of flanges shall be in accordance with B16.5/ MSS-SP44/ B16.47 Series A, as applicable.
- Neck of weld neck (WN) flanges shall suit pipe bore and thickness.
- Bore of socket welded (SW) flanges shall suit pipe O.D. and its thickness.
- Threads for screwed flanges, if used, shall conform to American Standard taper as per ASME B 1.20.1 NPT.

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- Sizes for blind flanges shall be indicated by nominal pipe size.
- Unless specified otherwise in Piping Material Specification the flange face finish shall be as per ASME B16.5.
- Butt welding ends of WN flanges shall conform to ASME B 16.25.
- Spectacle blind/spacer & blinds shall be in accordance with ASME B 16.48/ manufacturer's standard.
- Flange face finish for raised face flanges shall be as per ASME B16.5/ ASME B 16.47 as applicable. For RTJ flanges groove finish shall be 32-63 micro inches AARH as per MSS-SP-6. Hardness of groove surface shall be minimum 140 BHN.
- Butt welding ends of WN flanges shall conform to ASME B 16.25.
- Spectacle blind/spacer & blinds shall be in accordance with ASME B16.48 / manufacturer's standard.
- Two jackscrews, 180° apart shall be provided for all RTJ flange assemblies and Spacer blind/ Figure 8 assemblies. Holes for jackscrews shall be drilled and tapped at site. Jackscrews shall be as per ASTM A193 Gr. B7. Heads of jackscrews shall be heavy hexagonal type and jackscrew end shall be rounded. Dimensions shall be as per ASME B18.2.1.
- Flanges shall be packed and shipped in such a way as to prevent damage of machined parts.
- All machined or threaded parts shall be protected in accordance with ASTM A700. Suitable protection shield, or cover shall be provided on the gasket contact surface.
- Carbon steel forgings shall be supplied with a maximum carbon content of 0.25% and CE of 0.45 by product analysis.
- The finish of contact faces of pipe flanges & connecting end flanges of valves & fittings shall be governed by ASME B16.5 & following:
Roughness requirements (Finish: AARH standards per ASME B46.1):
 - a) Raised Face (RF): Serrated finish 125 to 250 µin Ra.
 - b) Flat Face (FF): Serrated finish 125 to 250 µin Ra.
 - c) Ring Type Joint (RTJ): Extra-smooth finish 63 µin Ra max.
- Flat face flanges, unless specified on the Piping Specifications, shall not be used without specific Client/PMC approval. Full-face gaskets shall be used with flat-face flanges as per ASME B16.20.
- All flanged joints shall be installed with a single gasket between contact faces.

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- Spectacle blank (figure 8 blank), blank (blind) & spacer shall confirm to the requirement of ASME B16.48 up to sizes 24". For 150#, 300# and 600# spectacle blank shall be used up to 8", blank (blind) & spacer for sizes 10" & above

11.0 GASKETS

- Spiral wound metallic gasket with Graphite filled winding with SS304 inner ring and CS outer ring/ Soft iron octagonal ring type joint gasket, and shall conform to ASME B 16.20/ API 601
- Spiral wound gaskets shall be self-aligning type.

12.0 BOLTING & THREADS

- Nuts for stud bolts shall be American Standard Hexagon Heavy Series and double chamfered.
- Dimension and tolerances for stud bolts and nuts shall be as per ASME B18.2.1 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 B16.5/ASME B16.47 with full threading.
- 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
- 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
- Threads for threaded pipe, fitting, flanges and valve shall be in accordance with B1.20.1 taper threads, unless specified otherwise.
- 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.

13.0 THREAD SEALANT

- Threaded joints shall be made with 1" wide PTFE jointing tape.

14.0 VALVES

- Valve ends shall be as per valve data sheets for various piping class.
- 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.

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- All buried valves shall be provided with stem extension shall have Butt Welded ends as per relevant specification/ data sheet.
- All valves in the piggable section of pipeline and Main Process Flow Line shall be Full Opening valve as per API 6D. Other valves shall be Reduced Opening type unless specified otherwise in P&ID.
- Flange dimensions and face finish of flanged end valves shall conform to clause 10.0 of this specification.
- Butt welding ends of Butt-Welded valves shall conform to ASME B 16.25.
- Face to face and end to end dimensions shall conform to applicable standards.
- 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 Valve	:	BS EN ISO 17292
Plug Valve	:	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 Valve	:	API 6D
Plug Valve	:	API 6D

- All manual operated valves shall be provided with wrench / hand wheel or gear operator as specified here in below.
- **Gate Valves**

For ANSI class 150 and 300	-	Hand wheel operated for size ≤ 12" NB. Gear operated for size ≥ 14" NB.
For ANSI class 600	-	Hand wheel operated for size ≤ 10" NB. Gear operated for size ≥ 12" NB.

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- **Globe Valves**

For ANSI class 150, 300, 600 and 900 - Hand wheel operated for all Size.

- **Ball Valves & Plug Valves**

For all ANSI class - Wrench operated for size ≤ 4 " NB.
Gear operated for size ≥ 6 " NB.

- **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.

15.0 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.

16.0 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.

17.0 PIPING SPECIALTY ITEMS

- Primary material Pipeline specialty items viz. flow tees, insulating joints, LR bends etc. shall be as per respective data sheets and specification.
- For mainline items, corrosion allowance shall be as per respective data sheet.

18.0 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.

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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.

18.1 Insulating Gaskets, Sleeves and Washer Materials Properties

Compressive Strength	:	65000 psi
Average Dielectric Strength	:	15 kV or more
Electrical Resistance	:	>1 MΩ (When tested with 500-1000 V DC merger)
Max. Operating Temperature	:	302°F (150°C)
Min. Operating Temperature	:	(-) 200°F (-129°C)
Water Absorption	:	5%
Flexural Strength	:	70000 psi
Tensile Strength	:	50000 psi
Bond Strength	:	2600 lb.
Shear Strength	:	22000 lb.

18.2 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.

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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.

19.0 CHARPY V-NOTCH TEST & HARDNESS 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)

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CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

Appendix – A

Piping Material Specification – Index

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Sr. No.	Piping Class	Rating	C. A. (MM)	Spl. Reqt.	Basic Material	Service	Remarks
1	15HC	150	1.5	NON-IBR	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE /NONFLAMMABLE, NON- LETHAL- HYDROCARBONS	Page 17
2	15HLT	150	1.5	LOW TEMPER ATURE SERVICE	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE /NON-FLAMMABLE, NON- LETHAL- HYDROCARBONS	Page 22
3	30HC	300	1.5	NON-IBR	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE / NONFLAMMABLE, NON- LETHAL- HYDROCARBONS	Page 28
4	30HLT	300	1.5	LOW TEMPER ATURE SERVICE	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE / NONFLAMMABLE, NON- LETHAL- HYDROCARBONS	Page 35
5	60HC	600	1.5	NON-IBR	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE / NONFLAMMABLE, NON- LETHAL- HYDROCARBONS	Page 40
6	60HLT	600	1.5	LOW TEMPER ATURE SERVICE	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE / NONFLAMMABLE, NON- LETHAL- HYDROCARBONS	Page 47

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Appendix – B

Piping Class

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CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

PIPE CLASS	15HC
DESIGN CODE	ASME B31.8
RATING	150#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Non-IBR
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	-29	38	93	149	204	260	316	343	371
Pressure	20.03	20.03	18.28	16.17	14.06	11.95	9.84	8.78	7.73

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.
- All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
- 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. Drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. Drawing
Vents	ON LINES <= 1.5"	Refer std Drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. Drawing

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Branch Table

Sockolet

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Date: 2026.09.03 19:02:02 IST



CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

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	14.000	STD	B-36.10	ASTM A 106 GR.B (Charpy)	BE, SEAMLESS
PIPE	16.000	24.000	STD	B-36.10	ASTM A 672 B65 CL-12 (Charpy)	BE, E.FS.W
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	24.000	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	00.500	24.000		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	24.000		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	12.000	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	24.000	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	24.000	M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW

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CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

T.RED	00.500	01.500		B-16.11	ASTM A 105	SW, 6000

Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
T.RED	02.000	24.000	M, M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW
REDUC. CONC	02.000	24.000	M, M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW
REDUC. ECC	02.000	24.000	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	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	24.000	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 GROUP						
VLV.GLOBE	00.250	01.500		BS EN 15015761	BODY-ASTM A 105,TRIM-STELLITED,STEM-13%CR STEEL	SW, 800, 3000, B-16.11
VLV.GLOBE	02.000	24.000		BS-1873	BODY-ASTM A 216 GR.WCB,TRIM- 13% CR.STEEL	FLGD, 150, B-16.5, RF/125AARH
VLV.CHECK	00.250	01.500		BS EN 15015761	BODY-ASTM A 105,TRIM-STELLITED	SW, 800, 3000, B-16.11

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VLV.CHECK	02.000	24.000		API-6D	BODY-ASTM A 216 GR.WCB,TRIM- 13% CR.STEEL	FLGD, 150, B-16.5, RF/125AARH

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CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
VLV.BALL	00.500	01.500		BS EN 15017292	BODY-ASTM A 105,TRIM-13% CR.STEEL, SEAT-RPTFE	SW, 800, B-16.11, RF/125AARH
VLV.BALL	02.000	24.000		API-6D	BODY-ASTM A216 GR.WCB,TRIM/BALL SEAT-(AISI 4140 + 0.003"ENP)/AISI 410	FLGD, 150, B-16.5, RF/125AARH
VLV.BALL	02.000	24.000		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,
VLV.PLUG	02.000	24.000		API-6D	BODY- A 216GR. WCB, PLUG: A216 GR.WCB + 0.003" ENP	FLGD, 150, B-16.5, RF/125AARH
VLV.PLUG	02.000	24.000	M	API-6D	BODY-ASTM A 216 GR.WCB, PLUG: A216 GR.WCB + 0.003"ENP	BW, 150, B-16.25
BOLT GROUP						
BOLT.STUD	00.500	48.000		B-18.2	BOLT:A193 GR.B7, NUT:A194 GR.2H	
GASKET GROUP						
GASKET	00.500	24.000		B-16.20-ANSI B16.5	SP.WND METTALIC WITH GRAPHITE FILLER	SPIRAL, 150
GASKET	26.000	48.000		B-16.20-ANSI B16.47A	SP.WND METTALIC WITH GRAPHITE FILLER	SPIRAL, 150

Note: For all Valves, valve data sheets shall also be referred, stringent requirement among data sheet and above details shall be followed.

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CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

PIPE CLASS	15HLT
DESIGN CODE	ASME B31.8
RATING	150#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Low Temperature Service
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	-45	38	93
Pressure	18.63	18.63	17.92

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 (-) 45°C.
- All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
- 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. Drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. Drawing
Vents	ON LINES <= 1.5"	Refer std. Drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std Drawing

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Temp. Connection	1.5"	Flanged, installation as per std. Drawing, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std. Drawing

Branch Table

							T	6	BRANCH PIPE (INCH)
							T	4	
						T	T	3	
					T	T	T	2	
				T	T	T	W	1.5	
			T	T	T	S	S	1	
		T	T	T	T	S	S	S	0.75
T	T	T	T	S	S	S	S	0.05	
0.05	0.75	1	1.5	2	3	4	6		
PIPE RUN Size (INCH)									

CODES

T	Tees
W	Weldolet
S	Sockolet

DESCRIPTION

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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 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	00.75		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	6.000	M	B-16.9	ASTM A 420 GR.WPL6	BW, 1.5D
ELBOW.45	00.500	00.75		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	00.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000

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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 350 GR.LF2	SW, 3000
T.EQUAL	02.000	06.000	M	B-16.9	ASTM A 420 GR.WPL6	BW
T.RED	00.500	00.75		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	06.000	M, M	B-16.9	ASTM A 420 GR.WPL6	BW
REDUC. CONC	02.000	06.000	M, M	B-16.9	ASTM A 420 GR.WPL6	BW
REDUC. ECC	02.000	06.000	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	SCRF, 3000
CAP	02.000	06.000	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

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
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 GROUP						
VLV.GLOBE	00.50	01.500		BS EN 15015761	BODY-ASTM A 350 GR.LF2,TRIMSTELLITED, STEMSS304	SW, 800, 3000, B-16.11
VLV.GLOBE	02.000	06.000		BS-1873	BODY-ASTM A 350 GR.LF2,/ ASTM A 352 GR.LCB	FLGD, 150, B-16.5, RF/125AARH
VLV.CHECK	00.50	01.500		BS EN 15015761	BODY-ASTM A 350 GR.LF2,	SW, 800, 3000, B-16.11
VLV.CHECK	02.000	06.000		API-6D/BS-1868	BODY-ASTM A 350 GR.LF2,/ ASTM A 352 GR.LCB TRIM-STELLITED	FLGD, 150, B-16.5, RF/125AARH
VLV.BALL	00.500	01.500		BS EN 15017292	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	06.000		API-6D	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1,	FLGD, 150, B-16.5, RF/125AARH
VLV.BALL	02.000	06.000		API-6D	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1,	BW, 150, B-16.25

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BOLT GROUP						
BOLT.STUD	00.500	6.000		B-18.2	BOLT:A320 GR.L7, NUT:A194 GR.4	
GASKET GROUP						
GASKET	00.500	6.000		B-16.20- ANSI B16.5	SP.WND SS316+ GRAFOIL	SPIRAL, 150

Note: For all Valves, valve data sheets shall also be referred, stringent requirement among data sheet and above details shall be followed.

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CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

PIPE CLASS	30HC
DESIGN CODE	ASME B31.8
RATING	300#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Non-IBR
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	-29	38	93	149	204	260	316
Pressure	52.02	52.02	47.45	46.05	44.64	42.18	40.66

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
9. 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. drawing

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	ON LINES $\geq 2.0"$	As per P&ID or 0.75". Refer std. drawing
Vents	ON LINES $\leq 1.5"$	Refer std. drawing
	ON LINES $\geq 2.0"$	As per P&ID or 0.75". Refer std. drawing
Temp. Connection	1.5"	Flanged, installation as per std. drawing, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std drawing

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CODES	DESCRIPTION
T	Tees
W	Weldolet
S	Sockolet

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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	14.000	STD	B-36.10	ASTM A 106 GR.B (CHARPY)	BE, SEAMLESS
PIPE	16.000	20.000	XS	B-36.10	ASTM A 672 Gr B65 CL-12 (CHARPY)	BE, E.FS.W
PIPE	24.000	24.000	S30	B-36.10	ASTM A 672 Gr B65 CL-12 (CHARPY)	BE, E.FS.W
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	24.000	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	24.000		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

Item	Lower Size (Inch)	Upper Size (Inch)	Sch ./ Thk	Dmn. STD	Material (Charpy)	Description
FLNG.FIG.8	02.000	08.000		ASME- B 16.48	ASTM A 105 (CHARPY)	300, FF/125AARH
SPCR&BLND	10.000	24.000		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

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ELBOW.90	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
ELBOW.90	02.000	24.000	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	24.000	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
T.EQUAL	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
T.EQUAL	02.000	24.000	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	24.000	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
REDUC. CONC	02.000	24.000	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
REDUC. ECC	02.000	24.000	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	24.000	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	STM 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	0.750		B-16.11	ASTM A 105	SW, 6000

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch ./Thk .	Dmn. STD	Material (Charpy)	Description
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
SOCKOLET	01.000	01.500		MSS-SP97	ASTM A 105	SW, 3000
WELDOLET	02.000	08.000	M, XX	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%	SW, 800, 3000, B-16.11
VLV.GATE	02.000	24.000		API 600/ ISO 10434	BODY-ASTM A 105/ ASTM A 216 GR.WCB STELLITED, STEM- SS304	FLGD, 300, B-16.5, RF/125AARH
VLV.GLOBE	00.500	01.500		BS EN ISO 15761	BODY-ASTM A 105, TRIM- STELLITED, STEM- 13%	SW, 800, 3000, B-16.11
VLV.GLOBE	02.000	24.000		BS 1873	BODY-ASTM A 105 / ASTM A 216 GR.WCB , TRIM-13% CR.STEEL	FLGD, 300, B-16.5, RF/125AARH
VLV.CHECK	00.500	01.500		BS EN ISO 15761	BODY-ASTM A 105, TRIM- STELLITED	SW, 800, 3000, B-16.11
VLV.CHECK	02.000	24.000		API-6D/BS-1868	BODY-ASTM A 105 / ASTM A 216 GR.WCB	FLGD, 300, 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 150 17292	BODY-ASTM A 105,	SW, 800, B-16.11, RF/125AARH
VLV.BALL	02.000	24.000		API-6D	BODY-ASTM A 216 GR.WCB/ ASTM 105	FLGD, 300, B-16.5, RF/125AARH
VLV.BALL	02.000	24.000	M	API-6D	BODY-ASTM A 216 GR.WCB/ASTM 105,	BW, 300, 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
VLV.PLUG	02.000	24.000		API-6D	BODY- A 216GR. WCB, PLUG: A216 GR.WCB + 0.003" ENP	FLGD, 300, B-16.5, RF/125AARH
VLV.PLUG	02.000	24.000	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	30.000		B-18.2	BOLT:A193 GR.B7, NUT:A194 GR.2H	
GASKET						
GASKET	00.500	24.000		B-16.20-ANSI B16.5	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 300
GASKET	26.000	30.000		B-16.20-ANSI B16.47A	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 300

Note: For Valve Material, valve data sheet shall also be referred, stringent requirement among data sheet and above details shall be followed.

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PIPE CLASS

30HLT

DESIGN CODE	ASME B31.8
RATING	300#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Low Temperature Service
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	-45	38	93	120	149	204
Pressure	48.86	48.86	46.05	45.54	44.99	43.59

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
- Flanged end shall be as per ASME B 16.5 for valve up to 24" (excluding 22"), for 22" as per MSS-SP-44.
- Charpy V notch test and hardness test shall be conducted for pipes, fittings and flanges at (-) 45°C.
- All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
- 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. drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. drawing

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Vents	ON LINES $\leq 1.5"$	Refer std. drawing
	ON LINES $\geq 2.0"$	As per P&ID or 0.75". Refer std. drawing
Temp. Connection	1.5"	Flanged, installation as per std. drawing, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std. drawing

Branch Table

													T	16	BRANCH PIPE (INCH)								
													T	T		14							
													T	T		T	12						
													T	T		T	T	10					
													T	T		T	T	T	8				
													T	T		T	T	T	6				
													T	T		T	W	W	W	4			
													T	T		T	W	W	W	3			
													T	T		T	W	W	W	2			
													T	T		T	S	S	S	S	1.5		
													T	T		T	S	S	S	S	S	1	
													T	T		T	S	S	S	S	S	S	0.75
													T	T		T	S	S	S	S	S	S	S
0.05	0.75	1	1.5	2	3	4	6	8	10	12	14	16											
PIPE RUN Size (INCH)																							



CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

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	14.000	STD	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	14.000	M	B-16.5	ASTM A 350 GR.LF2	300, RF/125AARH
FLNG.BLIN D	00.500	14.000		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&BLN D	10.000	14.000		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	14.000	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	14.000	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

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
T.EQUAL	02.000	14.000	M	B-16.9	ASTM A 420 GR.WPL6	BW
VALVE GROUP						
VLV.BALL	00.500	01.500		BS EN ISO 17292	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1,	SW, 800, 3000, B-16.11
VLV.BALL	02.000	14.000		API-6D	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1,	FLGD, 300, B-16.5, RF/125AARH
VLV.GATE	00.500	01.500		API-602	BODY-ASTM A 350 GR.LF2,TRIM-STELLITED,STEM- SS	SW, 800, 3000, B-16.11
VLV.GATE	02.000	14.000		API 600/ ISO 10434	BODY-ASTM A 350 GR.LF2,/ ASTM A 352 GR.LCB STELLITED,STEM- SS304	FLGD, 300, B-16.5, RF/125AARH
VLV.GLOBE	00.500	01.500		BS EN ISO 15761	BODY-ASTM A 350 GR.LF2,TRIM-STELLITED,STEM- SS304	SW, 800, 3000, B-16.11
VLV.GLOBE	02.000	14.000		BS-1873	BODY-ASTM A 350 GR.LF2,/ ASTM A 352 GR.LCB	FLGD, 300, B-16.5, RF/125AARH
VLV.CHECK	00.500	01.500		BS EN ISO 15761	BODY-ASTM A 350 GR.LF2,TRIM- STELLITED	SW, 800, 3000, B-16.11
VLV.CHECK	02.000	14.000		API-6D/BS-1868	BODY-ASTM A 350 GR.LF2,/ ASTM A 352 GR.LCB TRIM-STELLITED	FLGD, 300, B-16.5, RF/125AARH
VLV.PLUG	00.500	01.500		BS-5353	BODY-ASTM A 350 GR.LF2, PLUG: A350 GR.LF2 + 0.003" ENP	SW, 800, 3000, B-16.11
VLV.PLUG	02.000	14.000		API-6D	BODY-ASTM A 352 GR.LCB / A350 GR.LF2,	FLGD, 300, B-16.5, RF/125AARH

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VLV.PLUG	02.000	14.000		API-6D	BODY-ASTM A 352 GR.LCB/ ASTM A350GR.LF2,	BW, 300, B-16.25
BOLT & GASKET						
BOLT.STUD	00.500	14.000		B-18.2	BOLT:A320 GR.L7, NUT:A194 GR.4	
GASKET	00.500	14.000		B-16.20- ANSI B16.5	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 300

Note: For all Valves, valve data sheets shall also be referred, stringent requirement among data sheet and above details shall be followed.

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PIPE CLASS	60HC
DESIGN CODE	ASME B31.8
RATING	600#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Non-IBR
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	(-)29	38	93	149
Pressure	104.05	104.05	94.91	92.45

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. Corrosion allowance of 1.5 mm has been considered for terminal piping.
6. All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
7. For valves, refer valve data sheets as enclosed.
8. Design Factor 0.5
9. 9. Ball Valve to be used in main pipeline shall have butt welded ends.

ITEM	SIZE	DESCRIPTION
Maintenance joints	ALL	Flanged, to be kept minimum

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Pipe joints	1.5" & BELOW	SW coupling
	2.0" & ABOVE	Butt welded
Drains	ON LINES $\leq 1.5"$	Refer std. drawing
	ON LINES $\geq 2.0"$	As per P&ID or 0.75". Refer std. drawing
Vents	ON LINES $\leq 1.5"$	Refer std. drawing
	ON LINES $\geq 2.0"$	As per P&ID or 0.75". Refer std. drawing
Temp. Connection	1.5"	Flanged, installation as per std. drawing, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std drawing

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CODES	DESCRIPTION
T	Tees
W	Weldolet
S	Sockolet

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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	08.000	XS	B-36.10	ASTM A 106 GR.B (CHARPY)	BE, SEAMLESS
PIPE	10.000		14.27	B-36.10	ASTM A 106 GR.B (CHARPY)	BE, SEAMLESS
PIPE	12.000		17.48	B-36.10	ASTM A 106 GR.B (CHARPY)	BE, SEAMLESS
PIPE	14.000		As Calculated	B-36.10	ASTM A 106 GR.B (CHARPY)	BE, E.FS.W
PIPE	16.000		As Calculated	B-36.10	ASTM A 106 GR.B (CHARPY)	BE, E.FS.W
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	600, RF/125AARH
FLNG.WN	02.000	24.000	M	B-16.5	ASTM A 105 (CHARPY)	600, RF/125AARH
FLNG.BLIND	00.500	01.500		B-16.5	ASTM A 105	600, RF/125AARH
FLNG.BLIND	02.000	24.000		B-16.5	ASTM A 105 (CHARPY)	600, RF/125AARH
FLNG.FIG.8	00.500	01.500		ASME- B 16.48	ASTM A 105	600, FF/125AARH

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch ./ Thk	Dmn. STD	Material (Charpy)	Description
FLNG.FIG.8	02.000	08.000		ASME- B 16.48	ASTM A 105 (CHARPY)	600, FF/125AARH
SPCR&BLND	10.000	24.000		ASME- B 16.48	ASTM A 105 (CHARPY)	600, 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	24.000	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	24.000	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
T.EQUAL	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
T.EQUAL	02.000	24.000	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	24.000	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
REDUC. CONC	02.000	24.000	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
REDUC. ECC	02.000	24.000	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

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CAP	02.000	24.000	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	STM 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	0.750		B-16.11	ASTM A 105	SW, 6000
Item	Lower Size (Inch)	Upper Size (Inch)	Sch ./Thk .	Dmn. STD	Material (Charpy)	Description
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
SOCKOLET	01.000	01.500		MSS- SP97	ASTM A 105	SW, 3000
WELDOLET	02.000	08.000	M, XX	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%	SW, 800, 3000, B-16.11
VLV.GATE	02.000	24.000		API 600/ ISO 10434	BODY-ASTM A 105/ ASTM A 216 GR.WCB STELLITED, STEM- SS304	FLGD, 600, B-16.5, RF/125AARH
VLV.GLOBE	00.500	01.500		BS EN ISO 15761	BODY-ASTM A 105,TRIM- STELLITED,STEM- 13%	SW, 800, 3000, B- 16.11

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VLV.GLOBE	02.000	24.000		BS 1873	BODY-ASTM A 105 / ASTM A 216 GR.WCB , TRIM-13% CR.STEEL	FLGD, 600, B-16.5, RF/125AARH
VLV.CHECK	00.500	01.500		BS EN 15015761	BODY-ASTM A 105, TRIM- STELLITED	SW, 800, 3000, B-16.11
VLV.CHECK	02.000	24.000		API-6D/BS-1868	BODY-ASTM A 105 / ASTM A 216 GR.WCB	FLGD, 600, B-16.5, RF/125AARH
Item	Lower Size (Inch)	Upper Size (Inch)	Sch . /Thk .	Dmn. STD	Material (Charpy)	Description
VLV.BALL	00.500	01.500		BS EN 15017292	BODY-ASTM A 105,	SW, 800, B-16.11, RF/125AARH
VLV.BALL	02.000	24.000		API-6D	BODY-ASTM A 216 GR.WCB/ ASTM 105	FLGD, 600, B-16.5, RF/125AARH
VLV.BALL	02.000	24.000	M	API-6D	BODY-ASTM A 216 GR.WCB/ASTM 105,	BW, 600, 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
VLV.PLUG	02.000	24.000		API-6D	BODY- A 216GR. WCB, PLUG: A216 GR.WCB + 0.003" ENP	FLGD, 600, B-16.5, RF/125AARH
VLV.PLUG	02.000	24.000	M	API-6D	BODY-ASTM A 216 GR.WCB, PLUG: A216 GR.WCB + 0.003"ENP	BW, 600, B-16.25
BOLT GROUP						
BOLT.STUD	00.500	30.000		B-18.2	BOLT:A193 GR.B7, NUT:A194 GR.2H	
GASKET						
GASKET	00.500	24.000		B-16.20-ANSI B16.5	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 600

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GASKET	26.000	30.000		B-16.20-ANSI B16.47A	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 600

Note: For Valve Material, valve data sheet shall also be referred, stringent requirement among data sheet and above details shall be followed.

PIPE CLASS

60HLT

DESIGN CODE	ASME B31.8
RATING	600#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Low Temperature Service
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	-45	38	93	120
Pressure	98.07	98.07	92.79	91.27

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. Flanged end shall be as per ASME B 16.5 for valve up to 24" (excluding 22"), for 22" as per MSS-SP-44.
5. Charpy V notch test and hardness test shall be conducted for pipes, fittings and flanges at (-) 45°C.

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6. All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
7. 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 $\leq 1.5"$	Refer std. drawing
	ON LINES $\geq 2.0"$	As per P&ID or 0.75". Refer std. drawing
Vents	ON LINES $\leq 1.5"$	Refer std. drawing
	ON LINES $\geq 2.0"$	As per P&ID or 0.75". Refer std. drawing
Temp. Connection	1.5"	Flanged, installation as per std. drawing, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std. drawing

Branch Table

											T	16	BRANCH PIPE (INCH)								
											T	T		14							
											T	T		T	12						
											T	T		T	T	10					
											T	T		T	T	T	8				
											T	T		T	T	T	T	6			
											T	T		T	W	W	W	4			
											T	T		T	W	W	W	W	3		
											T	T		T	W	W	W	W	W	2	
											T	T		T	T	S	S	S	S	S	1.5
											T	T	T	S	S	S	S	S	S	S	1

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	T	T	T	T	S	S	S	S	S	S	S	S	0.75	
T	T	T	T	S	S	S	S	S	S	S	S	S	0.05	
0.05	0.75	1	1.5	2	3	4	6	8	10	12	14	16		
PIPE RUN Size (INCH)														

CODES

T
W
S

DESCRIPTION

Tees
Weldolet
Sockolet

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	08.000	XS	B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
PIPE	10.000		14.27	B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
PIPE	12.000		17.48	B-36.10	ASTM A 333 GR.6	PBE, 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	600, RF/125AARH
FLNG.WN	02.000	14.000	M	B-16.5	ASTM A 350 GR.LF2	600, RF/125AARH
FLNG.BLIND	00.500	14.000		B-16.5	ASTM A 350 GR.LF2	600, RF/125AARH
FLNG.FIG.8	00.500	08.000		ASME- B 16.48	ASTM A 350 GR.LF2	600, FF/125AARH
SPCR&BLIND	10.000	14.000		ASME- B16.48	ASTM A 350 GR.LF2	600, FF/125AARH
FITTINGS						

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VLV.GLOBE	02.000	14.000		BS-1873	BODY-ASTM A 350 GR.LF2,/ ASTM A 352 GR.LCB	FLGD, 600, B-16.5, RF/125AARH
VLV.CHECK	00.500	01.500		BS EN ISO 15761	BODY-ASTM A 350 GR.LF2,TRIM- STELLITED	SW, 800, 3000, B-16.11
VLV.CHECK	02.000	14.000		API-6D/BS- 1868	BODY-ASTM A 350 GR.LF2,/ ASTM A 352 GR.LCB TRIM- STELLITED	FLGD, 600, B-16.5, RF/125AARH
VLV.PLUG	00.500	01.500		BS-5353	BODY-ASTM A 350 GR.LF2, PLUG: A350 GR.LF2 + 0.003" ENP	SW, 800, 3000, B-16.11
VLV.PLUG	02.000	14.000		API-6D	BODY-ASTM A 352 GR.LCB / A350 GR.LF2,	FLGD, 600, B-16.5, RF/125AARH
VLV.PLUG	02.000	14.000		API-6D	BODY-ASTM A 352 GR.LCB/ ASTM A350GR.LF2,	BW, 600, B-16.25
BOLT & GASKET						
BOLT.STUD	00.500	14.000		B-18.2	BOLT:A320 GR.L7, NUT:A194 GR.4	
GASKET	00.500	14.000		B-16.20- ANSI B16.5	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 600

Note: For all Valves, valve data sheets shall also be referred, stringent requirement among data sheet and above details shall be followed.

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LIST OF RECOMMENDED VENDORS FOR BOUGHT OUT ITEMS

**TOTAL
SHEETS**

61

DOCUMENT NO

VCS-00-00-VL-0001

LIST OF RECOMMENDED VENDORS FOR BOUGHT OUT ITEMS

16	31.12.2025	Issued as Standard	Ramveer Singh	Safdar Ali	Rachna Shukla
REV	DATE	DESCRIPTION	PREP	CHK	APPR



LIST OF RECOMMENDED VENDORS FOR BOUGHT OUT ITEMS

**TOTAL
SHEETS**

61

DOCUMENT NO

VCS-00-00-VL-0001

LIST OF RECOMMENDED VENDORS FOR BOUGHT OUT ITEMS

17	01.04.2026	Issued as Standard	Durgesh Baghel	Rajesh Sharma	Ashwani Chandra
REV	DATE	DESCRIPTION	PREP	CHK	APPR

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A. MECHANICAL & PIPELINE

1.0 CARBON STEEL PIPES

1.1 PIPE CARBON STEEL TO INDIAN STANDARDS

- a. A.S.T. Pipes Pvt. Ltd. (AST Group)
- b. Advance Steel Tube Ltd.
- c. Apl Apollo Tubes Ltd. (Er. Bihar Tubes Ltd.)
- d. Asian Mills Pvt. Ltd.
- e. Asrani Tubes Limited
- f. Dadu Pipes (P) Ltd.
- g. Essar Steel Limited (Er Hazira Pipes Mill)
- h. Gaurang Products Pvt Ltd. (Ast Group)
- i. Goodluck Steel Tubes Ltd.
- j. Hi-Tech Pipes Limited
- k. Indus Tube Limited
- l. Jindal Industries Ltd
- m. Jindal Pipes Ltd.
- n. Jindal Saw Ltd (Kosi Works)
- o. Jotindra Steel & Tube Ltd
- p. Lalit Pipes And Pipes Ltd.
- q. Maharashtra Seamless Ltd.
- r. Man Industries (India) Ltd. – Pithampur
- s. Man Industries (India) Ltd. Anjar
- t. Mukat Tanks & Vessels Ltd.
- u. Nezone Tubes Limited
- v. North Eastern Tubes Limited



- w. Pratibha Industries Limited
- x. Pratibha Pipes & Structural Ltd.
- y. Psl Ltd (Chennai)
- z. Psl Ltd (V1, V2 & NC)
- aa. Rama Steel Tubes Ltd.
- bb. Ratnamani Metals And Tubes Ltd.
- cc. Ravindra Tubes Limited
- dd. Samshi Pipe Industries Limited
- ee. Surya Roshni Ltd.
- ff. Swastik Pipes Ltd.
- gg. Utkarsh Tubes & Pipes Ltd. (Formerly Bmw)
- hh. Welspun Corp. Limited (Dahej)
- ii. Zenith Birla (India) Limited

1.2 PIPE & TUBULARS TO A.P.I. STANDARDS

- a. Arcelormittal Tubular Products Roman Sa, Romania
- b. Bhel (Trichy), India
- c. Dalmine Spa (Enquiry To Tenaris), Uae
- d. Eewkorea Co. Ltd (Germany), Korea
- e. Eew Korea Co. Ltd. (Korea), Korea
- f. Eisenbau Kramer Gmbh, Germany
- g. Hyundai Rb Co. Ltd. South Korea
- h. Ilva Lamiere E Tubi Srl (Enq To Ilva Spa, Italy)
- i. Inox Tech. Spa, Italy
- j. ISMT Ltd. Ahmednagr, India
- k. TATA Steel, India
- l. PSL
- m. Jindal Pipes Ltd., India
- n. Jindal Saw Ltd. (Kosi Works), India
- o. Jindal Saw Ltd. (Nashik Works), India
- p. Lalit Pipes And Pipes Ltd. India
- q. Maharashtra Seamless Ltd., India
- r. Man Industries (I) Ltd. (Pithampur), India
- s. Mukat Tanks & Vessels Ltd., India
- t. Pratibha Industries Limited, India



- u. Ratnamani Metals And Tubes Ltd., India
- v. Siderca S.A.I.C (Enquiry Totenaris), Uae
- w. Sumitomo Metal Ind. Ltd., India
- x. Surya Roshni Ltd., India
- y. Swastik Pipes Ltd, India
- z. Tata Steel Uk Limited (Formerly C702)
- aa. Tubos De Acero De Mexico Sa (Enq. Tenaris), Uae
- bb. Tubos Reunidos Sa Spain
- cc. Umran Steel Pipe Inc (Turkey), Turkey
- dd. Valcovny Trub Chomutov, Czech Republic
- ee. Vallourec And Mannesmann Tubes, France
- ff. Welspun Corp Limited (Dahej), India

1.3 PIPE/TUBE CS (SEAMLESS) TO ASTM STANDARDS

- a. Arcelormittal Tubular Products Roman Sa, Romania
- b. Bhel (Trichy), India
- c. Changshu Seamless Steel Tube Co. Ltd., China
- d. Dalmine Spa (Enquiry To Tenaris, Uae
- e. Heavy Metals & Tubes Limited (Mehsana), India
- f. Ismt Ltd. Ahmedngr, India
- g. Ismt Ltd. Baramati India
- h. Jfe Steel Corporation, Uae
- i. Jindal Sdaw Ltd (Nashik Works) India
- j. Klt Automotive And Tubular Products Ltd., India
- k. Mahalaxmi Seamless Limited, India
- l. Maharashtra Seamless Ltd, India
- m. Products Tubulares S.A.U, Spain
- n. Ratnadeep Metal Tubes Ltd., India
- o. Staineest Tubes Pvt Ltd., India
- p. Sumitomo Metal Ind. Ltd., India
- q. Tubos Reunidos Sa Spain
- r. Valcovny Trub Chomutov, Czech Republic
- s. Vallourec Andmannesmann Tubes France
- t. Yangzhou Chengde Steel Pipe Co. Ltd Dubai (UAE)
- u. Jindal SAW Ltd Kosi Kalan Mathura

**1.4 PIPE CARBON STEEL (WELDED) TO ASTM STANDARDS**

- a. Eew Korea Co. Ltd. (Germany), Korea
- b. Eew Korea Co. Ltd. (Korea), Korea
- c. Eisenbau Kramer GmbH, Germany
- d. Hyundai Rb Co. Ltd., South Korea
- e. Inox Tech. Spa, Italy
- f. Jindal Saw Ltd (Kosi Works), India
- g. Lalit Pipes and Pipes Ltd., India
- h. Man Industries (I) Ltd.(Pithampur), India
- i. Man Industries (India) Ltd. Anjar, India
- j. Mukat Tanks & Vessels Ltd., India
- k. Ratnamani Metals And Tubes Ltd., India
- l. Sumitomo Metal India Ltd., India
- m. Tata Steel Uk Limited

2.0 VALVES**2.1 GLOBE VALVES**

- a. BDK (New Delhi)
- b. Datre Corpn (Calcutta)
- c. KSB Pumps (New Delhi)
- d. L&T (New Delhi)
- e. Neco Schuber & Salzer Ltd. (New Delhi)
- f. Niton Valve (Mumbai)
- g. Ornate Valves (Mumbai)
- h. Panchavati Valves (Mumbai)
- i. AV Valves Ltd.
- j. BHEL (Trichy), India
- k. Econo Valves Pvt Ltd, India
- l. Fouress Engg (I) Ltd (Aurangabad)
- m. Guru Industrial Valves Pvt Ltd
- n. Leader Valves Ltd, India
- o. NSSL Ltd. (Neco Schubert & Salzerltd)
- p. Oswal Industries Ltd, India
- q. Petrochemical Engineering Enterprises, India
- r. Sakhi Engineers Pvt Ltd



- s. Shalimar Valves Pvt Ltd
- t. Steel Strong Valves India Pvt Ltd, India
- u. Petro Valves Pvt. Limited, Ahmedabad
- v. Hawa Engineers Limited, Ahmedabad (Non API)
- w. G M Engineering PVT LTD (Non API)
- x. Libra Valves India Pvt. Ltd.

2.2 CHECK VALVES

- a. Advance Valves Pvt. Ltd., Noida
- b. Aksons & Mechanical Enterprises, Mumbai
- c. Larsen & Toubro Limited (Audco India Limited, Chennai)
- d. AV valves Ltd., Agra
- e. BDK engineering India Ltd., Hubli
- f. BHEL, OFE&OE Group, New Delhi
- g. Datre Coroportion Limited, Calcutta
- h. Leader Valves Ltd., Jalandhar
- i. Neco schubert & Salzer Ltd., New Delhi
- j. Niton Valves Industries (P) Ltd., Mumbai
- k. Precision Engg. Co., Mumbai
- l. Econo Valves Pvt Ltd, India
- m. Fouress Engg (I) Ltd (Aurangabad)
- n. KSB Pumps Ltd (Coimbatore), India
- o. NSSL Ltd. (Neco Schubert & Salzer Ltd)
- p. Oswal Industries Ltd, India
- q. Panchvati Valves & Flanges Pvt Ltd, India
- r. Petrochemical Engineering Enterprises, India
- s. Sakhi Engineers Pvt Ltd
- t. Shalimar Valves Pvt Ltd
- u. Steel Strong Valves India Pvt Ltd, India
- v. Shiv Shakti Engineering Works (Approved up to 06 inch)
- y. Hawa Engineers Limited, Ahmedabad
- z. G M Engineering PVT LTD (Non API)
- aa. Libra Valves India Pvt. Ltd.

**2.3 PLUG VALVES**

- a. Breda Energia Sesto Industria Spa, Italy
- b. Fisher Sanmar Ltd., Chennai
- c. Larsen & Toubro Ltd., New Delhi
- d. Nordstrom Valves, USA
- e. Serck Audco Valves, UK
- f. Sumitomo Corporation India Pvt. Ltd., New Delhi
- g. Z Corporation, Korea
- h. Hawa Valves (India) Pvt. Ltd., Mumbai
- i. Steel Strong Valves India Pvt. Ltd., Navi Mumbai
- j. Econo Valves
- k. Flow-Serve PTE (Mfr. SERCK), India
- l. Libra Valves India Pvt. Ltd.

2.4 BALL VALVES

- a. Hawa Valves (India) Pvt. Ltd, Navi Mumbai
- b. Larsen & Toubro, Delhi
- c. Microfinish Valves Pvt. Ltd., Noida
- d. Oswal Industries Ltd., Gandhi nagar
- e. Virgo Engineers Ltd., Delhi
- f. Boteli Valve Group Co. Ltd., China
- g. Cameron (Malaysia) SDN BHD, Malaysia
- h. Dafram S.P.A., Italy
- i. Fangyuan Valve Group Co. Ltd., China
- j. Franz Schuck GmbH, Germany
- k. O.M.S. Saleri (Italy)
- l. Pibi Viesse S.P.A (Italy)
- m. Nuovo Pignone (Italy)
- n. Perar S.P.A (Italy)
- o. Pietro Fiorentini (Italy)
- p. Cooper Cameron Valv Italy SRL-FRM, Italy
- q. Petrol Valves SRL
- r. Tormene Gas Technology S.P.A (VALVITALIA)
- s. Petro Valves Pvt. Limited, Ahmedabad
- t. Shiv Shakti Engineering Works (Approved up to 08 inch)



- u. Hawa Engineers Limited, Ahmedabad
- v. G M Engineering PVT LTD.
- w. DelVal Flow Controls Pvt. Ltd
- x. Libra Valves India Pvt. Ltd.

2.5 GATE VALVES

- a. Libra Valves India Pvt. Ltd.

3.0 TEE

3.1 FLOW TEE

- a. Coprosider SPA, Italy
- b. GEA Energy System India Limited, Chennai
- c. Multitex Filtration
- d. Pipeline Engineering, UK
- e. Scomark Engg. Limited (U.K.)
- f. Skeltonhall Limited, Engaland(U.K.)
- g. Technospecial SPA, Italy
- h. Tectubi SPA, Italy
- i. RMA Germany
- j. Pipefit Engineers Pvt. Ltd.
- k. Vee Kay Vikram & Co.
- l. United Forge Industries

3.2 SPLIT TEE

- a. IPSCO, Canda
- b. TD Willamsons, USA
- c. Plant-Tech Power Technical Services Pvt Ltd
- d. Teemans, UK
- e. Vee Kay Vikram & CO.

4.0 FLANGES

- a. Aditya Forge Ltd., Vadodara
- b. Amforge Industries Ltd., Mumbai
- c. CD Engineering Co., Ghaziabad
- d. Echjay Forgings Pvt. Ltd. (Bombay), Mumbai
- e. Echjay Industries Ltd., Rajkot
- f. Forge & Forge Pvt. Ltd., Rajkot



- g. Golden Iron & Steel Works, New Delhi
- h. JK Forgings, New Delhi
- i. Metal Forgings Pvt. Ltd., Mumbai
- j. Perfect Marketings Pvt. Ltd., New Delhi
- k. Sky Forge, Faridabad
- l. S&G, Faridabad
- m. Chaudhry Hammer Works Ltd, India
- n. JAV Forgings (P) Ltd, India
- o. Kunj Forgings Pvt Ltd, India
- p. MS Fittings
- q. R.N. Gupta & Co. Ltd, India
- r. R.P. Engineering Pvt Ltd, India
- s. Sanghvi Forgings & Engineering Ltd
- t. Shri Ganesh Forgings Ltd., India
- u. Uma Shankar Khandelwal & Co., India
- v. Sawan Engineers, Baroda
- w. Stewarts & Lloyds of India Ltd., Kolkata
- x. Engineering Services Enterprises
- y. Pipefit Engineers Pvt. Ltd.
- z. Jindal Forging
- aa. Vivial Forges
- bb. N J Engineers (Up to 12 Inch Class 600 Only)
- cc. United Forge Industries

5.0 FITTINGS

- a. Commercial Supplying Agency, Mumbai
- b. Dee Development Engineers Ltd.
- c. Eby Industries, Mumbai
- d. Flash Forge Pvt. Ltd., Vishakhapatnam
- e. Gujarat Infra Pipes Pvt. Ltd., Vadodara
- f. M.S. Fittings Mfg. Co. Pvt. Ltd., Kolkata
- g. Stewarts & Lloyds of India Ltd., Kolkata
- h. Teekay Tubes Pvt. Ltd., Mumbai
- i. Pipe Fit, Baroda
- j. Sky Forge, Faridabad



- k. S&G, Faridabad
- l. Sawan Engineers, Baroda
- m. Eby Fasteners, India
- n. Leader Valves Ltd, India
- o. R.N. Gupta & Co. Ltd, India
- p. Exten Engg Pvt Ltd
- q. Sivananda Pipe & Fittings Ltd
- r. Jindal Forging
- s. Vivial Forges
- t. PK Tubes Rajasthan
- u. CSA Fitting
- v. Gujarat Infrapipes pvt ltd, Vadodara
- w. KS Pipes Fitting Pvt Ltd, Palwal
- x. Tube Bend, Kolkata
- y. United Forge Industries

6.0 PIG LAUNCHERS/ RECEIVERS/ PIG SIGNALERS

- a. Bassi Luigi Fittings B.V., Holland
- b. BRAUN STAHL PIPE TEC, GERMANY
- c. FORAIN, ITALY
- d. Fluidel SRL, ITALY
- e. RMA Maschinen- und, GERMANY
- f. Siiritec Nigi, Itlay
- g. SCHUCK ARMATUREN, GERMANY
- h. T.D. Williamson Inc., USA
- i. Tectubi SPA, Italy
- j. Taylor Forge Engineering System INC, USA
- k. Tormene Americana S.A. (Argentina)
- l. Tormene Gas Technology S.p.A., Italy
- m. PIPELINE ENGINEERING, UNITED KINGDOM
- n. Krohne, Oil & Gas BV, Drive Houston,
- o. Multitex Filtration Engrs. Ltd, New Delhi
- p. BGR ENERGY SYSTEMS LIMITED New Delhi
- q. Glapwell Contracting Services Ltd. UK



- r. FULGOSI GIOVANNI S.n.c di Corrado & C, ITALY
- s. VEEKAY VIKRAM & CO, GUJRAT
- t. GBM S.R.L, ITALY
- u. Cardew Ltd., Alexeander
- v. Forain S.R.L.
- w. GD Engineering, India
- x. Pipeline Engineering, UK
- y. Siirtec Nigi SPA
- z. Control Plus
- aa. Oswal Infrastructure

7.0 LONG RADIUS BENDS

- a. Jindal Saw Ltd. (Kosi Works), India
- b. PSL Limited (Gandhidham – Mfrg), India
- c. BHEL, Trichy, Tamilnadu
- d. Welspun, Gujarat
- e. Sawan
- f. Gujarat Infra
- g. P K Tubes
- h. DEE Development
- i. Pipefit Engineers Pvt. Ltd.

8.0 CLEAN AGENT SYSTEM

- a. ADN Fire Safety Pvt Ltd (Vashi East, Thane)
- b. Chetan Corporation (Ahmedabad)
- c. Chetan Engineers (Ahmedabad)
- d. Mx Systems International Pvt. Ltd. (Mumbai)
- e. New Fire Engineers (P) Ltd (Sil Vassa)
- f. Nitin Fire Protection Industries Ltd (New Bombay)
- g. Nohmi Bosai (India) Private Limited
- h. Tyco Fire & Security India Pvt. Ltd (Bangalore)
- i. Vimal Fire Controls Pvt Ltd (Vadodara)

9.0 INSULATING JOINTS

- a. IGP Engineers
- b. V K Vikram



- c. Advance Electronics
- d. Nupros INC

10.0 GASKETS

- a. IGP Engineers (P) Ltd., Madras
- b. Madras Industrial Products, Madras
- c. Dikson & Company, Bombay
- d. Banco Products (P) Ltd., Vadodara
- e. Goodrich Gaskets Pvt Ltd
- f. Starflex Sealing India Pvt Ltd, India
- g. Teekay Meta Flex Pvt Ltd
- h. UNIKLINGER Ltd
- i. HEM Engg. Corp.
- j. Unique Industrial Packing Pvt. Ltd.

11.0 FASTENERS

- a. Nireka Engg. Co. (P) Ltd., Calcutta
- b. Precision Taps & Dies, Bombay
- c. AEP Company, Vithal Udyoug Nagar
- d. Fix Fit Fasteners, Calcutta
- e. Precision Engg. Industries, Baroda
- f. Echjay Forgings Pvt. Ltd., Bombay
- g. Capital Industries, Bombay
- h. Boltmaster India Pvt Ltd, India
- i. Deepak Fasteners Limited, India
- j. Fasteners & Allied Products Pvt Ltd, India
- k. Hardwin Fasteners Pvt Ltd, India
- l. J.J. Industries, India
- m. Multi Fasteners Pvt Ltd, India
- n. Nexo Industries, India
- o. Pacific Forging & Fasteners Pvt Ltd, India
- p. Pioneer Nuts & Bolts Pvt Ltd, India
- q. Precision Auto Engineers, India
- r. President Engineering Works, India
- s. Sandeep Engineering Works, India
- t. Syndicate Engineering Industries, India

**12.0 WELDING ELECTRODES FOR PIPELINE/PIPING WORK**

- a. For Mainline – Lincoln/ Bohler make
- b. For Terminal – For root pass –Lincoln/ Bohler make
For other passes – Lincoln, D&H or equivalent make Lincon
- c. D & H SECHERON ELECTRODE PVT. LTD. (For Mainline & Terminal- Root & Other pass)

13.0 STRAINERS

- a. Bombay Chemical Equipments
- b. Gujarat Auto filed
- c. Multitex Filtration Engineering Limited
- d. Grand Prix Engineering Limited

14.0 COLD APPLIED TAPES

- a. Denso GmbH
- b. Raychem

15.0 HEAT SHRINKABLE SLEEVE/ FIBREGLAS REINFORCED SLEEVE

- a. Covalence - Seal For Life India Pvt. Ltd. (Formerly Covalence Raychem- Berry Plastics Corporation)
- b. Canussa-CPS
- c. Rigil Techno India(Distributor for M/s CYG Changtong New Material Co Ltd,China)
- d. M/s Shri Narayan Impac-India LLP

16.0 STUD BOLTS WITH NUTS

- a. Multi Thread Fasteners, Baroda
- b. Darukhanwala
- c. Precision Engineers, Baroda
- d. Unbrako
- e. TVC

17.0 WARNING MAT

- a. Sparco Multiplast Pvt. Ltd., Ahmedabad
- b. Singhal Industries , Ahemdabad
- c. Puja Packing, Mumbai
- d. Bina Enterprises, Mumbai
- e. Shree Vijay Wire & Cable Industries

18.0 HDPE PIPES/DUCT



- a. Climax Synthetics (P) Ltd., Vadodra
- b. Indian Poly Pipes, Calcutta
- c. Jain Irrigation Systems Ltd., Jalgaon
- d. Kirti Industries (India) Ltd., Indore
- e. Ori Plast Limited, Calcutta
- f. Phoel Industries Limited, Delhi
- g. Sangir Plastics (P) Ltd., Mumbai
- h. Veekay Plast, Jaipur
- i. Kisan Irrigation
- j. Dutron Polymers Ltd.
- k. Manikya Plastichem (P) Ltd
- l. Himalyan Pipe Industries
- m. NorthEast Polypipes LLP
- n. Mukand Poly Products (for Duct)

19.0 DRY GAS FILTER & FILTER SEPERATOR

- a. Grand Prix Fab (Pvt.) Ltd. (New Delhi)
- b. Perry Equipment, USA
- c. Faudi Filter, Germany
- d. Forain S.r.l., Italy
- e. ABB, Faridabad
- f. Burgess Manning, USA
- g. Multitex Filtration Engineers India
- h. Triveni Plenty Engg. Ltd. (New Delhi)
- i. Siirtec International Contractor S.P.A (Italy)
- j. Flashpoint, Pune india
- k. Filtration Engineers (I) Pvt Ltd, India
- l. Gujarat Otofilt, India
- m. Tormene Gas Technology
- n. Ultrafilter (India) Pvt Ltd, India
- o. Ravi Techno Systems Pvt Ltd, India
- p. Siirtec Nigi S.P.A
- q. Filtan Filter Anlagenbau GmbH
- r. Fairley Arlon BV
- s. PECO Facet



- t. EPE Epenstenner GMBH
- u. Filtrex srl
- v. Petromar Engineered Soln
- w. Plenty Filter
- x. Eurofiltex
- y. PTI Technologies Inc
- z. R S Instrumentation and Services
- aa. Inel Gas Control Pvt Ltd

20.0 FILTER ELEMENT

- a. Peco – Facet
- b. Velcon
- c. Pall – Filterite
- d. Burgess Manning

21.0 NDT AGENCY

- a. NDT Services, Ahmedabad
- b. GEECY Industrial Services Pvt. Ltd., Mumbai
- c. Corrosion Control Services, Mumbai
- d. Perfect Metal Testing & Inspection Agency, Calcutta
- e. Inter Ocean Shipping Co., New Delhi
- f. RTD, Mumbai
- g. Sievert, Mumbai
- h. X-Tech, Vizag
- i. Industrial X Ray and Allied Radiographers (I) Pvt. Ltd.
- j. Inspection Technology
- k. IXAR
- l. Aditya NDT Services
- m. Riya NDT Engineers
- n. Star NDT Services
- o. Technical testing & Inspection Services
- p. PD Engineering Inspection Services
- q. Victor Engineering & Testing

22.0 Cold Applied Tapes

- a. Denso GmbH
- b. Polyken (Berry Plastics Corporation)

**22.1 End Seal Tape-PVC**

- a. MAASH Industries

23.0 PUR Coating

- a. Powercrete (Berry Plastics Corporation)

24.0 Casing End Closure

- a. Raci, Italy
- b. Raychem RPG Limited

25.0 Casing Insulators

- a. Raci, Italy
- b. Raychem RPG Limited
- c. VeekayVikram

26.0 FIRE FIGHTING EQUIPMENT**26.1 FIRE EXTINGUISHERS**

- a. Avon Services (Production & Agencies) Pvt. Ltd., Bombay
- b. Kooverji Devshi & Co., Bombay
- c. Reliable (Fire Protection) India Ltd., Bombay
- d. Zenith Fire Services, Bombay
- e. Safex Fire Services, Bombay
- f. Brij Basi Hi
- g. tech Udyog
- h. Bharat Engg Works, India
- i. Gunnebo India Ltd
- j. Nitin Fire Protection Industries Ltd, India
- k. Supremex Equipments, India
- l. Vimal Fire Controls Pvt Ltd., India

26.2 FIRE HYDRANTS, MONITORS, DELUGE VALVE, NOZZLES

- a. Zenith
- b. Minimax
- c. Newage
- d. HD Fire
- e. Vijay Fire



- f. Asco Strumech Pvt Ltd, India
- g. Brij Basi Hi
- h. tech Udyog
- i. Gunnebo India Ltd
- j. Nitin Fire Protection Pvt Ltd
- k. Shah Bhogilal Jethamal & Brothers
- l. Pumps & Engineering Works

26.3 FIRE & GAS DETECTION & ALARM

- a. Ambetronics Engineers PVT LTD.

26.4 RRL Hose

- a. Jayshree
- b. Newage

26.5 HOSES

- a. Ashit Sales Corporation, Bombay
- b. Royal India Corporation, Bombay
- c. Gayatri Industrial Corporation
- d. Simplex Rubber Products Ltd., Ahmedabad
- e. Zaverchand Marketing Pvt. Ltd., Baroda
- f. Presidency Rubber Mill, Calcutta
- g. The Cosmopolite, Calcutta
- h. Simplex Rubber Products, Thane

NOTE:

- 1) 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) The vendor / supplier should not be in the Holiday list of CLIENT / VCS / other PSU.
 - c) 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.
- 2) 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 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 / VCS.

- 3) The details of vendors indicated in this list are based on the information available with VCS, 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.

B. CIVIL AND STRUCTURAL

Sr. No.	Items/ Name of Products	Make/ Brands/ Manufactures
1.	Reinforcement Steel	TATA, SAIL, RINL, JSW.
2.	Cement	Ambuja, ACC, JK, Grasim, Ultratech, Birla, L&T, Cement Corporation of India
3.	Structural Steel	TATA, SAIL, RINL, IISCO, ESSAR
4.	Structural Steel Tubes ISI Marked	TATA, JINDAL, SURYA
5.	Mineral wool for thermal insulation of ceilings (Under deck insulation)	Rock wool (india) Ltd. Minwool Rock Fibres Ltd., Lloyd Insulation.
6.	Synthetic Enamel Paint (1st quality only)	ICI Paint (Dulux), Asian Paint (Apolite), Berger Paints (Luxol). Goodlass Nerolac Paints (Nerolac), Jenson & Nicholson Paints Ltd (Borolac)
7.	G.I SHEET	ESSAR, JSW, SAIL
8.	Sheeting Screw	Corroshield, Buildex,
9.	Chemical for Antitermite treatment	DE- NOCIL Bombay, Pest Control of India, Trishul
10.	Factory made Panelled Door shutter	Century; Godrej ; M/s Hindustan Housing factory Ltd., New Delhi ; M/s Delhi Construction Eqp, Sadar Bazar, Delhi ; M/s Joinery manufacturing Co., Calcutta;
11.	PVC Panel Door (Solid Core)	Rajshri Plastiwood Limited, Sintex, Hindopan, Marino
12.	Pressed steel door frames/ cupboard and window frames (manufacturers)	M/s SAIL, M/s TATA
13.	Pressed steel door frames/ cupboard and window frames (fabricators)	M/s Loyal safe works Mayapuri, N/Delhi M/s Multiwyn Industrial Corpn Calcutta M/s Metal Window Corpn N/Delhi



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		M/s Chhabra Steel Udyog, 260 Sadar Bazar, Meerut Cantt. M/s Delite safe works, Rani Jhansi Road, N/Delhi
14.	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 ; M/S Chhabra Steel Udyog 260, Sadar Bazar, Meerut Cantt ; Agent steel MFG Pvt Ltd, Ahmedabad ; Godrej ;
15.	AI Section for AI Door/ Window/ Partitions	Hindalco, Ajit India, Jindal
16.	AluminumI Door/ Window/ Glazing Fabricated and Anodized	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, M/s VR Associates, GH-14/242 Paschim Vihar, Delhi
17.	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, Bhole Nath Nagar, Shahadara, Delhi 110032. Mepro, Argent New Delhi, Classic, New Delhi. Jindal, Argent New Delhi, Golden Industries Pvt. Ltd. ECIE
18.	Aluminium Grill	Alu Grill, Arihant Aluminium Corporation, Decogrille
19.	Door Closer	Everite, Golden, Gandhi,
20.	Floor Spring	Prabhat, Everite
21.	Plywood for general purpose (IS-303)	National Plywood Inds Pvt Ltd, S Fancy lane, 8th floor, Calcutta-700001, Merino Plywood, Archid Ply, Ply, Swastik, Universal, Century, Greenply, National.
22.	Pre laminated Particle board	Kitply, Bhutan board, Ecoboard, Novapan, Archid ply, Merinova, Merino
23.	Laminated Sheets	Formica, Merino Lam, Greenlam, National, Century
24.	Modular Partitions	Godrej, Blowplast
25.	False Ceiling (Mineral Fibre Board)	Armstrong, Daiken, Luxalon, Llyods, Gypboard, Trac, Aerolite
26.	Aluminium False Ceiling	Lloyds, Armstrong, Luxlon, Trac
27.	Flooring Tiles (Mosaic / Terrazzo / PCC) (1st quality only)	Kajaria Ceramics, NITCO, Royal Tiles, Gem Tiles, Hindustan Tiles, M/S National Tiles & Industries, Ultra Tiles
28.	Glazed Ceramic Tiles, Non-Skid (Floor/Wall), (1st quality only)	Kajaria, Somany, NITCO. Murudeshwar Ceramic Ltd (Navin Diamond tile), Johnson (Marbonite),
29.	Vitrified/ Designer Vitrified Tiles (1st quality only)	Asian, Marbonite (Johnson), Kerrogres (Kajaria), NITCO, Orient
30.	PVC Tiles/Flooring (IS 3461) (1st quality only)	Marblex Tiles, Krishna Tiles, Polyfin, Armstrong, Wonder floor.



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31.	False Flooring	Godrej or equivalent
32.	Glass Mosaic Tiles (1st quality only)	Paladio, Coral, Accura, Bisazza, Italia, Mridul.
33.	Designer Paver Tiles/ Interlocking tiles ISI marked/ Grass-jointed Tiles. (1st quality only)	Pavit, Ultra, Hindustan, Eurocon, Vyara, National Tiles, Gem, Unistone, Konkrete, Unitile
34.	Wall care Putty for Base preparation (1st quality only)	Birla Wall care putty, Berger, Jenson & Nicholson, JK White
35.	White Cement (1st quality only)	Birla, JK
36.	Cement based Paints (1st quality only)	Super Snowcem, Duracem, Super Acrocem.
37.	Dry Distemper / Oil bound Distemper (1st quality only)	Goodlass Nerolac Paint, Shalimar Paint, Jenson & Nicholson, Asian Paint, Berger. ICI Dulux
38.	Acrylic Washable Distemper (1st quality only)	Asian, Berger, ICI Dulux, Jenson & Nicholson, Nerolac, Shalimar, Garware & Goodlass
39.	Plastic Emulsion Paint (1st quality only)	Asian, Berger, ICI, Nerolac, Jenson & Nicholson, Shalimar, Garware & Goodlass
40.	Exterior Acrylic Emulsion (1st quality only)	ICI (Weathercoat), Excel (Nerolac), Apex (Asian), Berger, Jenson & Nicholson, Shalimar, Garware & Goodlass
41.	Polymer based Paint	STP, CICO
42.	Textured Paint / Wall Tile (1st quality only)	Unitile, Heritage, Spectrum, Iokos, Acropaints, Asian
43.	Flexible board for Expansion joint	STP or equivalent
44.	Grout	Shrinkomp, Fosroc, Fairmate
45.	Integral water proofing compound	STP, Pidilite, Fosroc, CICO, Sika.
46.	Concrete Admixture	Pidilite, Fosroc, CICO, Sika.
47.	Water proofing for cementations surface IS-2645	Acrocrete & Acrocote, CICO, Fosroc, STP
48.	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
49.	Hardeners	Ironite, Ferrok, Hardonate
50.	Construction Chemicals	Choksey, CICO, Forsroc, Sika



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51.	Stainless Steel Cladding	Jindal
52.	Punch Tape Concertina Coil	Global Technocrat, S.G. Engineers Delhi
53.	Stainless Steel Railing	Jindal
54.	FRP/ HDPE Garbage Bins	Sintex, Swift, Nutech, Sheetal
55.	Sanitary ware	Neycer Kermag (standard), Hindustan Sanitary Ware (Ist quality), Parryware (superfine), Cera (Ist quality), Classica (Ist / standard)
56.	WC seat cover ISI Marked	Parryware, Neycer Kermag (standard), Hindustan Sanitary Ware (Ist quality), Cera (Ist quality), Classica (Ist / standard)
57.	PVC Flushing Cistern IS: 774-1984 (ISI Certified)	Parryware, Hindustan Sanitary Wares, Cera.
58.	Faucets & Taps, Stop Valves & Pillar Taps, Surgical basin mixer, Shower rose etc.	Gem, Parko, Parryware, HSW, Jaquar
59.	Kitchen Stainless Steel Sink	Diamond, Nirali, Neel Kanth, Jayna
60.	Looking Mirror	Saint Gobain, Modi Float, Triveni Float Glass, Crown, Atul.
61.	Readymade Bathroom Cabinets	Commander Gratings (I) Pvt Ltd, Gratolite Cabinet, A- 4 Sector Viii Noida-202701, Alpina, Cera.
62.	Float Valve	Leader, Bombay Metal & Alloy Co, Bombay superflow.
63.	SGSW Pipes (IS-651) ISI Marked	Perfect Agra, Devraj Ind Gaziabad, Buran, RK, Prince,
64.	CI (Centrifugally Cast) Pipes for sewage disposal ISI marked	NICCO, SRIF, A-1 Singhal Casting Co Agra, Jindal Saw, Kesoram, NECO
65.	PVC rain water/sewage pipes (IS-4985)	Reliance, Finolex, Supreme, Kisan, Prince, Hindustan Plastic & machine corporation, Polypack industries (P) Ltd.
66.	HDPE Water storage tanks (Rotational Moulded)	Sintex, Swift, Nutech, Sheetal
67.	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
68.	RCC Pipes	Indian Hume Pipe Company, Delhi / Allahabad / Chandigarh / Lucknow; Hindustan Pressure Pipes, Kolhapur; Dhere Concrete Products, Pune or any other approved manufacturer conforming B.I.S. Standard
69.	Brass Fittings	Leader Engineering Works, Jalandhar; L & K Mathura; Luster Sanitary, Jalandhar; Annapurna Metal Works, Calcutta; Neta Metal Works, Jalandhar
70.	C.P. Fittings	Ego Metal Works, Ballabhgarh; Jaquar Industries, Delhi; Soma Plumbing Fixtures Limited, Calcutta; Gem Sanitary Appliances Pvt. Ltd., Delhi; Essco



		Sanitations, Delhi.
71.	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.
72.	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.

List of Recommended Vender/Suppliers of Major Bought-Out Items: 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 RECOMMENDED list for structural items thereon.

Sl. No.	Items/Name of Products	Makes/Brands/Manufactures
1	Structural Steel	SAIL / TATA / RINL / IISCO / ESSAR / ISPAT
2	Structural Steel Tubes ISI Marked	TATA / JINDAL / SURYA / SWASTIK
3	Synthetic Enamel Paint 1st Quality only	ICI Paint (Deluxe), Asian Paint (Apolite), Shalimar Paint (Superlac), Goodlass, Nerolac Paint (Nerolac), Berger Paints

Any materials not fully specified in these specifications 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.

**C. ELECTRICAL****LIST OF SUPPLIERS OF MAJOR BOUGHT-OUT ITEMS****1.0 AIR CONDITIONER**

- a. Blue Star
- b. O General.
- c. Daikin.
- d. Carrier
- e. Hitachi.
- f. LG.
- g. Lloyds
- h. Mitsubishi
- i. Panasonic
- j. Sharp
- k. Samsung.
- l. Blue star.
- m. Haier.
- n. Voltas.
- o. Videocon.

2.0 BATTERIES (LEAD ACID)

- a. Amco Batteries Ltd.
- b. Exide Industries Ltd.
- c. HBL Power System Ltd.
- d. Amara Raja Batteries Ltd.
- e. Su-Kam Power Systems Ltd.
- f. Base Corporation Ltd.
- g. Okaya Power Ltd.
- h. Southern Batteries Pvt Ltd.
- i. True Power International Ltd.
- j. Evolute Solutions Pvt Ltd.
- k. Greenvision Technologies Pvt Ltd.
- l. Artheon Electronics Ltd.

**3.0 BATTERIES (NICKEL CADMIUM)**

- a. Amco Saft Batteries Ltd.
- b. HBL Power Systems Ltd.

4.0 BATTERIES (Lithium-ion)

- a. PROSTARM INFO SYSTEMS LTD.

5.0 BATTERY CHARGER/DC-DC CONVERTER

- a. Amara Raja Power System(P)Ltd.
- b. BCH.
- c. Chhabi Electricals Pvt. Ltd.
- d. Caldyne Automatics Limited.
- e. HBL Nife Power Systems Ltd..
- f. Universal Instrument Mfg. Co Pvt Ltd.
- g. Hitachi HI-REL Power Electronics P. Ltd
- h. Mass-Tech Controls Pvt Ltd
- i. Dubas Engineering Pvt Ltd
- j. Chloride Power Systems & Solutions Ltd
- k. Synergee
- l. Enertech
- m. Vertiv

6.0 CABLE – FIRE ALARM & COMMUNICATION CABLES

- a. Cords Cable Industries Ltd.
- b. CMI.
- c. Delton cables Ltd.
- d. ELKAY Telelinks.
- e. KEI Industries Ltd.
- f. Elkay Telelinks

7.0 CABLE – HT(XLPE)

- a. Universal Cable Ltd.
- b. KEI Industries Ltd.
- c. Industrial Cables.
- d. NICCO Corporation Ltd.



- e. Uniflex.
- f. Polycab.
- g. Torrent cables Ltd.

8.0 CABLE – LT / MV POWER AND CONTROL

- a. Cords Cable Industries Ltd.
- b. Universal Cable Ltd.
- c. KEI Industries Ltd.
- d. Havells.
- e. Delton.
- f. Elkay Telelinks.
- g. Evershine Electricals.
- h. Ecko.
- i. Ravin.
- j. Rallison.
- k. Suyog.
- l. Netco.
- m. Uniflex.
- n. Paramount.
- o. Gloster.
- p. Associated cables Pvt Ltd.
- q. CMI.
- r. Gemscab.
- s. Industrial cables.
- t. NICCO.
- u. Polycab.
- v. Torrent.

9.0 CABLE – GLAND

- a. Baliga.
- b. Comet.
- c. Flexpro.
- d. Flameproof.
- e. FCG.



- f. Electro Werke.
- g. Dowels.
- h. CCI.
- i. Sudhir Switchgear
- j. Keyson Techno Equipments,
- k. RAY Flameproof Pvt Ltd

10.0 CABLE – LUGS & TERMINAL BLOCKS

- a. Dowels.
- b. Jainson.
- c. Sharma Electrical
- d. Punitam
- e. Yamuna Powers
- f. Rapid Manufacturer
- g. Varun Controls.

11.0 CABLE – TRAY

- a. Ercon Composites.
- b. Yamuna Power & Infrastructure Ltd.
- c. MEM
- d. Bharti
- e. Profab.
- f. Ratan.
- g. Slotco.

12.0 CABLE TERMINATION AND JOINTING KIT

- a. CCI.
- b. Raychem.
- c. M-Seal.

13.0 CEILING/EXHAUST/PEDESTAL FANS & CIRCULATORS

- a. Bajaj Electricals Ltd.
- b. Crompton Greaves Ltd.
- c. Khaitan Electricals Ltd.



- d. Havell's.
- e. Philips
- f. Usha
- g. Orient

14.0 CONTRACTORS – AC POWER

- a. Andrew Yule.
- b. ABB.
- c. BHEL.
- d. C&S.
- e. Havell's.
- f. L&T.
- g. Schneider.
- h. Siemens Ltd.
- i. Telemecanique.
- j. GE India Industrial

15.0 CONTROL TRANSFORMER

- a. AE.
- b. Indushree.
- c. Intra Vidyut.
- d. Kalpa Electricals.
- e. Transpower Industries Ltd.
- f. Siemens.
- g. PROSTARM INFO SYSTEMS LTD.

16.0 GAS GENERATOR/DIESEL GENERATOR SET

- a. Sterling and Wilson.
- b. Jackson Limited.
- c. Sudhir Gensets.
- d. Power Engineering (India) Pvt Ltd.
- e. Prasha Technologies Limited.
- f. Kumar Generator house.
- g. Ashok Leyland Ltd.



- h. Powerica Limited.
- i. Supernova Engineers Limited.
- j. Bhaskar Power Products (P) Ltd.
- k. Caterpillar India (P) Ltd.
- l. Cummins India Ltd.
- m. Escorts Ltd.
- n. Greaves Cotton Ltd.
- o. Kirloskar Ltd.
- p. Mahindra & Mahindra Ltd.
- q. Honda.
- r. Perkins.
- s. Eicher.
- t. Tata Motors.
- u. Ashok Leyland.

17.0 FLAME PROOF LDB'S/ JB'S/CONTROL STATION/ SWITCHES

- a. FCG.
- b. Sudhir switchgears.
- c. Prompt Engineering Works
- d. Flame Proof equipments pvt. Ltd.
- e. Baliga Lighting Equipments Pvt. Ltd.
- f. Flexpro Electricals Pvt. Ltd.
- g. Exprotecta, Beroda.
- h. FFLP Control Gears.
- i. Sterling.
- j. Kaysons Techno Equipment
- k. Bajaj
- l. Phoenix Contact
- m. RAY Flameproof Pvt Ltd

18.0 HIGH MAST

- a. Bajaj Electricals Limited.
- b. Crompton Greaves Limited.
- c. Philips India Limited.



- d. Surya Roshani.
- e. Transrail

19.0 HIGH VOLTAGE PCC/ MCC PANELS

- a. BHEL.
- b. Control and Switchgear.
- c. Siemens.
- d. Tricolite Electrical Industries.
- e. Schneider.
- f. CGL.
- g. L&T.
- h. ABB.

20.0 INDICATING LAMPS

- a. Alstom Ltd.
- b. BCH.
- c. L&T Ltd.
- d. Siemens Ltd.
- e. Vaishno Electricals.
- f. Tecknik
- g. ABB

21.0 INDICATING METERS

- a. L&T
- b. ABB.
- c. AMCO.
- d. AE
- e. Alstom Ltd. (EE).
- f. Conzerv/Schneider
- g. Elecon Measurement Pvt. Ltd.
- h. HPL Electric & Power Pvt. Ltd.
- i. MECO Instruments Ltd.
- j. Minilec.



- k. Rishabh Instruments Pvt. Ltd.
- l. Trinity energy system.
- m. Kaycee.
- n. Salzer.
- o. Trinity
- p. Secure Meters Limited

22.0 LIGHTING FIXTURES

- a. GE Lighting Pvt. Ltd.
- b. Bajaj Electricals Ltd.
- c. Crompton Greaves Ltd.
- d. Philips India Ltd.
- e. Havells
- f. Wipro
- g. Osram
- h. Siska
- i. Halonix
- j. Surya
- k. Polycab
- l. Kawlity Photonix

23.0 LIGHTING FIXTURES – FLAMEPROOF

- a. Bajaj Electricals Ltd.
- b. Baliga Lighting Equipment Pvt. Ltd.
- c. Crompton Greaves Ltd.
- d. CEAG Flameproof Controlgear Pvt. Ltd.
- e. Flexpro Electricals Pvt. Ltd.
- f. Philips India Ltd.
- g. Sudhir Switchgears Pvt. Ltd.
- h. FCG.

24.0 MINIATURE CIRCUIT BREAKERS (MCBS) AND LIGHTING DB

- a. ABB.
- b. Hagger.
- c. Havell's India Ltd.



- d. Indo Asian Fusegear Ltd.
- e. Legrand.
- f. MDS Switchgear Ltd.
- g. Schneider.
- h. Siemens Ltd..
- i. HPL.
- j. L & T
- k. Siemens

25.0 MOULDED CASE CIRCUIT BREAKER (MCCBS)

- l. ABB.
- m. Andrew Yule.
- n. Larsen & Toubro.
- o. Schneider.
- p. Siemens.
- q. Control and Switchgear.
- r. Indo Asian,
- s. Hager.
- t. Merlin Gerin.
- u. Havell's India Ltd
- v. General Electric

26.0 PROTECTION RELAYS

- a. BCH.
- b. L&T Ltd.
- c. Siemens Ltd.
- d. Tele-mechanique & Controls (India) Ltd.
- e. Eaton
- f. Alsthom
- g. ABB
- h. Ashida
- i. Novatek Electronics
- j. Cantronics
- k. Control & Switchgear
- l. Frick Electronics



- m. Indian Technologies
- n. Rao Electromechanical
- o. Kudam Corporation

27.0 LOW/MEDIUM VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB

- a. ABB.
- b. BCH.
- c. BHEL.
- d. C & S.
- e. Elecmech Switchgear & Instrumentation.
- f. KMG ATOZ.
- g. L&T.
- h. Pyrotech Electronics Pvt. Ltd.
- i. Risha Control Engineers Pvt. Ltd.
- j. UDKAM PROCESS EQUIPMENT INDIA PVT. LTD
- k. Tricolite Electrical Industries.
- l. Unilec Engineers Ltd.
- m. Vidyut Control India Pvt. Ltd.
- n. Control and Schematic.
- o. Zenith Engineering.
- p. Schneider Electric,
- q. AEG,
- r. HAVELL'S,
- s. MDS
- t. Synergy System
- u. Expert Engineers
- v. R K Engineering & Infrastructure

28.0 PUSH BUTTONS

- a. BCH.
- b. Alstom Ltd.
- c. L&T.
- d. Siemens Ltd.
- e. Tele-Menchanique & Controls (India) Ltd.



- f. Vaishno Electricals.

29.0 SWITCHES-CONTROL

- a. BCH.
- b. Easum Reyrolle Relays & Devices Ltd.
- c. Alstom.
- d. Kaycee Industries Ltd..
- e. L&T.
- f. Siemens Ltd.

30.0 SWITCHES – 5/15A PIANO/ PLATE, SWITCH SOCKET

- a. Anchor Electronics & Electricals Pvt. Ltd.
- b. Kingal Electricals Pvt. Ltd.
- c. North-West Switchgear Ltd.
- d. Schneider
- e. Havells
- f. Cona
- g. Orient
- h. Panasonic

31.0 SWITCH SOCKET OUTLETS (INDUSTRIAL)

- a. Alstom Ltd.
- b. Best & Crompton Engineering Ltd.
- c. BCH.
- d. Crompton Greaves Ltd.
- e. Essen Engineering Company Pvt. Ltd.

32.0 SOLAR POWER SYSTEM MODULES

- a. Tata Power Solar Systems Ltd
- b. REIL,
- c. CEIL,
- d. HBL Power.
- e. Vikram Solar.
- f. Waaree Solar.
- g. Solar Semiconductor.



- h. Sonali.
- i. Mundra Solar
- j. Vikram Solar
- k. Bharat Electronics Limited
- l. Waaree
- m. Lumipex
- n. Independent Qualitative Accessories
- o. Statcon Energy
- p. Volks Energy
- q. Green Engineering

33.0 SOLAR PCU/CHARGE CONTROLLER

- a. Statcon Energy
- b. Enertech UPS Pvt Ltd
- c. Consul Nowatt
- d. OPS India
- e. Schneider
- f. Delta Electronics
- g. ABB Ltd
- h. KACO
- i. SMA
- j. HBP Power
- k. Universal Instrument

34.0 TERMINALS BLOCKS

- a. Connectwell.
- b. Controls & Switchgear Co. Ltd.
- c. Elmex Controls Pvt. Ltd.
- d. Essen Engineering Co. Pvt. Ltd.
- e. Phoenix Contact

35.0 DISTRIBUTION TRANSFORMERS

- a. ABB.
- b. Andrew Yule.
- c. Areva.



- d. BHEL.
- e. Bharat Bijlee
- f. Crompton Greaves.
- g. EMCO Ltd.
- h. Intra Vidyut.
- i. Indushree.
- j. Indcoil
- k. Kirloskar.
- l. Skippers Electricals.
- m. Transformers & Rectifiers (I) Ltd.
- n. Voltamp.

36.0 UPS SYSTEM AND INVERTER

- a. DB Power.
- b. Keltron.
- c. Hi-Rel/HITACHI.
- d. Dubas.
- e. Toshiba Corporation.
- f. Fuzi Electric Co Ltd.
- g. Emerson.
- h. Synergy System.
- i. Eaton.
- j. Enertech
- k. PROSTARM INFO SYSTEMS LTD.

37.0 GI-OCTAGONAL POLE

- a. Bajaj.
- b. Transrail.
- c. Wipro.
- d. K.L. Industries.

38.0 ELECTRICAL MOTORS

- a. Siemens.
- b. Crompton Greaves.
- c. Kirloskar.
- d. BHEL.



- e. Bharat Bijlee.
- f. Hindustan motors.
- g. Alstom.
- h. Texmo.
- i. GE India.
- j. National Motors.
- k. ABB.

39.0 ELECTRICAL PROCESS HEATER

- a. Escorts Limited, Faridabad, Haryana.
- b. Spherehot / Kanti Lal Chuni Lal & Sons Appliances Pvt Ltd.Surat.
- c. Kerone, Bhayander(E), Thane – 401105.
- d. Excel Heaters, Andheri (West), Mumbai - 400 053, India.
- e. Nirmal Industrial Controls Pvt. Ltd., Mulund(W), Mumbai - 400 080.

40.0 CATHODIC PROTECTION AGENCIES/CONTRACTOR/ VENDERS

- a. CALTECH Engineering Service.
- b. Universal Corrosion Prevention India.
- c. Cathodic Technology Limited.
- d. Cathodic Control Company Pvt. Ltd.
- e. CORRTECH International Pvt Ltd.
- f. MITCORR Cathodic Protection Pvt Ltd.
- g. Underground Pipeline & NDTs Pvt. Ltd.
- h. JG Corrosion Solution.
- i. Mercury Cathodic Protection Service.
- j. UNDTs Corrosion Service.
- k. SARK EPC Projects Pvt. Ltd.

41.0 BACKUP AGENCY FOR INTERFERENCE SURVEY & MITIGATION

- a. PLE Germany
- b. Vendor Velde
- c. Nippon Japan
- d. SSS India CIPL / interference survey.
- e. Balslev Denmark, .
- f. SSS Germany



- g. Jef Techno Slutions Pvt. Ltd.
- h. SARK EPC Projects Pvt. Ltd.

42.0 PERMANENT REFERENCE CELL

- a. PERMACELL/ HARCO (USA)
- b. CORRTECH (ZULU), INDIA
- c. TINKER RASOR, USA
- d. SILVION, UK

43.0 CP CABLES

- a. Brooks Cables.
- b. Nicco Corporation Ltd.
- c. CCI Ltd.
- d. Delton Cables Ltd.
- e. KEI Industries.
- f. Torrent Cables.
- g. Universal cables.
- h. Victor Cables.
- i. Associated Flexible & Wires Pvt Ltd.
- j. Asain Cables (RPG Cables).
- k. Fort Gloster (Gloster Cables Ltd).
- l. Finolex Cable.
- m. Rediant Cables.
- n. NETCO Cables Pvt Ltd.
- o. Havells Ltd.

44.0 CP SACRIFICIAL ANODES

- a. Scientific Metals Engineers Pvt. Ltd., Karaikudi
- b. PSL Holding Pvt. Ltd., Mumbai.
- c. Cathodic Controls, Bangalore.
- d. BHEL, Bhopal.
- e. Nippon Corrosion, Japan.
- f. AFIC, KSA.
- g. Platt Bros. and Company, USA



- h. Wilson Walton International.
- i. Impalloy International.
- j. Corrpro International.
- k. HOCKWAY, UK
- l. NAKABOHTEC, Japan .
- m. Cortech International
- n. Titanor Component
- o. Shakti Metals, Ahmedabad
- p. Shaktianodes Private Limited, Ahmedabad

45.0 CP PORTABLE /PERMANENT REFERENCE CELL

- a. M/S PERMACELL/HARCO, USA
- b. M/S BORIN MANUFACTURER, USA
- c. M/S M.C.MILLER, USA
- d. M/S TINKER RASOR

46.0 CPTR (AC OPERATED)

- a. Canara Electric
- b. CATHODIC CONTROL COMPANY PVT LTD.
- c. Kriston Systems

47.0 PIN BRAZING / THERMITWELD

- a. SAFETRACK, SWEDEN
- b. CadWeld
- c. BAC, UK
- d. ERICO, USA
- e. THERMOWELD, USA
- f. ERICO, EUROPE

48.0 CP SURGE DIVERTER/SPARK GAP ARRESTOR (EX-D)

- a. Dhen,
- b. OBO
- c. Corrpro system
- d. Sohne
- e. Dairyland

49.0 CP SOLID STATE POLARISATION CELL.

- a. Dairyland



- b. Metricorr
- c. Rustol
- d. Dhen
- e. Kriston Systems

50.0 PETROLEUM COKE BREEZE:

- a. M/S LORESCO, USA
- b. M/S ASBURY, USA
- c. M/S GOA CARBON, GOA
- d. M/S INDIA CARBON, CALCUTTA
- e. M/S PETROCARBON & CHEMICAL COMPANY, HALDIA

51.0 CP ANODE (MMO TYPE):

- a. Corrttech
- b. Scientific Metal Engineers Karaikudi
- c. Titanor Component Ltd., Goa, India.
- d. Denora Permelic S.P.A (Italy). .
- e. Oronzio De Nora S.A. Ingano Switzerland
- f. CER Anode Technologies International USA
- g. ACTEL, UK
- h. ELTECH System Corporation, Texas
- i. MAGNETO-CHEMIE, Netherlands
- j. MATCOR (USA)

52.0 HEAT SHRINK CAP FOR CP ANODE

- a. MATCOR (USA) To Cable Joint
- b. Seal For Life

**53.0 ER- PROBE (EXTERNAL CORROSION) ER- PROBE & CORROSION
COUPON ASSEMBLY**

- a. Rose Corrosion Services UK
- b. Metal Samples, USA. .
- c. Roharbak Cosasco USA
- d. Caproco UK
- e. Emetricorr, Denmark

54.0 HEAT SHRINK CAP FOR ANODE TO CABLE JOINT



- a. Raychem, USA
- b. Matcor (USA)

55.0 MMO WIRE ANODES (WITH FACTORY PRE-PACKED COKE BREEZE)

- a. Matcor (USA)
- b. Covalence (USA)
- c. Berry Plastics (USA) – (Seal for Life Industries)

56.0 MMO WIRE ANODES (WITHOUT FACTORY PRE-PACKED COKE BREEZE)

- a. GROUPPO DENORA, GOA, INDIA
- b. CERANODE TECHNOLOGIES, USA
- c. TELPRO, USA

57.0 MMO TUBULAR/ STRIP/ RIBBON ANODES

- a. GROUPPO DENORA, GOA, INDIA
- b. ORANZIO DE NORA, ITALY
- c. MAGNETOCHEMIE, HOLLAND
- d. ACTEL LTD., U.K.
- e. ELTECH SYSTEMS CORPORATION, USA
- f. CERANODE TECHNOLOGIES, USA
- g. MATCOR (USA)

Note: -

For any other brought out item(s) for which the vendor list is not provided in the tender , bidders can supply those item(s) from vendors/ suppliers who have earlier supplied similar item(s) for the intended services in earlier Oil and Gas projects and the item(s) offered is in their regular manufacturing/ supply range.

- 1) The vendor/supplier should not be in the Holiday list of OWNER/ CONSULTANT/other PSU
- 2) The bidder is not required to enclose documentary evidences (PO copies, Inspection & Completion with satisfactory working certificates etc.) along with their offer, however in case of successful bidder, these documents shall required to be submitted by them within 30 days from date of Placement of Order for approval to OWNER / CONSULTANT.

**D. INSTRUMENTATION****LIST OF RECOMMENDED VENDER/SUPPLIERS OF MAJOR BOUGHT-
OUT ITEMS****1.0 PRESSURE GAUGES**

- a. AN Instruments Pvt Ltd
- b. Badotherm Process Instruments B.V.
- c. Baumer Bourdon Haenni S.A.S
- d. British Rototherm Co Ltd
- e. Budenberg Gauge Co Ltd
- f. Dresser Inc
- g. Forbes Marshall (Hyd) Pvt Ltd
- h. General Instrument Consortium
- i. H. Guru Instruments (South India) Pvt Ltd
- j. Manometer (India) Pvt Ltd
- k. Nagano Keiki Seisakusho Ltd
- l. Hirlekar Precision, India
- m. Waaree Instruments Ltd
- n. Walchandnagar Industries Ltd (Tiwac Divn)
- o. Wika Alexander Wiegand & Co GmbH
- p. Wika Instruments India Pvt Ltd
- q. Ashcroft India Pvt Ltd.
- r. ITEC Measures Pvt Ltd

2.0 TEMPERATURE GAUGES

- a. AN Instruments Pvt Ltd.
- b. Badotherm Process Instruments B.V.
- c. Bourdon Haenni S.A.
- d. Dresser Inc.



- e. General Instruments Consortium
- f. H. Guru Instruments (South India) Pvt Ltd
- g. Nagano Keiki Seisakusho Ltd
- h. Solartron ISA
- i. Walchandnagar Industries Ltd (Tiwac Divn)
- j. Wika Alexander Wiegand & Co GmbH
- k. Wika Instruments India Pvt Ltd
- l. Pyro Electric, Goa
- m. Ashcroft India Pvt Ltd.
- n. ITEC Measures Pvt Ltd

3.0 TEMPERATURE ELEMENTS INCLUDING SKIN TYPE

- a. ABB Automation Ltd
- b. Altop Industries Ltd
- c. Bourdon Haenni S.A.
- d. Detriv Instrumentation & Electronics Ltd
- e. General Instruments Consortium
- f. Japan Thermowell Co Ltd
- g. Tecnomatic S.P.A
- h. Tempsen Instrument India Ltd
- i. Thermo Electric Co. Inc.
- j. Thermo-Couple Products Co
- k. Thermo-Electra B.V.
- l. Wika Alexander Wiegand & Co GmbH
- m. Altop Industries Ltd., Baroda
- n. Nagman Sensors (Pvt.) Ltd.
- o. Pyro Electric, Goa
- p. ITEC Measures Pvt Ltd

4.0 POSITIVE DISPLACEMENT FLOW METERS

- a. RMG (Germany)
- b. Elster Instromet
- c. Romet
- d. Dresser
- e. Itron



- f. FMG
- g. Common
- h. Metreg
- i. Raychem RPG
- j. Vemmtec

5.0 TURBINE FLOW METER

- a. Daniel
- b. Elster Instromet
- c. Itron
- d. RMG
- e. Rockwin

6.0 ELECTRONIC VOLUME CORRECTOR

- a. Elgas
- b. Itron
- c. Plum
- d. Pietro Fiorentini

7.0 ORIFICES (METER RUN, FLOW CONDITIONER, ORIFICE PLATE AND ASSEMBLY)

- a. Emerson
- b. FMC, USA
- c. Pietro Fiorentini S.P.A (Italy)
- d. Canalta Controls, Canada

8.0 ULTRASONIC FLOW METERS

- a. Daniel (USA)
- b. RMG (Germany)
- c. Instromet International (Belgium)
- d. Sick Maihak, Germany
- e. FMC, Germany

9.0 MASS FLOW METERS



- a. Daniel Measurement & Control Asia Pacific
- b. Endress + Hauser Instruments International
- c. FMC Measurements Solutions
- d. Heinrichs Messtechnik GMBH
- e. Rheonik MessGerate GMBH

10.0 FIELD INSTRUMENTS (P, DP, F, L, T)

- a. ABB Ltd
- b. Honeywell
- c. Fuji Electric Instruments Co Ltd
- d. Yokogawa
- e. Invensys India Pvt.Ltd

11.0 LEVEL GAUGES/ LEVEL INSTRUMENTS

- a. Bliss Anand
- b. Chemtrols
- c. V-Automat
- d. Levcon
- e. Nivo Controls
- f. Sbeletro Mechanicals
- g. TRAC

12.0 PRESSURE REGULATOR AND SLAM SHUT VALVE

- a. Pietro Fiorentini S.P.A. (Italy)
- b. Emerson
- c. RMG-Regel Messtechnik (Germany)
- d. Mokveld Valves BV (Netherlands)
- e. Schlumberger (USA)
- f. Gortter Controls B V (Netherlands)
- g. Instromet International NV



- h. Nirmal Industrial Controls Pvt Ltd. (up to 6" size only)
- i. ESME Valves Ltd
- j. Kaye & Macdonald Inc.
- k. Nuovo Pignone S.P.A (Italy) (GE Oil Co.)
- l. Richards Industries (Formerly Treloar)
- m. Samson AG Mess-und Regeltechnik
- n. Tormene Gas Technology
- o. Dresser Inc, USA (upto 8" size, 300# class only)

13.0 PRESSURE SAFETY VALVES

- a. Keystone Valves (India) Pvt. Ltd.
- b. Larson & Toubro Ltd.
- c. Lesser GmbH & Co KG
- d. Mekaster Engg Ltd..
- e. Tyco Sanmar Ltd. (New Delhi)
- f. Anderson Greenwood Crosby
- g. BHEL (Trichy)
- h. Curtiss Wright Flow Control Corporation
- i. Dresser Inc.
- j. Fukui Seisakusho Co. Ltd
- k. Nakakita Seisakusho Co Ltd
- l. Nuovo Pignone S.P.A (Italy) (GE Oil co)
- m. Parcol S.P.A
- n. Safety Systems UK Ltd
- o. Tai Milano S.P.A
- p. Weir Valves & Controls France
- q. Bliss Anand Pvt Ltd.

14.0 CONTROL PANEL & ACCESSORIES

- a. Keltron Controls Ltd., Kerala
- b. Elechmec Corporation Ltd., Mumbai
- c. Industrial Controls & Appliances Pvt. Ltd.,
- d. Alstom System Ltd., Noida
- e. Emerson Process Management (I) Pvt. Ltd.
- f. ABB Instruments Ltd., New Delhi
- g. Larsen & Toubro Ltd.



- h. Control & Automation, New Delhi
- i. GE Fanuc Systems Pvt. Ltd., New Delhi
- j. Rockwell Automation (I) Ltd., Ghaziabad
- k. Honeywell Automation Ltd.
- l. Rittal
- m. Pyrotech Elcronics Pvt Ltd.
- n. Positronics Pvt Ltd.
- o. Electronics Corporation of India Ltd.
- p. Phoenix Contact (I) Pvt. Ltd

15.0 JUNCTION BOXES AND CABLES GLANDS

- a. Ex-Protecta
- b. Flameproof Control Gears
- c. Baliga
- d. Flexpro Electricals
- e. RAY Flameproof Pvt Ltd (Flameproof Weatherproof)

16.0 CONTROL AND SIGNAL CABLES

- a. Associated Cables
- b. Brook
- c. Associated Flexibles & Wires (Pvt) Ltd
- d. Universal Cables Ltd, India
- e. Delton Cables Ltd, India
- f. KEI Industries Ltd INDIA
- g. CMI Limited
- h. Cords Cable Industries Ltd, India
- i. Elkay Telelinks (P) Ltd., India
- j. Udey Pyrocables Pvt Ltd, India
- k. Goyolene Fibres (I) Pvt Ltd, India
- l. Netco Cable Industries Pvt Ltd, India
- m. Nicco Corporation Ltd, India
- n. Paramount Communications Ltd, India
- o. Polycab Wires Pvt Ltd, India
- p. Radiant Cables Pvt Ltd, India
- q. Reliance Engineers Ltd., India
- r. Suyog Electricals Ltd, India



- s. Thermo Cables Ltd

17.0 GAS DETECTION SYSTEM

- a. Crowcon Detection Instruments Ltd
- b. Detection Instruments (I) Pvt Ltd
- c. Detector Electronics Corporation
- d. Drager Safety AG & Co. KGAA
- e. General Monitors Ireland Ltd
- f. Mine Safety Appliances Company
- g. MSA – Mines Safety Appliances(India) Ltd
- h. Industrial Scientific Oldham France S.A.
- i. Riken Keiki Co Ltd
- j. Simrad Optronics Icare
- k. Honeywell Analytics
- l. Net Safety Monitoring Inc.
- m. Simtronics SAS
- n. Pollution Protection Systems Mumbai Pvt Ltd

18.0 MOV ACTUATOR:

- a. Rotork- UK, USA & INDIA
- b. Limitorque
- c. Auma- India
- d. Biffi- Italy
- e. DelVal Flow Controls Pvt. Ltd

19.0 PNEUMATIC ACTUATOR (SOLENOID OPERATED ON-OFF TYPE)

- a. Metso Automation
- b. Tyco
- c. Samson Controls
- d. L&T
- e. Emerson
- f. Fisher
- g. Masoneilan Process Control
- h. Instrumentation Limited (IL)-Palghat



- i. Micro Finish
- j. Rotex

20.0 SOLENOID VALVES

- a. Avcon
- b. Festo
- c. DelVal Flow Controls Pvt. Ltd

21.0 ELECTRO – HYDRAULIC ACTUATOR

- a. Avcon Rotork controls (Deutschland Gmbh)
- b. Biffi Italia Srl
- c. Ledeen (Italy)
- d. Virgo Valves and Controls Ltd.-India
- e. Limittorque
- f. Reineke
- g. Voith
- h. Bettis
- i. Rotork- UK, USA & INDIA
- j. Rotex
- k. Schuck Group
- l. DelVal Flow Controls Pvt. Ltd

22.0 GAS OVER OIL ACTUATOR

- a. Biffi Italia Srl,
- b. Ledeen(Italy)
- c. Virgo Valves & Control Ltd.-India,
- d. Voith,
- e. Bettis,
- f. Rotork-UK, USA, India,
- g. Rotex,
- h. Schuck Group,
- i. Valve Italia.

23.0 OFC

Manufacture/ Procurement, Testing and supply of suitable OFC Joint closures including all necessary accessories of any of the following make:



- a. Raychem
- b. 3M
- c. Siemens
- d. Any other make from the approved vendor list of client with supporting paper.

24.0 FLOW CONTROL VALVES

- a. Fouress Engg. (New Delhi)
- b. Fisher Xomox (New Delhi)
- c. MIL Control Ltd. (Noida)
- d. KOSO India Pvt Ltd
- e. Samson Control (Thane)
- f. Dresser Valves India Pvt Ltd.
- g. Fisher Controls
- h. Valvitalia Italy
- i. CCI Valve technology
- j. Flowserve Pvt Ltd.
- k. Metso Singapore Pvt Ltd.
- l. Instrumentation Ltd Palghat
- m. Dresser Inc. USA

25.0 FLOW COMPUTERS

- a. Emerson
- b. Instromet International (Belgium)
- c. FMC Measurement Solutions (UK)
- d. RMG (Germany)
- e. OMNI Flow Computers Inc.
- f. Thermo Fisher, USA

26.0 INDICATORS & CONTROLLERS

- a. Yokogawa
- b. Eurotherm Chessel
- c. Honeywell
- d. Emerson

27.0 BARRIERS

- a. MTL
- b. STHAL



- c. P&F
- d. Phoenix Contact (I) Pvt. Ltd.

28.0 GAS CHROMATOGRAPH

- a. ABB
- b. Emerson
- c. Instromet International, NV
- d. RMG Regal+Messtechnik GmbH
- e. Yokogawa

29.0 I/P CONVERTERS

- a. ABB
- b. Emerson
- c. IMI Watson Smith Ltd.
- d. Moore Controls Ltd
- e. Shreyas Instruments Pvt Ltd, India
- f. Thermo Brandt Instruments

30.0 SS FITTINGS, INSTRUMENT VALVES & MANIFOLDS**30.1 FOR CNG WORK:**

- a. DK-LOK
- b. Swagelok Co.
- c. Parker
- d. Dawsons Tech Components LLP
- e. ASTEC Valves & Fittings Pvt Ltd
- f. Thomas & Brian Mfg. Pvt. Ltd
- g. Global Valves and fittings(India) Pvt Ltd

30.2 EXCEPT CNG WORK:

- a. Swagelok Co.
- b. Parker
- c. Aura INC.
- d. HOKE
- e. Excelsior Engineering works
- f. Swastik Engineering works India
- g. Comfit and valves pvt ltd
- h. Arya craft and engineering Pvt ltd



- i. DK lok
- j. ASTEC Valves & Fittings Pvt Ltd
- k. Dawsons Tech Components LLP
- l. DelVal Flow Controls Pvt. Ltd
- m. Thomas & Brian Mfg. Pvt. Ltd
- n. Global Valves and fittings(India) Pvt Ltd

31.0 SS TUBES

31.1 FOR CNG WORK:

- a. Swagelok Co.
- b. Parker
- c. Sandvik
- d. Jindal Saw
- e. Tubacex Tubes and Pipes Private Ltd
- f. Krystal Global Engineering Ltd.
- g. Maxim Tubes Company Pvt. Ltd.
- h. VENUS PIPES & TUBES LIMITED

31.2 EXCEPT CNG WORK:

- a. Swagelok Co.
- b. Parker
- c. Sandvik
- d. Heavy metal and tube limited
- e. Nuclear fuel complex India
- f. Scorodite
- g. Ratnamani Metals and Tubes
- h. Jindal Saw

**E. SHOP & FIELD PAINTING****LIST OF RECOMMENDED VENDER/SUPPLIERS OF MAJOR BOUGHT-
OUT ITEMS****1.0 INDIAN VENDORS**

- a. Asian Paints (I) Ltd.
- b. Berger Paints Ltd.
- c. Goodlass Nerlolac Paints Ltd.
- d. Jenson And Nicholson Paint Ltd & chokuGu Jenson & Nicholson Ltd.
- e. Shalimar Paints Ltd.
- f. Sigma Coating, Mumabai
- g. CDC Carboline Ltd.
- h. Premier Products Ltd.
- i. Coromandel Paints & Chemicals Ltd.
- j. Anupam Enterprises
- k. Grand Polycoats
- l. Bombay Paints Ltd.
- m. Vanaprabha Esters & Glycer, Mumbai
- n. Sunil Paints and Varnishes Pvt. Ltd.
- o. Courtaulds Coating & Sealants India (Pvt.) Ltd.
- p. Mark-chem Incorporated, Mumbai (for phosphating chemicals only)
- q. VCM Polyurethane Paint (for polyurethane Paint only)

2.0 FOREIGN VENDORS FOR OVERSEAS PRODUCTS

- a. Sigma Coating, Singapore
- b. Ameron, USA
- c. Kansai Paint, Japan
- d. Hempel Paint, USA
- e. Valspar Corporation, USA
- f. 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 client, 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.
3. Equipment / Instruments of any make which is offered by one bidder and acceptable to client 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.

**F. FOR PE & LMC WORK (GI/CU)****1.0 MDPE PIPE**

- a. Mukand Poly Products,
- b. Dewa Polymers Pvt. Ltd.
- c. Rungta Irrigation Ltd.

2.0 MDPE FITTINGS & MDPE VALVES

- d. Aliaxis,
- e. George Fischer,
- f. Al-Aziz,
- g. Kimplas,
- h. Banides,
- i. Agru,
- j. Friatech,
- k. Plasson

3.0 GI PIPE

- a. Swastik Pipe Ltd.
- b. Jindal Industries Ltd.
- c. Vishal Pipes Ltd.
- d. Indus Tubes Ltd
- e. Advance steel Tubes Ltd.
- f. Good Luck Tubes Ltd.
- g. Surya Roshni Limited
- h. APL Apollo Tubes Limited
- i. Jindal Pipes Limited
- j. RK Steel Manufacturing Company Private Limited
- k. PSL Tubes Limited

4.0 CASTING GI FITTINGS

- a. Sarin Industries Ltd.
- b. Jupiter Metal Industries Ltd.
- c. Jainsons Industries Ltd.
- d. Jinan Meide Casting Co. Ltd.
- e. Green Malleable Pvt. Ltd.
- f. Chandan Enterprises



- g. Unique Pipe Fitting Co

5.0 FORGED GI FITTING (FOR HIGH RISE SEGMENT)

- a. Jainsons Industries
b. B.M. Meters Pvt. Ltd.

6.0 COPPER TUBES & FITTINGS

- a. Jay Banas Mehta Tubes Limited- Trade Mark "MEXFLOW"
b. Rajco metal (Tubes & Fittings)
c. Paras Industries
d. MERCURE METAL & ALLOYS PVT LTD
e. Chandan Enterprises (Fittings only)

7.0 BRASS VALVES

- a. Universal srl, Italy
b. Tiemme Raccorderie Sede, Italy
c. Enolgas Bonimu s.a.s., Italy
d. Fratelli Fortis s.r.l, Italy
e. Giacomo Climbrio, Italy
f. Parker Hannifin S.P.A., USA
g. Singapore Valve & Amp; Fittings Pte Limited, Singapore /Bengaluru
h. Rubinetterie Utensilerie Bonomi (RUB), Italy
i. Zhegiang Valogin Technology Co. Ltd., China,
j. Ningbo Zhiqing Industrial Co. Ltd., China,
k. Zhegiang Dunan Valve Co. Ltd.,
l. Ningbo Huaping, China.
m. Chandan Enterprises

8.0 Isolation & Appliance valves

- a. Chandan Enterprises

9.0 BRASS FITTINGS

- a. Chandan Enterprises
b. Paras Industries Ltd.
c. Chokhawala Distributors – Brass Adaptor.

10.0 STEEL RE-INFORCED RUBBER HOSE (TYPE-4)



ENERGISING QUALITY

LIST OF RECOMMENDED VENDORS FOR BOUGHT OUT ITEMS

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- a. Super Seal Flexible Hose Ltd.
- b. Suraksha Products Pvt. Ltd.
- c. Vansh Industries
- d. T & L Gases

11.0 CORRUGATED FLEXIBLE METAL HOSES (ANACONDA)

- a. KPC Flex Tubes
- b. Vestas Hose Division
- c. Alpha Flexi Tubes
- d. Chandan Enterprises

Note:

1. Vendor may procure material from any of approved vendors listed.
2. For equipment/components other than the above, vendor shall submit past track record for the proposed sub-vendors and obtain written approval from Owner / Consultant before placing order.
3. In case of exigencies like long delivery periods from approved vendors, the contractor shall list down the proposed suppliers/vendors for such items and submit the same for owner review/approval along with necessary documents/PTR.
4. Non-acceptance of a particular proposed vendor due to any reasons whatsoever shall not be a cause of schedule and cost implication. If equipment is sourced from outside India, vendor shall obtain prior approval for make of equipment before placement of order.

Above mentioned vendor list is tentative and further addition/deletion may be done as per discretion of Owner/VCS.



Energising Quality

LIST OF AUTHORIZED THIRD-PARTY INSPECTION AGENCY (TPIA)

DOC. NO.- VCS-C&P-TPIA-001

Rev No : 17

SL. NO.	NAME OF TPIA
1	Det Norske Veritas (DNV)
2	Germanischer Lloyd Industrial Services GmbH
3	Bureau Veritas (India) Pvt. Ltd.
4	Moody International (India) Pvt. Ltd. (Industry Services Division)
5	SGS India Pvt. Ltd.
6	Certification Engineer International Limited (CEIL)
7	TÜV SÜD South Asia Pvt. Ltd.
8	ABS Industrial Verification (India) Pvt. Ltd.
9	Lloyd Register of Industrial Services
10	IRCLASS Systems and Solutions Private Limited
11	Tata Projects Limited
12	International Certification Services Pvt. Ltd.
13	TUV India Pvt. Ltd., Industrial Services Division
14	Intertek India Pvt. Ltd. (Industry Services Division)
15	Quality Austria Central Asia Pvt. Ltd.
16	Edlipse Engineering Global Pvt. Ltd.
17	TUV-Rheinland
18	Hertz Inspection & Services Pvt Ltd
19	Alfred H Knight India Pvt Ltd (Formely known as Dr. Amin Controllers Pvt Ltd)