



VCS Quality Services Private Limited

TENDER FOR

COMPOSITE WORK OF (MECHANICAL & ELECTRICAL WORKS) AT CNG OLS & DBS STATIONS (12 Nos. of DBS STATIONS & 3 Nos. of OLS STATIONS AT NAGALAND GA)

CITY GAS DISTRIBUTION NETWORK IN NAGALAND GA

TENDER NO.: HOGPL/VCS/25-26/C&P-NL/WC/CW/045

VCS REF. NO. VCS/HOGPL/261162/WC/2026/003-R

DATE: 24/03/2026

TECHNICAL VOLUME

(Volume II of II)



HPOIL GAS PRIVATE LIMITED



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 ENERGISING QUALITY		PROJECT NUMBER: C261162					
PROJECT SCOPE OF WORK					Total Sheets		08
Document No		C261162	CGD	PL	BSOW	001	
HPOIL GAS PRIVATE LIMITED (HOGPL) CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS NAGALAND GA SCOPE OF COMPOSITE WORK OF (MECHANICAL&ELECTRICAL WORKS) AT CNG OLS & DBS STATIONS (12 Nos. of DBS STATIONS & 3 Nos. of OLS STATIONS AT NAGALAND GA PROJECT AT NAGALAND GA							
C1	07.01.2026	Issued for Client Review	PT	PA	DK		
Rev	Date	Description	Prepared By	Checked By	Approved By		



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

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

2.0 PROJECT SCOPE OF WORK

The scope of work includes **COMPOSITE WORK OF CNG STATIONS** at NAGALAND GA.

The scope of work includes, MECHANICAL and ELECTRICAL Works.

2.1 MECHANICAL

This document covers the details of supply and installation of mechanical equipment at CNG Stations at NAGALAND GA. It includes installation of Cascades, and supply and installation of Fire extinguisher and trailer panel etc. All works and clauses of this document shall be applicable unless specifically mentioned otherwise.

This document shall be read in conjunction with Schedule of Rates, specifications, standards, drawings, and other documents forming a part of the Tender Document.

2.1.1 The scope of work given below: -

- Supply & Installation of Above Ground Piping
- Supply and installation of all fittings
- Welding, Radiography, Painting etc.
- Supply and installation Fire Fighting Equipment
- Supply & Installation of Signage Board.
- Supply and Installation of LCV Filling facility (Trailer Panel) with mass flow meter, flow range (0 to 100 kg/min) along with associated fittings & consumables - 1 Nos at each station.
- Supply, erection, laying, testing and safely commissioning of SS tubing, fittings, Ferrules, and valves and necessary adaptors, clamps, brackets etc., as required from compressor priority panel to mobile cascade, stationary cascade, DRS and dispenser of Online stations as per the tentative quantities mentioned in the SOR, Standard technical specifications of the SS tube and Fittings.

For Detail Scope of Work, please refer Doc No. - C261162-00-PP-SOW-001 in Mechanical Tender Document

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CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

2.2 ELECTRICAL

2.2.1 The scope of work given below: -

2.2.1.1 Supply & Installation of 11/0.433 kV, 315 KVA copper wound Distribution Transformer complete with accessories and systems as mentioned below.

- Distribution Transformer with Double Pole, Gang switch, overhead Conductor of suitable rating and all necessary accessories for completion of work including tapping from existing HT line etc. complete as per specification, SOR and requirement of approval from respective electricity/statutory authority.
- All electrical work i.e., charging of transformer, pole mounted substation, tapping from battery limit of electricity board shall be carried out in supervision of respective authority including necessary approval, if required.
- Double pole structure with AB Switch, Lightning arrestors, horn gap fuse, copper wire jumpers up to transformer HT terminals.
- ACSR conductor, 9m MS joint/pole, Pin insulator and G I hardware etc. as required from respective state electricity board battery limit up to double pole structure inside mother station.
- Supply & Laying of Cables between transformer LT terminals of transformer & load break fuse switch unit, cable supports, double compression cable glands, lugs etc. as required.
- Supply & laying of 400 A TPN, AC-23 duty switch fuse disconnecter in outdoor type dust & weather proof steel enclosure.

2.2.1.2 415V, 25 kA Single Front Indoor, fixed type, LT Panel to receive and distribute power to all electrical equipment etc. as per SLD No. **C261162-NL-EL-SLD-4002**. Cable gland plate of suitable size & of minimum 3mm thickness shall be provided for cable termination, wherever required, for all the electrical panels (MEDB, UPSDB etc.). The MFM of MEDB shall have provision for energy metering also and valid calibration report shall be submitted of the same. Type1+Type2 Surge protection device to be provided for both incoming feeders. Both the feeders should have electrical interlock between them as shown in SLD. The MEDB should have provision to send signal to AMF panel during mains failure and on restoration of grid power to ensure auto ON/OFF of DG.

2.2.1.3 63 kVA rating diesel engine driven emergency generator with AMF panel. There shall be provision of transfer of power to DG set in case of mains failure and re- transfer to mains on restoration of mains supply

2.2.1.4 Single online UPS (1 nos. X 100% ratings+ bypass with SCVS) 5 kVA, 230V OUTPUT, Industrial UPS with SCVS bypass. The UPS shall be industrial type i.e., having single phase input and single-phase output. The UPSDB shall have a digital meter with provision to display current and voltage ratings. The scope includes incoming cables for UPS & all outgoing cables & cabling work from UPS to UPS ACDB.
1 no. (1 X 100 %) Sealed maintenance free (SMF) VRLA battery bank as per SOR for UPS suitable for 1 hour battery back-up time, with isolator, battery rack, earthing of battery rack, complete.

Battery shall be sized with ageing factor, SoC and temperature derating factors.

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- 2.2.1.5 Power cable (XLPE – insulated armoured Al/Cu conductor 1/2/3/3.5/4 core cables) as per SOR. Scope includes preparation of RCC/ Buried trench, conduiting in roof/walls as required, laying of GI/HDPE pipes and laying of cables in RCC/buried trenches, pipes and cable trays etc. along with termination of cables using cable glands of proper sizes. FLP (CMIFR tested, PESO approved) type double-compression nickel-plated brass cable glands, tinned- copper lugs, clamping material etc. shall be used for cable termination in FLP street lights.
- 2.2.1.6 HDPE pipes GI Cable-trays and accessories like, cable markers, identifier tags, GI saddles and all other associated accessories for cable-laying.
- 2.2.1.7 Flameproof Lights suitable for outdoor and indoor lighting and flameproof exhaust fan for battery room as per SOR. GI poles of 6-meter height to be installed for street lights complete with swan neck/ bracket for lighting fixture mounting. FLP JB to be used for street light poles installed in hazardous area.
- 2.2.1.8 Supply of light-weight collapsible aluminum trolley step ladder of 7 M height.
- 2.2.1.9 Fabrication and supply of MS frames, supports, canopies and brackets for miscellaneous electrical equipment, including welding, supply of bolts, nuts etc. for mounting and other necessary supplies, all inclusive of painting as specified.
- 2.2.1.10 Earthing & Lightning Protection system Complete with conventional GI pipe/Copper plate earth electrode, GI/Copper strips as per SOR.
- 2.2.1.11 Safety materials and Insulated Rubber Mats to withstand High Voltages as per IS 15652 to be placed in front of all Electrical panels.
- 2.2.1.12 Supply & Installation of 1.5T, 5-star Split Air Conditioners with stabilizer and mounting stand. Scope includes all necessary accessories like clamps, pipes etc.
- 2.2.1.13 Emergency shutdown button to be provided in sales/office room and one flameproof emergency shutdown button each to be provided on Dispenser Island and compressor fencing. The button shall trip both the incomers to MEDB and also the UPSDB incomer. For Detail Scope of Work, please refer Doc No. – C261162-NL-EL-SLD-4002. in Electrical Tender Document

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 ENERGISING QUALITY	PROJECT NUMBER: C261162				
SCOPE OF WORK MECHANICAL			Total Sheets		06
Document No	C261162	CGD	PL	SOW	001
HOGPL GAS PRIVATE LIMITED CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS NAGALAND GA SCOPE OF COMPOSITE WORK OF (MECHANICAL & ELECTRICAL WORKS) AT CNG OLS & DBS STATIONS (12 Nos. of DBS STATIONS & 3 Nos. of OLS STATIONS AT NAGALAND GA					
C1	07.01.2026	Issued for Client Review	PT	PA	DK
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1.0 INTRODUCTION

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

2.0 OVERALL SCOPE OF MECHANICAL WORKS FOR CNG STATION

The scope of work includes Mechanical Works for CNG stations at Dimapur in Nagaland GA.

All materials and consumables (e.g., Valves, Fittings, Flanges, Assorted Pipes etc.) of below 2 inches required for satisfactory completion of the job shall be in the scope of the Contractor except free issue material provided by Owner. It shall include Supply, Erection, Testing and safely commissioning of all items required for completion of all the jobs mentioned in scope of work including inspection of all supply items but not limited to above. Wherever it is mentioned in the Specifications or Scope of Work that the Contractor shall perform certain work or provide certain facilities, contractor shall execute the work without any extra charges.

2.1 Scope – Mechanical

This document covers the details of supply and installation of mechanical equipment at CNG Stations at Dimapur in Nagaland. It include installation of Cascades, and supply and installation of Fire extinguisher and trailer panel etc. All works and clauses of this document shall be applicable unless specifically mentioned otherwise.

This document shall be read in conjunction with Schedule of Rates, specifications, standards, drawings and other documents forming a part of the Tender Document.

3.0 SCOPE OF SUPPLY

The detail scope of work given below: -

3.1 MOTHER STATION

- Supply & Installation of Above Ground Piping
- Supply and installation of all fittings
- Welding, Radiography, Painting etc.
- Supply and installation of 75 kg capacity DCP type (trolley mounted)
- Supply and installation of 9 kg capacity DCP fire extinguisher
- Supply and installation of 4.5 kg capacity CO2 fire extinguisher
- Supply and Installation of LCV Filling facility (Trailer Panel) with mass flow meter,

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flow range (0 to 100 kg/min) along with associated fittings & consumables - 1 Nos at each station.

- Supply, erection, laying, testing, and safely commissioning of SS tubing, fittings and valves and necessary adaptors, clamps, brackets etc., as required from compressor priority panel to mobile cascade, stationary cascade, DRS and dispenser of Online stations as per the tentative quantities mentioned in the SOR, Standard technical specifications of the SS tube and Fittings.

4.0 BASIS OF WORK

- 4.1 The design, construction, manufacture, supply, testing and other general requirements of the Fire Extinguisher shall be strictly in accordance with the applicable OISD codes, technical specification, approved drawing. /Document and shall comply fully with relevant National/ International standards, Indian Electricity Act, Indian Electricity Rules, regulations of Insurance Association of India and Factories Act while carrying out work as per this specification.
- 4.2 Any modification suggested by the statutory bodies either during drawing approval or during inspection, if any, shall be carried out by the Bidder without any additional cost and delivery implications.
- 4.3 Following codes, standards and regulations & all their subsequent amendments to be considered:
- OISD-179
 - OISD-226
 - PNGRB-T4S-CGD
 - PETROLEUM RULES-2002
 - GAS CYLINDER RULES-2004/2016 (GOVT. OF INDIA)
 - GUIDELINES OF CHIEF CONTROLLER OF EXPLOSIVES.

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- 4.4 The design, construction, manufacture, supply, testing and other general requirements of the Fire Extinguisher shall be strictly in accordance with the applicable OISD codes, technical specification, approved drawing. /Document and shall comply fully with relevant National/ International standards, Indian Electricity Act, Indian Electricity Rules, regulations of Insurance Association of India and Factories Act while carrying out work as per this specification.
- 4.5 Any modification suggested by the statutory bodies either during drawing approval or during inspection, if any, shall be carried out by the Bidder without any additional cost and delivery implications.
- 4.6 Following codes, standards and regulations & all their subsequent amendments to be considered:
- OISD-179
 - OISD-226
 - PNGRB-T4S-CGD
 - PETROLEUM RULES-2002
 - GAS CYLINDER RULES-2004/2016 (GOVT. OF INDIA)
 - GUIDELINES OF CHIEF CONTROLLER OF EXPLOSIVES.

5.0 STORAGE OF MATERIALS

- 5.1 All materials shall be preserved against deterioration and corrosion due to poor or improper storage while under the custody of the Contractor.
- 5.2 All materials shall be duly protected by the Contractor at his own cost with the appropriate preservatives like primer, lacquer, coating, grease etc. and shall be covered with suitable material to prevent them from direct exposure to sun, rain, wind and dust.
- 5.3 The Contractor shall check that equipment's, pipes, specials etc. are not subjected to corrosion from hydrostatic test water. Any such condition when detected should be brought to the notice of Engineer-in-Charge and remedial measures taken as directed.
- 5.4 All machined surface shall be properly greased and should be maintained and protected from damages.

6.0 AS-BUILT DOCUMENTS

- 6.1 Three sets of hard copies of following documents shall be submitted by Contractor:
- (i) Updated as-built drawings (made earlier) of Piping GAD's.
 - (ii) Project Records
 - (iii) Isometrics
- 6.2 In addition, the above documents shall also be submitted in electronic media i.e., CD

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ROM diskettes. Software used for the presentation of these documents shall be as follows:

Type of document	Software
Reports	MS Word/ Excel
Drawings	AutoCAD

- 6.3 For the purpose of preparation of as-built drawings, Contractor shall update the "Issued for Construction" (IFC) drawings approved by the Company. Contractor shall be provided with electronic file of all 'IFC' drawings/ alignment sheets. Contractor shall update all the drawings issued by the Company. As-built drawings shall be prepared on AutoCAD.

7.0 DOCUMENTS TO BE SUBMITTED AT THE TIME OF BIDDING

- 7.1 No technical documents are required to be submitted at the time of bidding. Bidder is advised to comply with all the requirements of bid document without any deviations. Company reserves the right to reject any bid with deviations without making any reference to bidder.

8.0 GENERAL

In case of conflict between the requirements given in this document and the requirements of other specifications enclosed with the tender document, the requirements specified in Scope of Work document shall govern.

Should there be conflict, discrepancy, inconsistency, or dispute between the various documents, they shall be referred in the order of priority as given below:

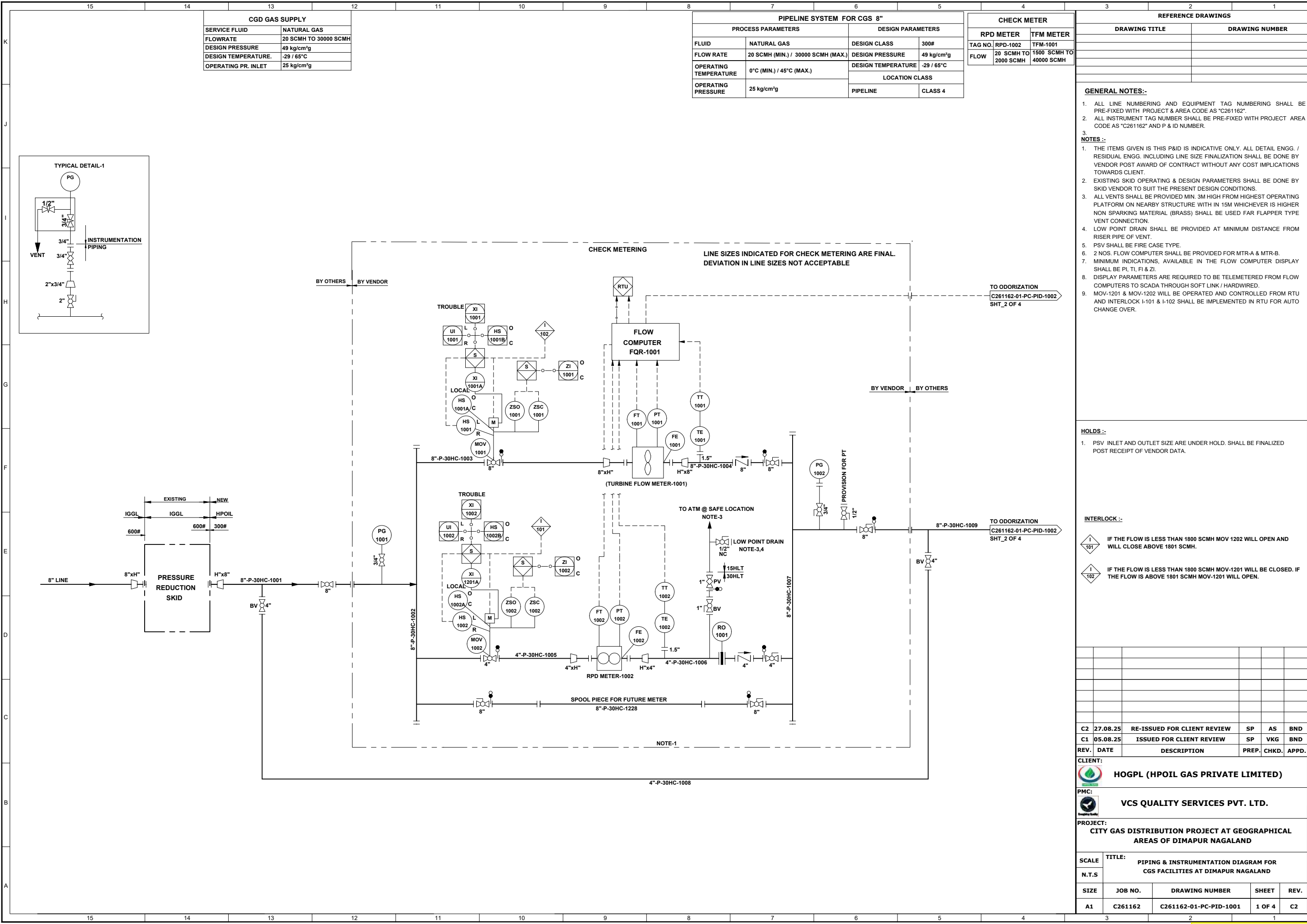
- Scope of work.
- Schedule of Rates.
- P & ID's
- IFC drawings
- Specifications
- Standards

9.0 AS BUILT DOCUMENT

On successful completion, the Contractor shall prepare As Built drawings / reports piping system as specified in scope of work. All "As Built" drawings / reports shall be submitted as below.

- All inspection & testing documents.
- All purchase specification & procurement documents.
- All piping GA drawings and supports at terminals.
- Installation and testing reports.
- All Inspection, Testing and NDT records. Radiographs/ UT of all weld joints.

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CGD GAS SUPPLY	
SERVICE FLUID	NATURAL GAS
FLOWRATE	20 SCMH TO 30000 SCMH
DESIGN PRESSURE	49 kg/cm ² g
DESIGN TEMPERATURE	-29 / 65°C
OPERATING PR. INLET	25 kg/cm ² g

PIPELINE SYSTEM FOR CGS 8"			
PROCESS PARAMETERS		DESIGN PARAMETERS	
FLUID	NATURAL GAS	DESIGN CLASS	300#
FLOW RATE	20 SCMH (MIN.) / 30000 SCMH (MAX.)	DESIGN PRESSURE	49 kg/cm ² g
OPERATING TEMPERATURE	0°C (MIN.) / 45°C (MAX.)	DESIGN TEMPERATURE	-29 / 65°C
OPERATING PRESSURE	25 kg/cm ² g	LOCATION CLASS	
		PIPELINE	CLASS 4

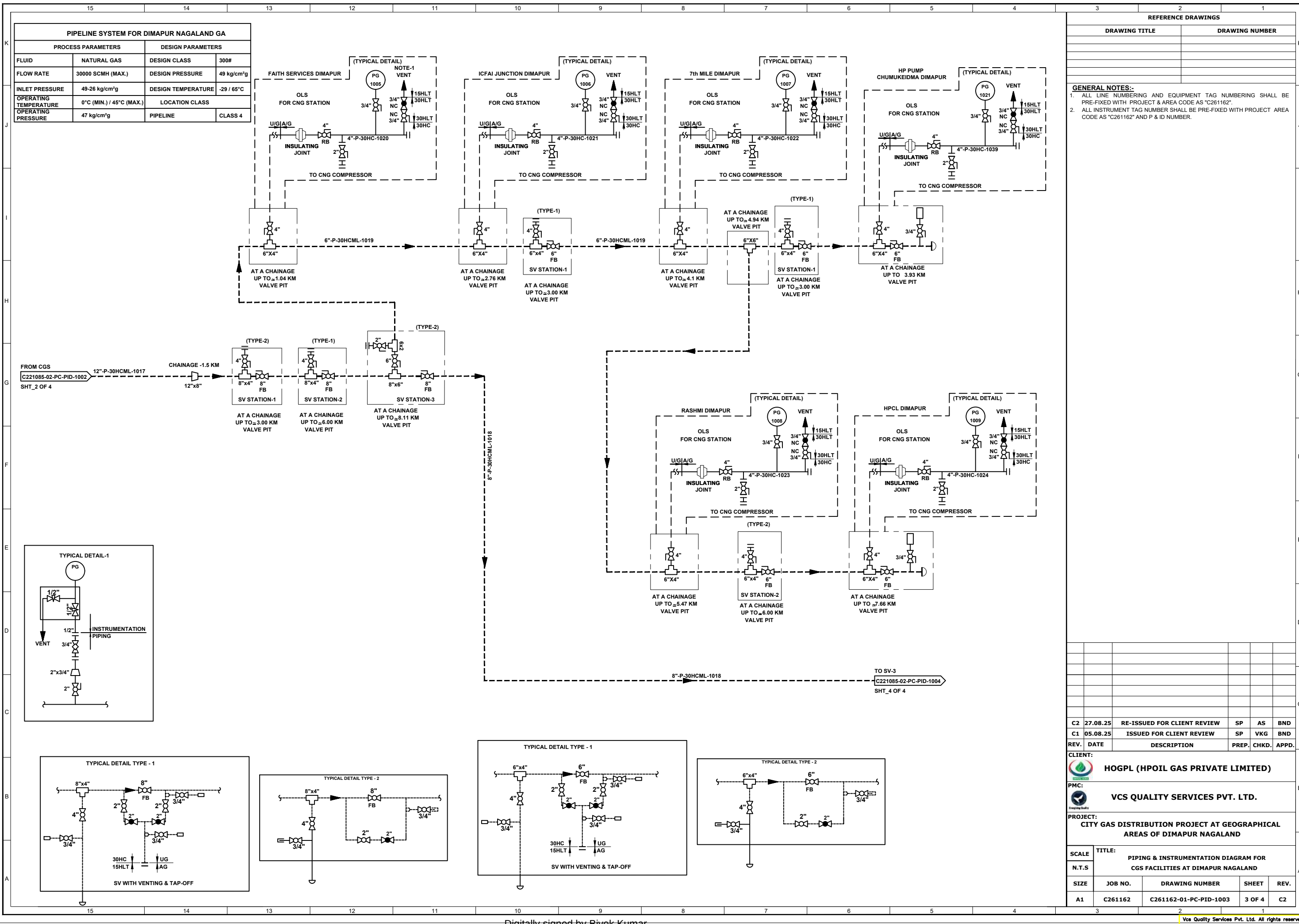
CHECK METER	
RPD METER	TFM METER
TAG NO. RPD-1002	TFM-1001
FLOW 20 SCMH TO 2000 SCMH	1500 SCMH TO 40000 SCMH

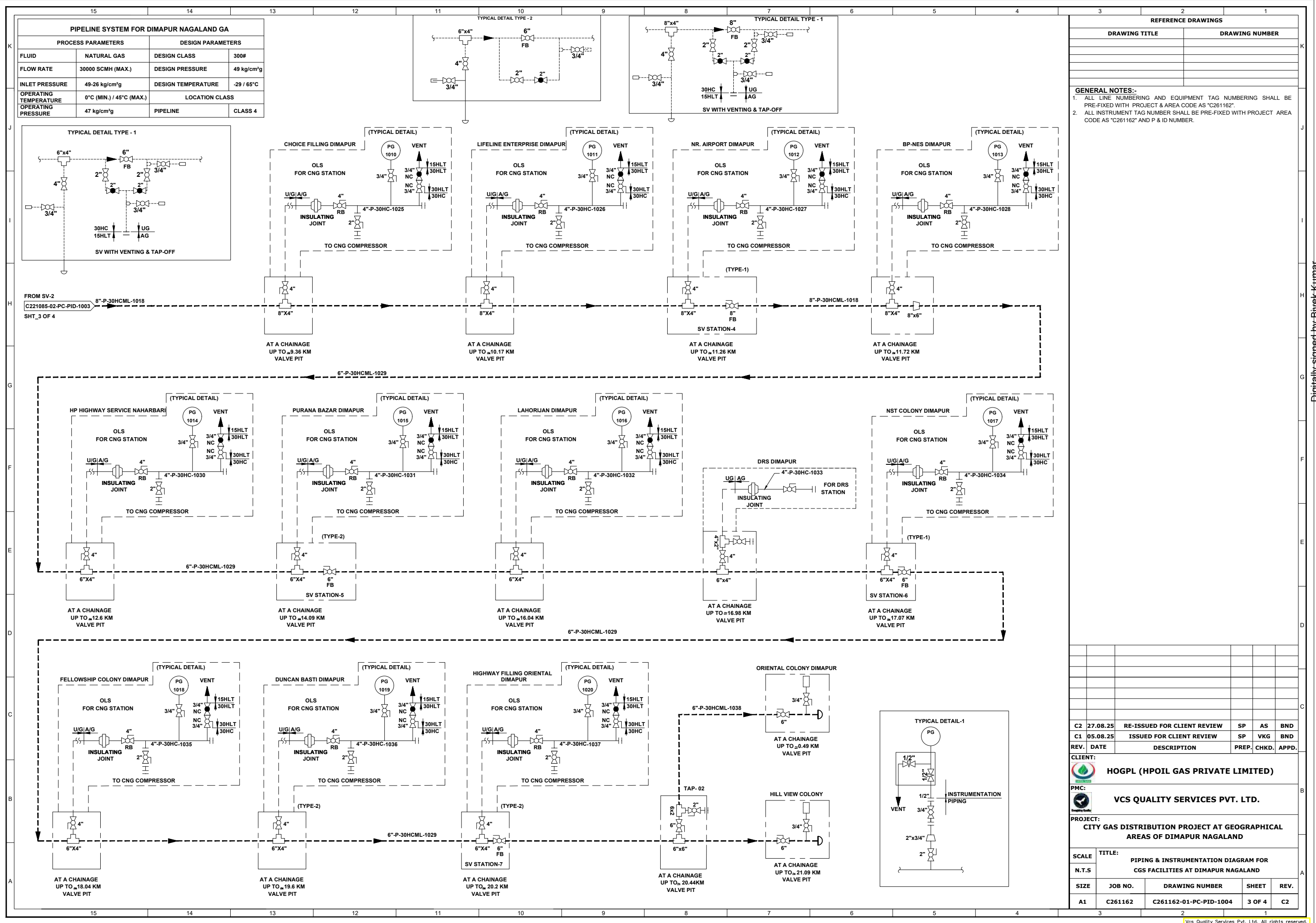
REFERENCE DRAWINGS	
DRAWING TITLE	DRAWING NUMBER

- GENERAL NOTES:-**
- ALL LINE NUMBERING AND EQUIPMENT TAG NUMBERING SHALL BE PRE-FIXED WITH PROJECT & AREA CODE AS "C261162".
 - ALL INSTRUMENT TAG NUMBER SHALL BE PRE-FIXED WITH PROJECT AREA CODE AS "C261162" AND P & ID NUMBER.
- NOTES :-**
- THE ITEMS GIVEN IN THIS P&ID IS INDICATIVE ONLY. ALL DETAIL ENGG. / RESIDUAL ENGG. INCLUDING LINE SIZE FINALIZATION SHALL BE DONE BY VENDOR POST AWARD OF CONTRACT WITHOUT ANY COST IMPLICATIONS TOWARDS CLIENT.
 - EXISTING SKID OPERATING & DESIGN PARAMETERS SHALL BE DONE BY SKID VENDOR TO SUIT THE PRESENT DESIGN CONDITIONS.
 - ALL VENTS SHALL BE PROVIDED MIN. 3M HIGH FROM HIGHEST OPERATING PLATFORM ON NEARBY STRUCTURE WITH IN 15M WHICHEVER IS HIGHER NON SPARKING MATERIAL (BRASS) SHALL BE USED FAR FLAPPER TYPE VENT CONNECTION.
 - LOW POINT DRAIN SHALL BE PROVIDED AT MINIMUM DISTANCE FROM RISER PIPE OF VENT.
 - PSV SHALL BE FIRE CASE TYPE.
 - 2 NOS. FLOW COMPUTER SHALL BE PROVIDED FOR MTR-A & MTR-B.
 - MINIMUM INDICATIONS, AVAILABLE IN THE FLOW COMPUTER DISPLAY SHALL BE PI, TI, FI & ZI.
 - DISPLAY PARAMETERS ARE REQUIRED TO BE TELEMETERED FROM FLOW COMPUTERS TO SCADA THROUGH SOFT LINK / HARDWIRED.
 - MOV-1201 & MOV-1202 WILL BE OPERATED AND CONTROLLED FROM RTU AND INTERLOCK I-101 & I-102 SHALL BE IMPLEMENTED IN RTU FOR AUTO CHANGE OVER.

- HOLDS :-**
- PSV INLET AND OUTLET SIZE ARE UNDER HOLD. SHALL BE FINALIZED POST RECEIPT OF VENDOR DATA.
- INTERLOCK :-**
- IF THE FLOW IS LESS THAN 1800 SCMH MOV 1202 WILL OPEN AND WILL CLOSE ABOVE 1801 SCMH.
 - IF THE FLOW IS LESS THAN 1800 SCMH MOV-1201 WILL BE CLOSED. IF THE FLOW IS ABOVE 1801 SCMH MOV-1201 WILL OPEN.

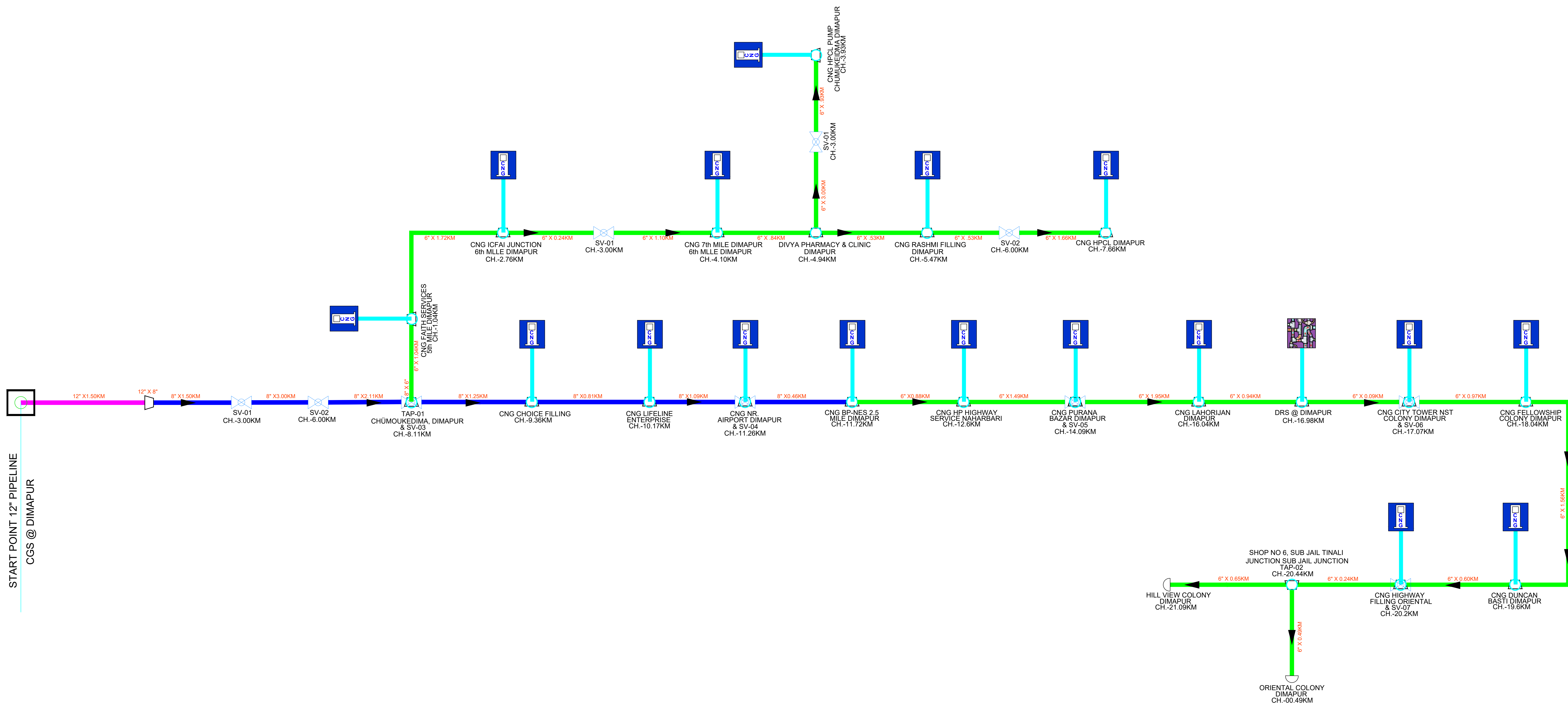
C2	27.08.25	RE-ISSUED FOR CLIENT REVIEW	SP	AS	BND
C1	05.08.25	ISSUED FOR CLIENT REVIEW	SP	VKG	BND
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
CLIENT: HOGPL (HPOIL GAS PRIVATE LIMITED)					
PMC: VCS QUALITY SERVICES PVT. LTD.					
PROJECT: CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF DIMAPUR NAGALAND					
SCALE	TITLE: PIPING & INSTRUMENTATION DIAGRAM FOR CGS FACILITIES AT DIMAPUR NAGALAND				
N.T.S					
SIZE	JOB NO.	DRAWING NUMBER	SHEET	REV.	
A1	C261162	C261162-01-PC-PID-1001	1 OF 4	C2	



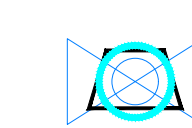
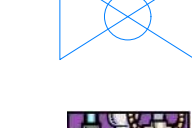
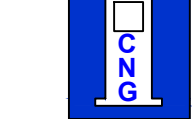


PIPELINE SCHEMATIC DRAWING

FOR :- DIMAPUR



LEGEND:

-  TAP OFF POINT WITH SECTIONALIZING VALVE
-  TAP OFF POINT
-  SECTIONALIZING VALVE
-  DISTRICT REGULATING STATION
-  RO STATION
-  6" PIPELINE
-  8" PIPELINE
-  12" PIPELINE

0	05.08.25	ISSUED FOR CONSTRUCTION	PUN	AS	BND
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
CLIENT:		HOGPL (HPOIL GAS PRIVATE LIMITED)			
PMC:		M/s. VCS QUALITY SERVICES PVT. LTD. PLOT #22, UNIT NO. 1109-1116, TOWER-4, ABC SECTOR-135, NOIDA - 201304			
TITLE		SCHEMATIC ARRANGEMENT OF PIPELINE FACILITIES FOR DIMAPUR GA			
SCALE	NTS	DWG. NO.	C261162-01-PL-SCMH-001	REV-0	



VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION FOR WELDING OF ONSHORE HYDROCARBON PIPELINE

VCS-SS-PP-2019

					
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.

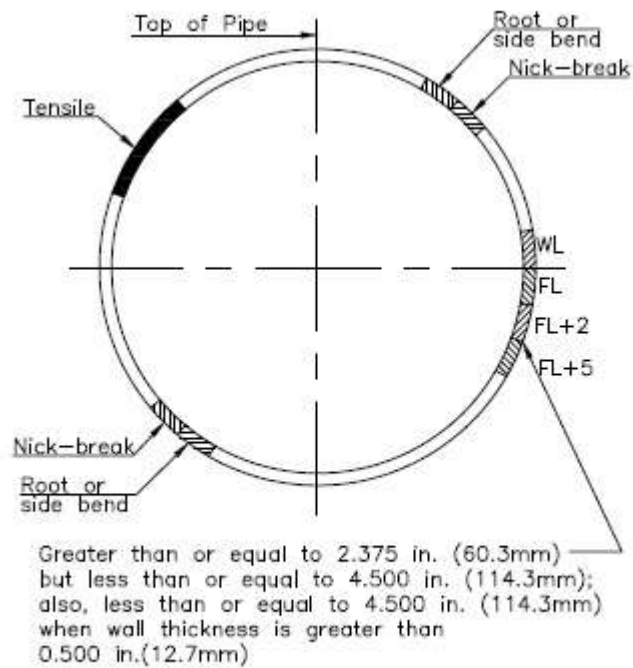
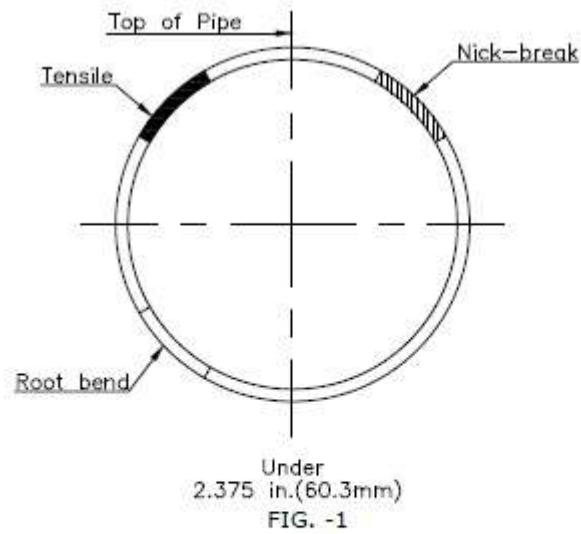
The test shall be carried out at laboratories approved by the COMPANY. The specimens shall be prepared in accordance with the figures given in the paragraphs that refer to the individual test.

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.



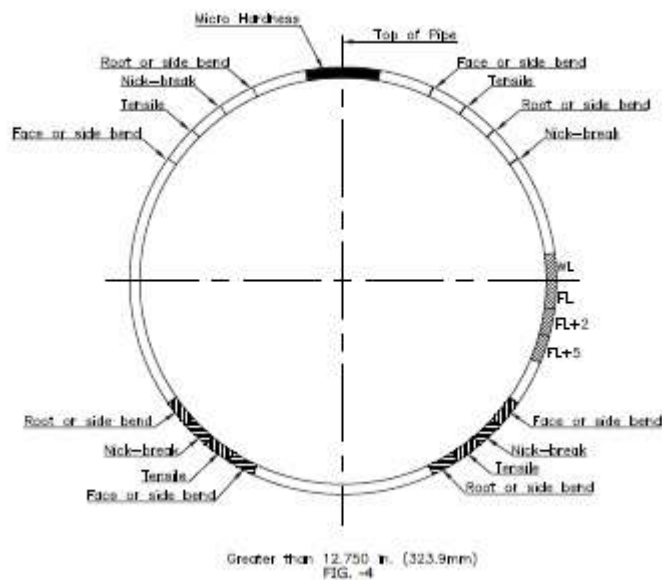
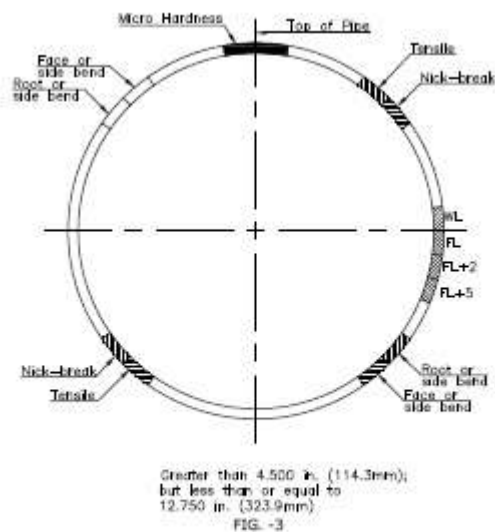


TABLE 1

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 break 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 Jaeger 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

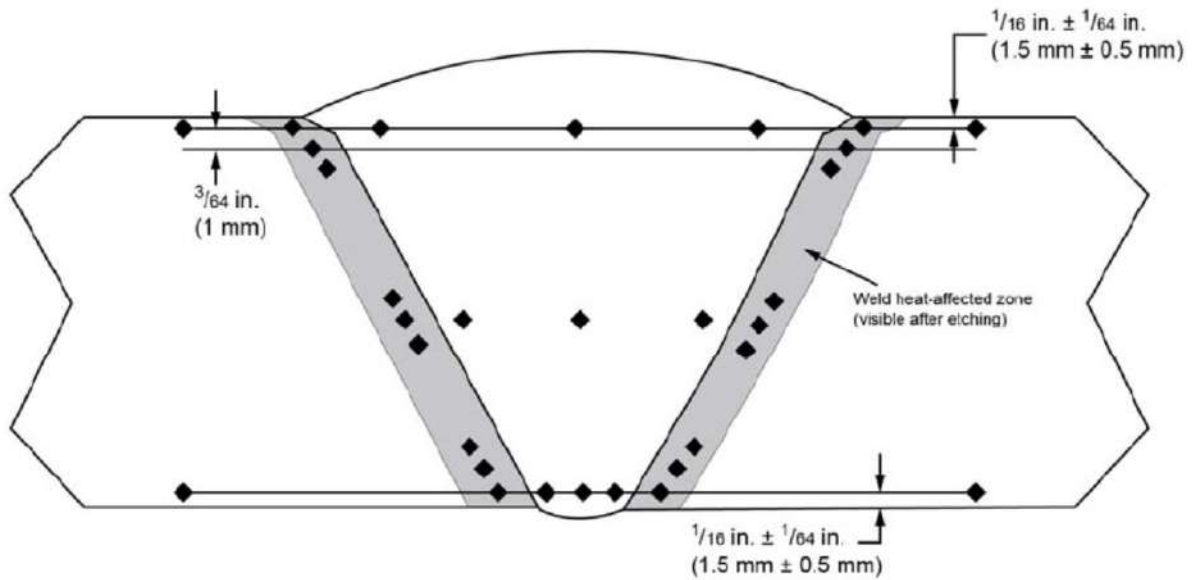
EXHIBIT- F

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

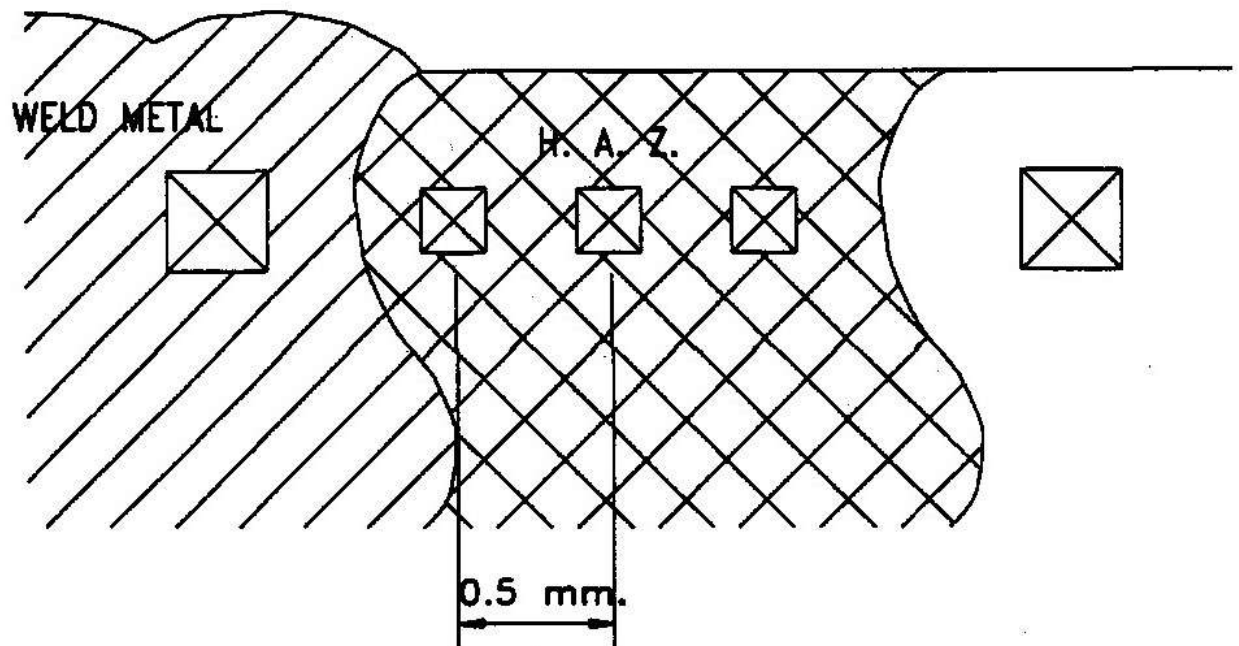


FIGURE 5
HARDNESS TESTING OF WELD JOINTS – SCHEMATIC

NOTCH POSITIONS

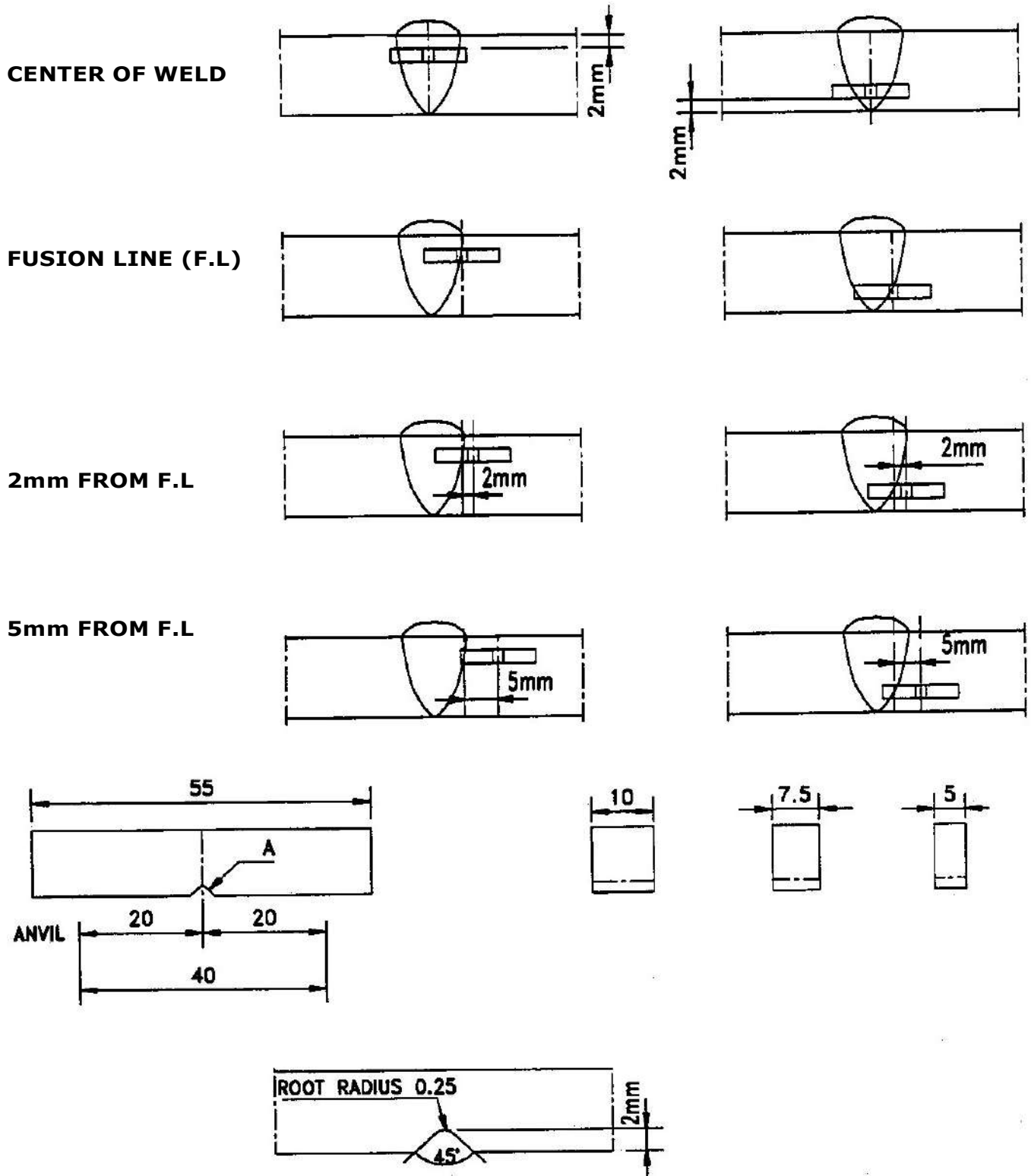


FIGURE 6
CHARPY V – NOTCH TEST SPECIMEN

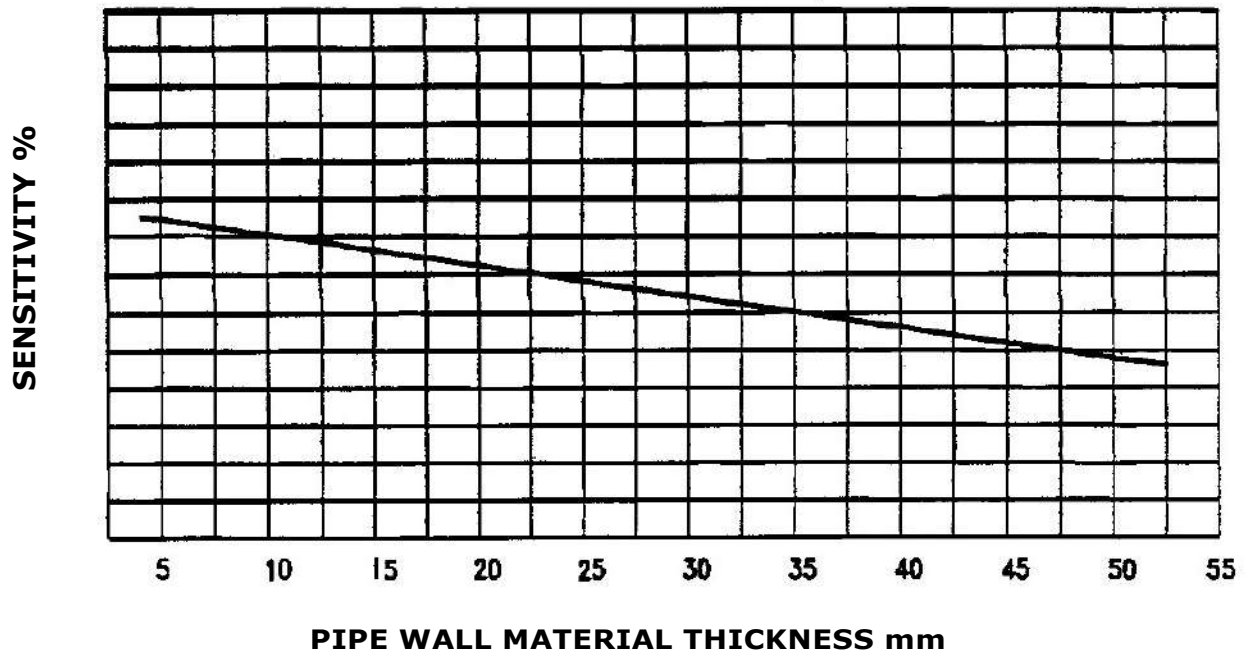


Figure-7

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



ENERGISING QUALITY

VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION FOR PRE-COMMISSIONING & COMMISSIONING OF PIPELINE SYSTEM

VCS – SS – PP - 2022

					
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ABBREVIATIONS:

NACE	National Association of Corrosion Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing of Materials
BHN	Brinell hardness number
MSS-SP	Manufacturers Standardization Society - Standard Practice
LTCS	Low temperature Carbon Steel AS Alloy Steel



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1.0 SCOPE

The specification covers the minimum technical requirements for testing and commissioning of entire pipeline facilities including Commissioning activities such as pre-commissioning checks, dewatering, swabbing, flushing/blowing, leak testing etc.

2.0 GENERAL

The scope of work for testing & commissioning including Pre – Commissioning activities shall include but not limited to the manpower, machinery & equipments, detailed Procedures, Materials & Consumable, Communications etc. to perform the work satisfactorily.

Contractor shall prepare detailed procedures for piping, dewatering, swabbing, pigging & commissioning of the pipeline, covering all aspects of work for owner's approval.

Contractors shall design & supply all temporary line connections Valves, Instruments, as required during the various operations.

In the event of any details which are not fully addressed, it is warranted by Contractor that work shall be performed in accordance with the specification & the best recognized practices in the onshore pipeline industry.

3.0 RESPONSIBILITY OF CONTRACTOR

The pipeline contractor shall be responsible for all the pre-commissioning and commissioning activities that need to be carried out for the project.

3.1 Pre-commissioning

In order to execute and perform pre-commissioning activities, the pipeline contractor shall be responsible for (but not limited to) the following: -

- Carrying out pre-commissioning checks of the pipeline system including Tap-off Stations/Receipt Stations, Sectionalizing Valve (SV) Stations and their associated facilities under the scope of work to ascertain that the project has been mechanically completed in all respects.
- Checking of field instruments, laying out survey of pipeline, checking of communication system, checking of Electrical, Instrumentation system, controls & interlock etc.
- Dewatering of Pipeline and above ground piping, flushing/air-blowing and leak testing of piping i.e. piping and equipments under their scope of work.
- Supply and supervision of manpower for pre-commissioning.
- Operation of machinery and equipment for pre-commissioning.
- Supply and use of materials/consumables as required for the pre-commissioning activities.

- Erection of all temporary facilities like pig launcher/receiver, line connections, spool pieces, pigs and requisite accessories, valves, instruments, manpower etc. as required during various operations.
- Preparation of detailed pre-commissioning procedures, activity schedules, bar charts, schemes etc.

This shall include preparation of detailed procedures for dewatering, electronic geometric pigging / caliper pigging (By other Contractor), idle time preservation (if applicable), removal of idle time preservers (if applicable, flushing/blowing, leak testing and shall address the sequence and methodology describing all operations, data on materials, equipments, instruments, consumables (e.g. Pigs and associated items), communication systems, necessary calculations, detailed time schedule and organization chart.

- All necessary work to perform the job successfully including all modifications that would be required at various stages.

The pipeline contractor shall demonstrate to the Owner / Consultant (for approval) the successful completion of all the above-mentioned activities.

In the event of any detail, which is not fully addressed, the pipeline contractor should warrant that work shall be performed in accordance with the relevant codes, Owner / Consultant's specifications and the best recognized engineering guidelines and practices being followed in the on-shore gas pipeline industry.

3.2 Commissioning

In order to execute and perform commissioning related activities, the pipeline contractor shall be responsible for providing all support/ assistance required for commissioning under the overall guidance and supervision of Owner / Consultant. Contractor shall submit a detailed commissioning procedure for Owner / Consultant approval.

The pipeline contractor shall be also responsible to coordinate with the Composite Contractor(s), who is responsible for commissioning of the cathodic protection of the entire pipeline so that the commissioning process can proceed uninterrupted in a harmonious manner for the entire project.

Commissioning assistance broadly covers the following activities:

- Commissioning checks including Safety Review prior to start of commissioning activities to achieve 'Ready for commissioning' status for pipeline
- Surveillance of pipeline and attending leaks and operation of SVs and metering station (at Dispatch Station/Tap-Off Station/Receipt Stations, IDS whenever required).
- Supply and supervision of manpower for commissioning. Manning of SV and Tap-Off Station/Receipt Stations for pig tracking, pig receiving and other activities.
- Supply and operation of machinery and equipment for commissioning, if required.
- Supply of Nitrogen and its associated accessories for purging required for carrying out commissioning.
- Supply and use of materials/consumables as required for the commissioning activities.

- Any other assistance required by Owner / Consultant.
- Erection and supply of all temporary line connections, spool pieces, strainers, valves, instruments, manpower etc. as required during various operations.
- Ensuring all communication facilities is in place and in proper working condition prior to start of commissioning activities of the pipeline system.
- Stabilization and total system operation for 72 hrs. with all instruments controls & interlocks working satisfactorily at normal operating conditions. On completion of this stage one-month operating run period will start.
- All necessary work to perform the job successfully including all modifications that would be required.

In the event of any detail, which is not fully addressed, contractor should warrant that work should be performed in accordance with the relevant codes, Owner's specifications and the best recognized engineering guidelines and practices being followed in the onshore pipeline industry.

3.3 Pre-commissioning Activities

3.3.1 PRE-COMMISSIONING CHECKS

Pre-commissioning checks shall be carried out for the pipeline system to ascertain that the pipeline system has been mechanically completed in all respect. These checks shall cover all the facilities of the main pipeline, including Metering Stations, tap-Off Stations, Receipt Stations, Sectionalizing Valve Stations, as applicable. The pre-commissioning checks shall include the following:

a) System Checks

The entire facilities shall be checked against the latest P&ID's, Engineering and Vendor Drawings/Documents and other design specifications. Any shortcoming observed shall be listed down in the form of punch lists and these should be duly attended or liquidated. The pipeline contractor should check the stations systems from the angle of pre-commissioning and commissioning and spell out any additional requirement of vents/drains, temporary arrangement/modification etc. that may be required during the pre-commissioning and commissioning activities and arrange for the same in consultation with the Owner / Consultant representative.

b) Checking of Field Instrument

All the field instruments like actuated valves, shutdown valves, transmitters, solenoid valves, shut down switches, alarms etc. shall be checked physically and also for their intended application by simulating the actual conditions. It will also include checking of different meters, gauges, action of actuated valves, control valves, shutdown valves etc.

c) Survey of the Pipelines

This shall be performed to confirm that proper fittings/ supports, Cathodic protection system, route markers, warning signs, fencing around SV stations, etc. have been installed along the pipeline.

d) Checking of Communication System

This is to check that there is proper communication with adequate back-up power to ensure uninterrupted communication.

e) Checking of Electrical Distribution System

This is to ensure safety and also to ensure an uninterrupted power supply during start-up and normal pipeline operation.

f) Checking of Instrument, controls & Interlocks

This is to check that instrument controls and interlocks are functional as per the normal operating conditions.

g) Checking of Utilities

This is to check that utilities like power system, etc. are available prior to start-up.

h) Any other checks as may be considered necessary.

**3.3.2 PRE-COMMISSIONING WORKS FOR THE ABOVE GROUND PIPING/ UG PIPELINE
(DISPATCH STATION, METERING STATIONS, RECEIPT STATIONS ETC. UNDER THE SCOPE
OF WORK)**

3.3.2.1 Dewatering (Hydro Test Water)

- General

Dewatering of a piping system shall be done subsequent to the hydro-test of the respective piping section. During the dewatering operation, the major quantity (to the maximum extent possible) of hydro-test water shall be removed from the main interconnecting piping work in the stations. A standard blind shall be arranged and provided at the inlet and outlet nozzles of pumps and sump tank to avoid entry of debris/dirt/mud etc., before start-up of pre-commissioning activities.

- Operational Requirements

The dewatering operation of the piping work in the stations shall consist of physically draining the water content in the piping work by opening low point drains and/or end flanges. If required, air shall be used to push-off water from the pipes. The pipeline contractor shall arrange suitable compressor for such purposes.

- Flushing/Blowing of Aboveground Piping in the Terminal

Flushing/blowing of the above ground piping with water/air to remove debris/dirt/mud from within the piping has to be performed by the pipeline contractor. Subsequent to water flushing, to ensure complete cleanliness of the piping work, air blowing/cardboard blasting method has to be adopted. All instruments, control valves, orifice plates etc. to be dismantled from the piping work and any gap produced should be bridged with suitable temporary spool. Proper supporting of the piping, during such flushing/blowing activities is to be ensured by the pipeline contractor.

The pipeline contractor has to make arrangement of clean water/air for these flushing / blowing activities.

The pipeline contractor should submit a plan/methodology for carrying out such activities detailing out each aspect/step.

- Acceptance Criteria

The pipeline contractor shall specify when flushing/air blowing is completed to the satisfaction of the Owner/Consultant, and shall obtain approval of the Owner/Consultant before proceeding to the next step.

Pipeline

The pipeline contractor has to dewater the pipeline section after hydrotest. After dewatering, swabbing shall be done.

The pipeline contractor should submit a plan/methodology for carrying out such activities detailing out each aspect/ step for review & Approval of Client /EIC/PMC.

The disposal of the water shall be performed such a way that no harm is done to the environment and animals and the Dewatering procedure should indicate this disposal methodology.

3.3.2.2 Swabbing

The swabbing operation, which shall be done subsequent to the dewatering operation, is meant to reduce the remaining water in the pipeline to acceptable condition and to ensure removal of free water left inside the pipeline prior to final drying/ purging and commissioning of the Pipeline system. This is done by driving number of foam pigs propelled by oil free compressed dry air, which can pick up free water in the pipeline.

- Acceptance Criteria

It is recommended that before foam pig run, number of batch pig run shall be done to minimize free water in the pipeline section. Then only foam pig run shall be started. Dewatering is considered as complete, when foam pig received is in touch dry condition & same is subjected approval of Client /EIC/PMC.

Dewatering & Swabbing procedure shall be submitted for review & approval of Client /EIC/PMC.

Contractor shall obtain approval of the Owner/ Consultant before proceeding to the next step.

3.3.2.3 Drying

The pipeline system including the underground pipeline and the above ground piping at dispatch and receipt stations, SV stations, all Terminal station, CGS/ PRS stations and hook-up / tap-of points needs to be dried prior to charging natural gas if specified in bid. Drying is required to prevent internal corrosion of the pipeline & to meet the supply specification and also as a means of preservation of the pipeline sections subsequent to the pre-commissioning activities. The pipeline shall be dried by using super dry air / vacuum method or by any other suitable method.

Contractor shall submit the detailed procedure and the duration of the drying operation and obtain Company's approval on the same prior to start of the drying operation.

Commissioning contractor shall assess any requirement of swabbing for entire pipeline to reduce the time for drying and shall carryout such activity.

- Acceptance Criteria

Contractor shall ensure that drying operation is complete before proceeding to the next step of inertization/ purging. The drying of the pipeline system shall be considered to be achieved on attaining a water dew point of -8°C at atmospheric pressure and this water dew point in pipeline shall be continuously maintained till inertisation or commissioning of the pipeline.

3.3.2.4 Internal Cleaning of Equipment

- General

Equipment's like filters, Corrosion Inhibitor Dosing Tanks, Sump Tanks are to be checked for internal cleanliness and shall be ensured by the pipeline contractor.

- Acceptance Criteria

The laying contractor has to demonstrate cleanliness of the internals of all equipment to the satisfaction of the Owner/Consultant and obtain approval for final box up of the equipment.

3.3.2.5 After dewatering / swabbing is over & all functional checks carried out as specified in pre-commissioning checks, drying of the pipeline is to be closed out with compressed air. The pipeline shall be dried to achieve a content dew point of -8 Deg C.

3.3.2.4 Trial Run of Rotating Equipments

The pipeline contractor has to arrange for trial run of the sump pump with water for short duration of time.

The pipeline contractor has to arrange all temporary arrangements required for such trial runs. The pipeline contractor has to submit procedure/method statement regarding how he plans to take such trial runs and take approval of the Owner/Consultant, before actually proceeding for the same. If pump vendor(s) is available for such trial run, the pipeline contractor has to provide all sorts of assistance to the vendor and help the vendor in completing the successful trial run.

3.4 Commissioning Related Activities

3.4.1 Safety Review Prior to Start of Commissioning Activities

A pre-start-up safety review of the cross-country pipeline system shall be arranged by the pipeline contractor, involving all concerned in the commissioning. The Owner/Consultant shall also participate in the pre-start-up safety review. The pipeline contractor shall generate all requisite formats to record the findings of such Safety Review.

3.4.2 Ready for Commissioning

After completion of pre-commissioning activities and Owner approved safety start-up review followed by liquidation of review punch list points, the pipeline contractor shall notify the Owner/Consultant that the pipeline systems in totality are ready in all respects for hydrocarbon-in. 'Ready for commissioning status' shall be jointly assessed by Owner/Consultant, composite work contractor, Pipeline contractor. After such joint assessment, if all the criteria are met, it will then be declared by the Owner that the entire pipeline system has reached a stage of 'Ready for Commissioning'.

Inertization/ Purging

Contractor shall carry out Inertization/ Purging of the entire pipeline system including the underground pipeline and the above ground piping at dispatch and receipt stations, SV stations, IP stations and hook-up / tap-of points).

Operational requirements:

During the Inertization/ Purging operation, the dry air left in all the pipeline shall be replaced by dry nitrogen before filling the natural gas into the pipeline for safe commissioning. Depending on the commissioning plan/ strategy, sections of the pipeline system may be taken up for commissioning in steps. One of the suggested methods for Inertization/ Purging of the underground pipeline is by the usage of nitrogen slugs separated by pigs. Depending on the length of the pipeline portion to be taken up for commissioning, the amount of the nitrogen use may vary. In general, the total volume of the nitrogen slug train must be at least 10% (by volume) of the total length of the pipeline under consideration. The last pig in the pig train shall be propelled by natural gas (during commissioning stage of the pipeline).

For above ground piping at dispatch and receipt stations, SV stations, IP stations and hook-up / tap-of points, the piping shall be purged with nitrogen

Nitrogen required for Inertization/ purging purpose of the pipeline and aboveground piping shall be supplied by the contractor and should be of purity level 99.9% or above. Nitrogen gas at ambient temperatures (AND NOT LIQUID NITROGEN) and in completely vaporized and gaseous state shall be used as the Energizing medium. In case, the source of gaseous nitrogen is from liquid nitrogen tankers, then all precautions (including verification of the lowest tolerable temperature of all components in the system under commissioning) should be ensured. All temporary connections required for nitrogen purging shall be done by contractor.

The contractor shall submit the detailed procedure (in line with the above suggested method or any other acceptable one) and the duration of the Inertization/ Purging operation and obtain approval of the company before starting the operation. Inertization/ Purging shall be followed immediately by charging of pipeline by natural gas.

- Acceptance Criteria

Inertization of the entire pipeline may be accepted to be complete when the required quantity of nitrogen has been introduced into the pipeline. The contractor has to ensure this condition for safe commissioning of the pipeline. For above ground piping at dispatch and receipt stations, SV stations, IP stations and hook-up / tap- of points, the inertization

may be accepted to be complete when the residual oxygen content in the piping is below 1% (vol/vol).

3.4.3 Commissioning and Pressure Stabilization

The pipeline contractor shall be responsible for providing all necessary assistance to carry out commissioning activities under the overall guidance and supervision of Owner/Consultant for the entire pipeline system.

Pipeline shall be commissioned and stabilized in 2 phase, i.e. up to 5 kg/cm² g pressure and then up to operation pressure. Pipeline shall be kept for 24 hours after Ist phase for pressure stabilization.

Low Pressure leak check for aboveground piping

- General

The aboveground piping sections of the pipeline system shall be checked for leaks at flange points of piping and equipment, instrument impulse tubing points etc. This shall be done by pressurizing the system piping / equipment with dry compressed air (for this purpose, oil free air compressors shall be used) and testing the system by means of soap solution for leaks.

The contractor shall submit the detailed procedure and the duration of the leak check operations and obtain approval of the company before starting the operation.

- Acceptance Criteria

The leak check operation shall be considered to be completed when the piping system / equipment is free of leaks, after equipment pressure stabilization. This shall be subject to Company's approval.

Commissioning of pipeline shall be considered completed when the line is charged with product natural gas at operating pressure and the total system operated at normal operating pressure for a minimum period of 72 hrs. with all the instruments, controls & interlock satisfactorily at normal operating conditions. Contractor shall submit a detailed commissioning procedure for owner's approval.

3.5 Commissioning Check List

Check list to be filled up for commissioning approval of the pipeline:

S. NO.	GENERAL INFORMATION	OBSERVATION/ COMMENTS		
		CONTRACTOR	CONSULTANT	CLIENT
a. GENERAL				
1	a) Name of the Pipeline: b) Services (NG) c) Design/ OISD code followed: d) Design capacity: e) Length of the Pipeline in kms:			



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	f) Size - Outside Dia. / Wall Thickness / Grade of Pipeline: g) Is the pipeline designed for scrapper / intelligent pigging? h) No. & location of isolation Valve(s) with chainages: (i) Hand Operated valves (ii) Remote Operated valves i) No. of water bodies crossings with Chainages: (i) Name of River (ii) Pond / Lake crossings (iii) Canal crossings (iv) Marshy land / creek j) No. of cased crossings Railway k) No of Road crossings (NH & SH) i) Cased ii) Non cased			
b. CROSS COUNTRY PIPELINE DETAILS				
1	Design pressure of the pipeline (In Kg/Cm2).			
2	Maximum allowable operating pressure of the pipeline, and normal Operating Pressure (In Kg/Cm2).			
3	Corrosion allowance for the pipeline. (In mm)			
4	Whether the pipeline has been hydrostatically tested. (i) Hydrotest Pressure (In Kg/Cm2) (ii) Period of Hold			
5	Type of Sectionalizing Valves used on the pipeline.			
6	Whether the pigging facility has been installed and the pipeline is piggable by scraper pig.			



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7	Whether the gauging pig was passed through the pipeline to prove its internal diameter and was it satisfactory.			
8	Whether EGP was carried out for the pipeline. Details to be provided.			
9	Whether the pipeline has been cleaned and swabbed.			
10	Whether adequate product is available for commissioning.			
11	Whether mechanical completion report for the pipeline is available.			
12	Whether ROU restoration completed.			
13	Whether following approvals have been obtained for pipeline before construction? - PESO (CCOE) approval for laying of pipeline/ construction of facilities. - State Pollution Control Board consent to establishment. - Registration of establishment from Central/ State Govt. labour commissioner under Contract Labour (Regulation and Abolition) Act'1970. - Permission from Irrigation/ PWD authority/ NHA etc.			
14	Whether following Clearances obtained before Commissioning? - Commissioning clearances from PESO (CCOE). - CCOE License as required. - Consent for operation from state pollution control board for Air and Water. - Factory License as required.			
15	Whether pre-tested Insurance Stock pipes earmarked and kept separately.			
COATING AND CATHODIC PROTECTION DETAILS				



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1	Type of External Coating used in the Pipeline (CTE/ 3LPE/ FBE/ Other) Coating (Thickness in mm).			
2	Whether the pipeline is adequately protected cathodically: Presently protected by TCP. Expected date of Commencing of PCP.			
3	Post Construction Coating Survey carried out or not?			
4	Whether Interference survey for the pipeline has been carried out and mitigation measures taken.			
5	Whether electrical Surge diverter provided across IJs?			
6	Whether corrosion coupons have been installed for internal corrosion monitoring.			
7	Whether all cased crossings have been checked and are free from any electrical shorting.			
8	Whether Natural PSP of the Pipeline has been taken?			
c. STATION PIPING				
1	Whether station piping has been provided as per the latest approved P&IDs.			
2	Whether mechanical completion certificate for the station is issued			
3	Whether all the flange connections have been checked for tightness and length of bolts are adequate. All short bolting have been checked?			
4	Whether flow direction has been marked on station piping and equipment.			
5	Whether proper direction for check valves and flow meters has been ensured.			



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6	Whether adequate crossovers for crossing and platforms to operate valves have been provided with safety hand rails?			
7	Whether access to all operating equipment's including vessels, valves, sump pump, scraper barrel is adequate.			
8	Whether CI dosing facilities with adequate stock is available for dosing in water and product.			
9	Whether proper arrangement has been made for drainage and disposal of the water during commissioning.			
10	Whether alignment of motor with main pump/ compressor and suction/ discharge piping is done and acceptable to the vendor/ owner.			
11	<i>MOVs which are on remote operation have been functionally tested for opening and closing operation?</i>			
12	<i>Whether Vent lines have been provided as per code/ standard/ specifications.</i>			
MISCELLANEOUS				
1	Power System Details: i) Transformer Rating & Type ii) HT Breaker Type & Rating iii) DG Set's Details			
2	Communication system details: i) Telephones ii) PA/Paging iii) VHF iv) Walkie/ Talkie v) Hot Line vi) VCS vii) CCTV			



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3	Whether firefighting equipment are provided as per code/ standard/ specifications.			
4	Whether list of contact persons has been displayed with telephone nos.			
5	Check availability of Visitor/ attendance Registers at the gate.			
STATUTORY APPROVALS				
1	Whether following approvals have been obtained for construction. - PESO (CCOE) approval for construction of facilities (Ref no. and Date). - Environmental clearance for the project (No. & date) - Pollution control.			
2	Whether following licenses/ approvals are available before commissioning: - CCOE License No., date, validity. - Is there any change with respect to approved CCOE layout? - NOC from District Magistrate/ District Collector in case CCOE License is not applicable - Govt. Notification for protected area declaration - Clearance from CEA/ State Electrical Inspectorate. - DG Set Installation approval - Any other applicable statutory license/ approval			

4.0 DOCUMENTATION

The pipeline contractor shall submit the complete description, detailed procedures and time schedule for all of the following activities for approval of the Owner/Consultant.

- Pre-commissioning Checks
- Dewatering
- Swabbing
- Flushing / Blowing
- Low Pressure Leak Test with Air
- Drying
- Idle Time Preservation (if applicable), including Removal of Preservers

All these documents should be prepared covering all aspects of HSE, quality assurance and quality control plans.

The pipeline contractor shall ensure that his documents are related to “as-built” conditions of the pipeline, equipment and structures involved.

Documents shall also contain all safety plans, procedures to be followed while carrying out the activities.

Upon successful completion of the work, the pipeline contractor shall prepare a final report of the work which shall include necessary charts, diagrams, graphs, calculations, recordings, daily logs, measurements, details of the operation etc. Report shall also include all certificates of calibration of instruments required, together with records of calibration performed at site prior to the start of any operation and the approved pre-commissioning and commissioning formats and check sheets.

5.0 SPARES AND CONSUMABLES

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

6.0 SAFETY

The pipeline contractor shall follow the safety practices during execution of pre-commissioning and commissioning works as detailed in the scope of work. The pipeline contractor shall also maintain and follow all safety practices equivalent or better than those being practiced by the industry during pre-commissioning and commissioning activities. A dedicated safety department from the pipeline contractor’s side should be available for the job.

7.0 OTHERS

The pipeline contractor, along with his bid documents, is required to submit the following:

- Execution plan and method statement for pre-commissioning and commissioning activities.



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- Past experience of pre-commissioning and commissioning activities carried out for a similar pipeline system / network.



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VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION FOR INSPECTION, FLUSHING & TESTING OF PIPING SYSTEM

VCS – SS – PP - 2501

01	27.01.2022	<i>R. Srinivasan</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
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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.

**STANDARD SPECIFICATION
FOR
THIRD PARTY INSPECTION AGENCY (TPIA)**

VCS – SS – PP - 2031

					
01	25.11.2022	AY	MC	HK	GW
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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 PAINTING

VCS – SS – PP - 2502

					
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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

<u>PRIMERS</u>	
P-1	Red oxide Zinc chromate Primer
P-2	Chlorinated rubber zinc Phosphate Primer
P-3	High build Zinc phosphate Primer
P-4	Etch Primer/Wash Primer
P-5	Epoxy Zinc Chromate Primer
P-6	Two component Epoxy Zinc Phosphate Primer cured with polyamine hardener
P-8	Epoxy red oxide zinc phosphate primer
<u>FINISH COATS / PAINTS</u>	
F-1	Synthetic Enamel
F-2	Two component Acrylic – Polyurethane finish paint
F-3	Chlorinated Rubber finish paint
F-5	Chemical resistant phenolic based enamel
F-6	High Build Epoxy finish coating cured with polyamide hardener
F-7	High build Coal Tar Epoxy coating cured with polyamine hardener
F-8	Self priming surface Tolerant High Build epoxy coating. cured with polyamine hardener
F-9	Two component Inorganic Zinc Silicate coating
F-10	High build Reinforced bituminous composition phenol based resin.
F-11	Heat resistant synthetic medium based Aluminium paint suitable for 250 deg C
F-12	Two component Heat resistant Silicone Aluminium paint. suitable for 400 deg C
F-13	Synthetic based aluminium Paint suitable for 150 deg C

Table – 18.2: Painting System for Normal Industrial Environment for Piping and Equipment (Above Ground)

Sl. No.	Temp. Range	Surface Preparation	Primer	Finish Coat	Total DFT	Remarks
1	-10 to 20	SSPC-SP-3	One coat P-2 50 microns / coat (min)	One coat F-4 65 microns/ coat (min) Two coats F-3, 30 Microns/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 DI 212;
- The dry layer thickness of the film will be measured electronically, will complete statistical information. in accordance will, ISO 2808 or ASTM D 1186.
- The thickness of each layer will be measured in accordance with ISO 2808. ASTM 4138 or DIN 50986.
- Adhesion tests will be carried out in accordance with ISO 2409. ASTM 3359 or DIN 53151.
- Traction tests will 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.



VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION FOR ASSORTED PIPES

VCS – SS – PP - 2503

					
01	30.06.2022	RP	MC	HK	GW
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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	12.10.2019					
		MB	AK	AD	SK	
01	30.06.2022					VCS QMS Integration
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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.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. 1¼ Cr												
A335 Gr.P22 / A691 Gr. 2¼ 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.



VCS QUALITY SERVICES PVT.LTD.

STANDARD SPECIFICATION FOR ASSORTED VALVES

VCS – SS – PP - 2504

					
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00	28.01.2020					
		MB	AK	AD	SK	
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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 $\leq 4"$	:	1/2"
On main valve 6" to 8"	:	3/4"
On main valve 10" & above	:	1"

By-pass piping shall be of same metallurgy as main valve. The by-pass piping, fittings and valve tag numbers shall be as specified in 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.

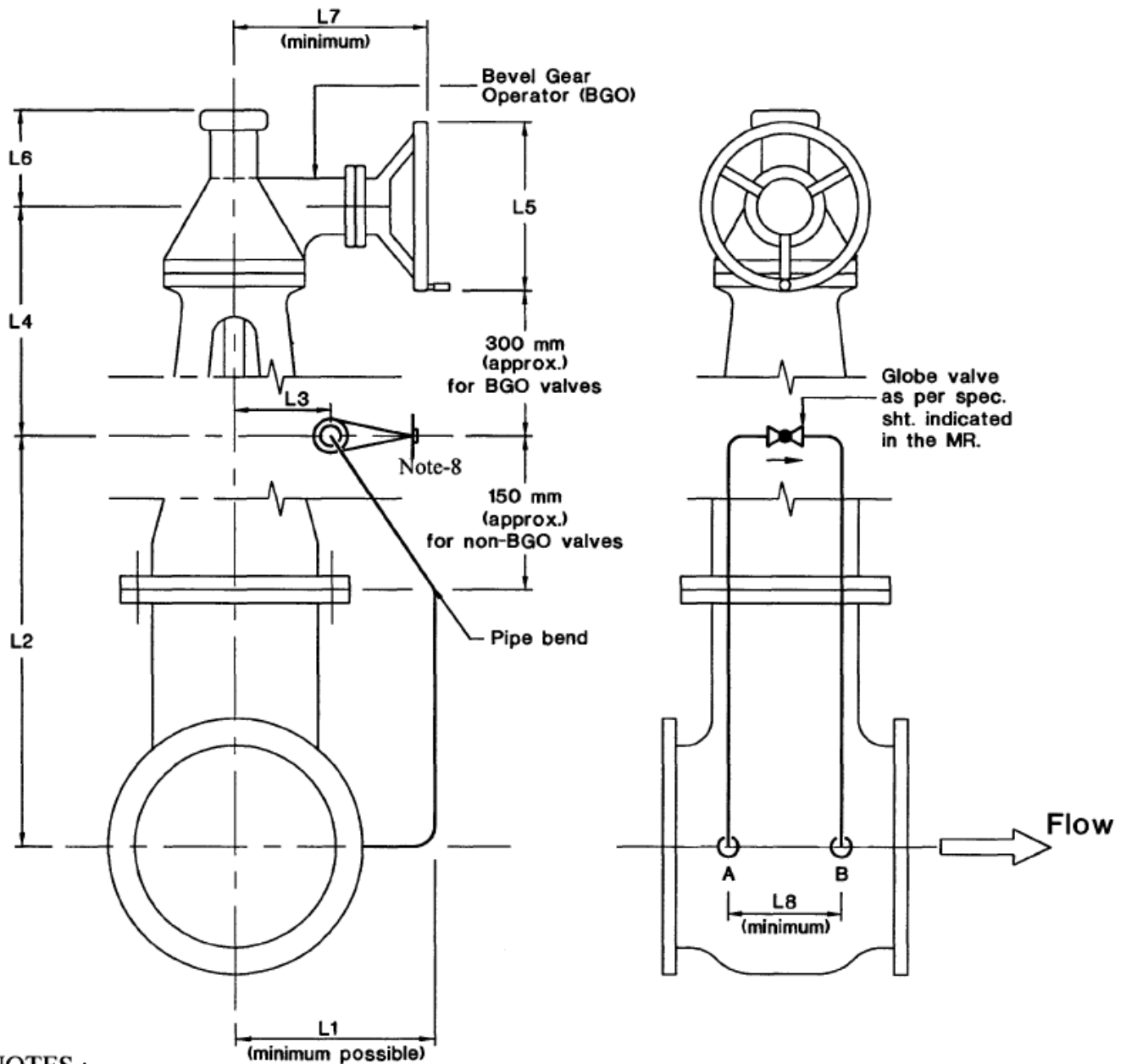
9.6 End protectors to be used on beveled end shall be securely and tightly attached.

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 Cytogenic Valves

**BYPASS PIPING ARRANGEMENT
(SS-PI-012-A1)**



NOTES :

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.

DESIGN GUIDE FOR RADIOGRAPHY REQUIREMENTS

VCS-SS-PP-2506

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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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:

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.

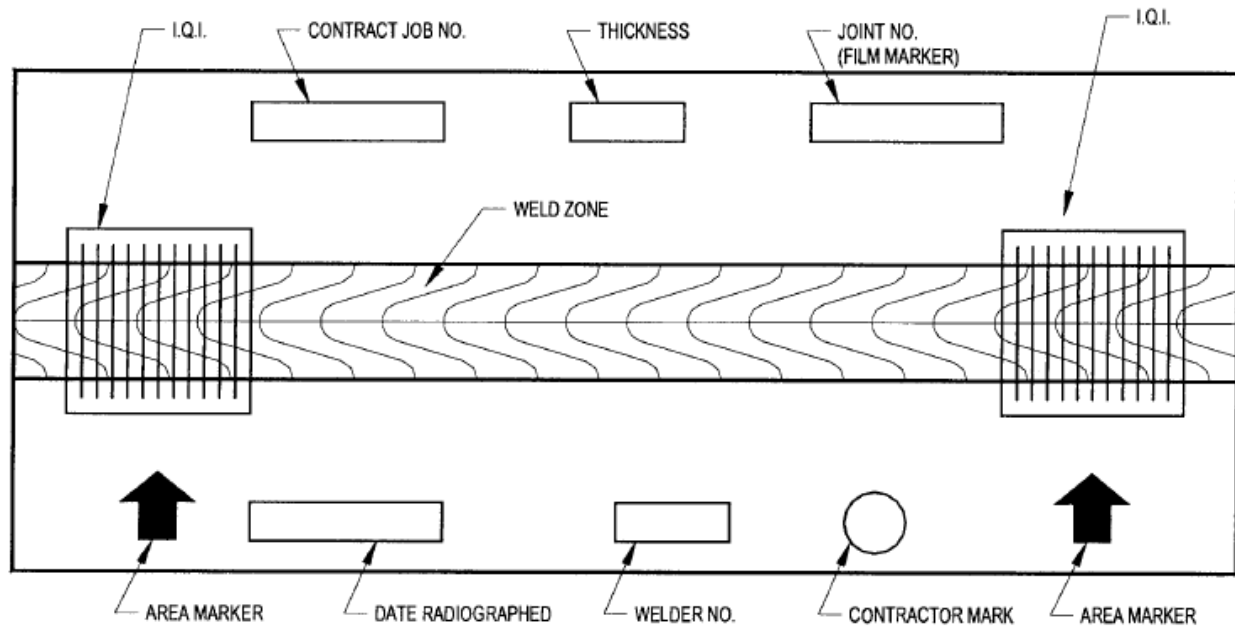


FIG.1 (a): FILM IDENTIFICATION AND PLACEMENT OF PENETRIMETERS

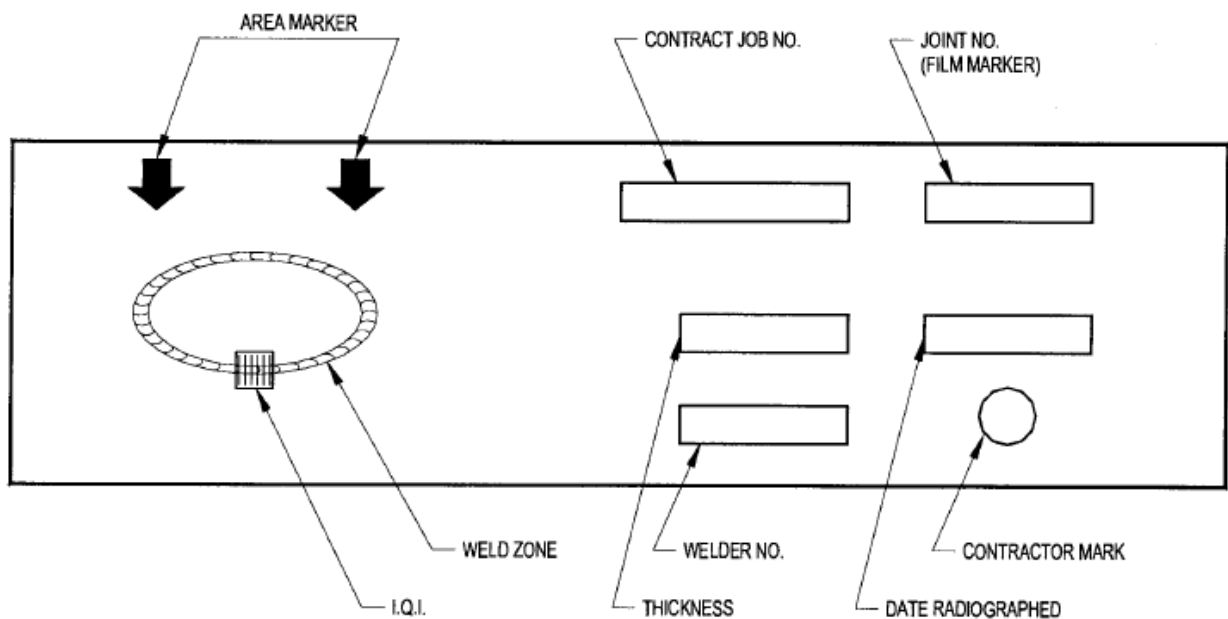


FIG.1 (b): FILM IDENTIFICATION AND PLACEMENT OF PENETRIMETERS
(DOUBLE WALL DOUBLE IMAGE)

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.



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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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.



VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION FOR NON-DESTRUCTIVE EXAMINATION REQUIREMENTS OF PIPING

VCS – SS – PP - 2508

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Abbreviations:

AS	:	Alloy Steel
ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society for Testing & Materials
CS	:	Carbon Steel
DP/LP	:	Dye/Liquid Penetrant
IBR	:	Indian Boiler Regulations
MP	:	Magnetic Particle
PMS	:	Piping Material Specification
SS	:	Stainless Steel

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1.0 GENERAL

1.1 Scope

This specification covers the general requirements for non-destructive examination of shop & field fabricated piping.

1.2 Related Codes & Engineering Standards

Referred codes/ standards are as follows. Latest editions of the Codes/Standards referred to shall be followed.

- a) ASME Boiler & Pressure Vessel Codes, Section V & VIII (Div.1) including addenda.
- b) ASME B31.3
- c) ASME B16.5
- d) ASME B16.34
- e) Standard Piping Material Specification; XXXX-XX-XX-XXX
- f) Standard Specification for Fabrication & Erection of Piping; VCS-SS-PP-2507
- g) ASTM E10
- h) Design Guide for Radiography Requirements; VCS-SS-PP-2506
- i) Indian Boiler Regulations (IBR)

2.0 VISUAL EXAMINATION

2.1 Weld shall be visually inspected wherever accessible in accordance with the following requirements:

a) Internal misalignment	1.5 mm or less
b) Cracks or lack of fusion	not permitted
c) Incomplete penetration	Depth shall not exceed the lesser of 0.8mm or 0.2 times thickness of thinner component joined by butt-weld. The total length of such imperfections shall not exceed 38 mm in any 150 mm of weld length.
d) Surface porosity and exposed slag inclusions (For nom. wall thickness 4.7 mm and less)	not permitted
e) Concave root surface (Suck up)	For single sided welded joints, concavity of the root surface shall not reduce the total thickness of joint, including reinforcement, to less than the thickness of the thinner of the components being joined.
f) Weld ripples irregularities	2.5 mm or less.



- g) Lack of uniformity in bead width 2.5 mm or less.
- h) Lack of uniformity of leg length 2.5 mm or less.
- i) Unevenness of bead 2.0 mm or less
- j) Weld undercutting 0.8 mm or 1/4 thickness of thinner components joined by butt weld, whichever is less. (shall be smooth finished)
- k) Overlap 1.5mm or less
- l) Bead deflection 2.5 mm or less

- m) External weld reinforcement and internal weld protrusion (when backing rings are not used) shall be fused with and shall merge smoothly into the component surfaces. The height of the lesser projection of external weld reinforcement or internal weld protrusion from the adjacent Base material surface shall not exceed the following limits:

Wall thickness of thinner component joined by butt Weld (mm)	Weld reinforcement or internal protrusion (mm) max
6.4 and under	1.6
Over 6.4 -12.7	1.2
Over 12.7 -25.4	4.0
Over 25.4	4.8

- n) Throat thickness of fillet welds:

Nominal thickness of the thinner component x 0.7 or more.

- o) Flattening

Flattening of a bend, as measured by difference between the nominal outside diameter and minimum or maximum diameter at any cross section shall not exceed 5 % of the nominal outside diameter of pipe.

- p) Reduction of wall thickness

Reduction of wall thickness of a bend, as measured by difference between the nominal thickness and minimum thickness shall not exceed 10 % of the nominal wall thickness of pipe.

2.2 Welds having any of imperfections which exceed the limitations specified in various clauses of 2.1 shall be repaired by welding, grinding or overlaying etc. Number of times of repair welding for the same weld, however shall conform to applicable notes to Table 1- Note 6(b) b.5.



3.0 NON-DESTRUCTIVE EXAMINATION

- 3.1 The type and extent of weld examination shall be in accordance with Table-1. A11 visual and supplementary methods of girth weld examination shall be in accordance with ASME B31.3 & the requirements of this standard specification.
- 3.2 Welds between dissimilar materials shall be examined by method & to the extent required for the material having the more stringent examination.



4.0 TABLE-1 (with applicable notes)

TABLE 1: CLASS, TYPE & EXTENT OF WELD EXAMINATION (CONTD.)

INSPECTION CLASS: II

INSP N. CLA SS	SERVICE	MATERI AL (NOTE 3)	P.NO .	TEMP . DEG. C	PRESS. CLASS B16.5/ B16.34	APPLICA- BLE PIPING CLASS	TYPE OF EXAMINATION	TYPE OF WELD EXAMINED				
								GIRTH BUTT WELD	SOCKET WELD (NOTE 2)	ATTAC- HMENT T WELD	FAB. BRANCH WELD (NOTE 1)	FAB. WELDS OF MITRES / REDUC.
1	2	3	4	5	6	7	8	9	10	11	12	13
II	a) ALL SERVICES COVERED UNDER INSPECTIONCLASS-1, BUT, EXCEEDING CATEGORY 'D' PR/T EMP LIMITATIONS.	CARBON STEEL	1	-29 TO 427	150# TO 60#	15HC, 30HC, 60HC						
	b) ALL SERVICES OTHER THAN COVERED UNDER INSPECTIONCLASS-1, BUT NON-TOXIC, NOT SUBJECT TO SEVERE CYCLIC CONDITIONS.						a) VISUAL	100%	100%	100%	100%	100%
	c) TOXIC, NON-LETHAL & FLAMMABLE						b) RADIOGRAPHY (NOTE 5,6)	5%	---	---	---	20%
	d) FLAMMABLE/NON FLAMMABLE & TOXIC/NON-TOXIC; NOT SUBJECT TO SEVERE CYCLIC CONDITIONS						c) MP / LP (NOTE 4,6,10,11)	---	5%	---	5%	20%
		LTCS		-45 TO 204		15HLT, 30HLT, 60HLT	d) HARDNESS	NOTE-7	NOTE-7	NOTE-7	NOTE-7	NOTE-7

REMARKS FOR ABOVE TABLE:

- i. MITRES & FABRICATED REDUCERS ARE PERMITTED ONLY IF SPECIFIED IN PMS.
- ii. NOTE- 7 FOR HARDNESS IS NOT VALID FOR P. NO. 8.



Applicable Notes to Table-1

1. Branch welds shall consist of the welds between the pipe & reinforcing element (if any), nozzles & reinforcing element and the pipe & nozzle under the reinforcing element. Reinforcing element to be interpreted as pads, saddles, weldolets, sockolets etc.
2. Seal welds of threaded joints shall be given the same examination as socket welds.
3. Unless specifically stated, all materials shall be for "Non-IBR" service.
4. Magnetic Particle & the Liquid Penetrant method of examination shall be in accordance with Section V of the ASME Boiler and Pressure Vessel Code, Article VII and VI respectively. The entire area of the accessible finished weld surface shall be examined. Selected root runs, subject to a maximum of 10%, before finished weld, may also be examined, at the discretion of the engineer-in-charge.
 - a) Wherever MP / LP testing is specified, either MP or LP test may be used. But wherever only MP test is specified, LP method of examination may be used only if MP examination is impracticable in the field as concurred by PMC/ Company site-in charge.
 - b) "Random 5%" of Liquid Penetrant / Magnetic Particle test shall mean testing, by applicable test, one weld for each twenty welds or less made by the same welding procedure. "Random 10%" shall mean testing, by applicable test, one weld for each ten welds or less made by the same welding procedure. Similarly "Random 20%" shall mean testing, by applicable test, one weld for each five welds or less made by the same welding procedure.
 - c) When Liquid Penetrant examination is specified, the surface shall be free of peened discontinuities.
 - d) Inspection shall be performed in the welds excluding those for which radiography has been done.
 - e) Girth weld, branch weld, attachment weld & socket weld of 3-1/2% Ni steel shall be Liquid Penetrant tested only when welded with austenitic material where MP test has been specified.
5. Radiography:
 - a) "Random 5%, 10% or 20% radiography" shall mean examining not less than one from each 20 welds or less in case of "Random 5% radiography", 10 welds or less in case of "Random 10% radiography", one from each five welds or less in case of "Random 20% radiography" made by the same welding procedure. Irrespective of percentage, no. of welds to be radiographed shall be minimum 1. However first two welds made by each welder shall also be radiographed in case of "Random radiography". Welds selected for examination shall not include flange welds and shall be radiographed for their entire length. However, where it is impossible or impracticable to examine the entire weld length of field welds for either random or 100% radiography, and if the same impossibility is agreeable to site-in-charge, then a single 120 deg. exposure of the weld length may be given a Magnetic Particle test or Liquid Penetrant test.



However in such cases for ferro-magnetic materials, only MP test shall be acceptable for classes higher than 600#.

- b) In-process examination shall not be substituted for any required radiographic examination.
- c) Number of radiography per one circumferential weld shall be as per ASME Sec.V Articles 2 and 22.

6. When radiography or other non-destructive inspection is specified, acceptance criteria for repairs or defects shall be as follows:

- a) In case of 100% examination, any unacceptable weld shall be repaired and re inspected.
- b) If required random examination reveals a defect requiring repair, then:
 - i. Two additional examinations of same type shall be made of the same kind of item (if welded joint, then by the same welding procedure or operator or both).
 - ii. If the group of items examined as required by b.1 above is acceptable, the items requiring repair shall be repaired or replaced and re-examined as required and all items represented by this additional examination shall be accepted.
 - iii. If any of the items examined as required by b.1 above reveals a defect requiring repair, two further comparable items shall be examined for each defective item found by examination.
 - iv. If all the items examined as required by b.3 are acceptable, the items requiring repair shall be repaired or replaced and re-examined as required, and all items represented by this further examination shall be accepted.
- v. Number of times repair welding could be done for the same weld before acceptance shall be as follows:

Material	No. of times repair welding is allowed
C.S. up to 300#	3 or less
C.S. above 300#	2 or less
Killed steel	2 or less
Low alloy steel	2 or less
Austenitic S.S.	2 or less
3.5 Ni steel	2 or less
Al & Al base alloy	2 or less



Cu & Cu base alloy	2 or less

Others	2 or less

vi. Welds not found acceptable for allowed number of times of repair as per b.5 above shall be replaced and re-examined.

vii. If any of the items examined as required by b.4 above reveals a defect requiring repair, all items represented by these examinations shall be either :

- Repaired or replaced and re-examined as required.
- Fully examined and repaired or replaced as necessary, and re-examined as necessary.

7. Hardness Test:

- a) Hardness test shall be in accordance with ASTM specification E10. Hardness tests of the heat affected zone shall be made at a point as near as practicable to the edge of the weld. One test per weld shall be performed.
- b) Hardness test where specifically called out in Table-1 of this specification or in PMS, shall be carried out irrespective of thickness and to the extent (%age) as mentioned therein.
- c) All welds which are given heat treatment shall be hardness tested. Hardness test shall be performed after final heat treatment.
- d) A minimum of 10% of welds, hot bends, and hot formed components in each furnace heat treated batch and 100% of those which are locally heat treated shall be hardness tested.
- e) Hardness test requirement not covered in this specification shall be as per ASME B31.3.
- f) The hardness limit applies to the weld and heat affected zone. Following hardness values shall be maintained:

Base Metal Group	Maximum Hardness (BHN/RC)
CS	238BHN/RC22
CS (NACE), Caustic, Amine, H ₂	200BHN
Cr Up to 2%	225BHN
Cr 2.25%-10%	241BHN
18/8 SS (NACE)	RC22

8. For IBR service lines, following IBR requirements shall apply in addition to the notes 4, 5, 6, 7, 12 and Table 1. In case of conflict between above notes and these requirements, the more stringent ones shall apply. IBR piping shall be erected of IBR inspector approved



material and construction procedure. Erected piping shall be hydro tested, inspected and approved by IBR inspector.

a) Piping over 102 mm (4") bore:

10% of welds made by each welder on a pipeline with a minimum of two welds per welder, selected at random, shall be subjected to radiography.

b) Piping 102 mm (4") bore and under, but not less than 38 mm (1-1/2") bore:

Two percent of welds made by each welder on a pipeline with a minimum of one weld per welder, selected at random, shall be subjected to radiography or may be cut for visual examination and tests.

c) Piping less than 38 mm (1.5") bore:

Special tests are not normally required but 2% of welds by each welder on a pipe line may be cut out from the pipeline for the visual examination and bend tests.

d) Retests:

If any test specimen is unsatisfactory, two further weld specimens for retests shall be selected from the production welds and subjected to tests. In the event of failure of any retest specimens, the production welds carried out by this welder subsequent to the previous test shall be given special consideration.

9. For fabricated fittings LP test shall be done on the final pass of welding only, in addition to visual examination.
10. For mitres and fabricated reducers, LP / MP test shall be done on root pass in addition to radiography applicable to circumferential joint of respective piping class.
11. For branch connections, LP/MP test shall be done on root pass and final pass.
12. 10% of the butt weld joints shall be radiographed, however, 50% of these butt weld joints shall be field weld joints.
13. For lined specs, testing (MP/LP/Radiography etc.) shall be performed before lining.



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



**WELDING SPECIFICATION FOR FABRICATION OF
PIPING**

**DOCNO: VCS-SS-PP-2509
Rev No : 01**

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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(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.



Sheet 1 of 3

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 ° 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.

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 Preheat Temp. _____ Inter pass Temp. _____	TECHNIQUE Travel Speed _____ 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

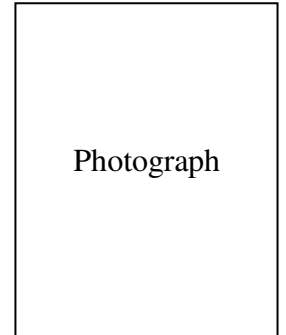
Ref. Para regarding recommended practice on placement of penetrameters Article 22, SE 142, ASME Sec. V.

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)



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≥19	All Materials	Gamma Ray	C5	Gamma ray	C5
8≤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**



ENERGISING QUALITY

VCS QUALITY SERVICES PVT. LTD.

TECHINICAL NOTES FOR BOLTS AND NUTS

VCS-SS-PP-2510

					
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

NCONTROLLED 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	The American Society of Mechanical Engineers
ASTM	The American Society for Testing and Materials
MR	Material Requisition
SS	Stainless Steel



CONTENTS

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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

					
01	30.06.2022	RP	MC	HK	GW
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Abbreviations:

AARH	Average Arithmetic Root Height
BHN	Brinnel 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.



ENERGISING QUALITY

VCS QUALITY SERVICES PVT.LTD.

STANDARD SPECIFICATION FOR PIPELINE BALL VALVES

VCS-SS-PP-2004

					
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		RP	MC	HK	GW	

ABBREVIATIONS:

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
BHN	Brinell Hardness Number
DN	Nominal Size
HAZ	Heat Affected Zone
LC	Lock Close (valve locked in full close position)
LO	Lock Open (valve locked in full open position)
MSS-SP	Manufacturers Standardization Society - Standard Practice
NDT	Non Destructive Testing
NPS	Nominal Pipe Size
RTJ	Ring Type Joint
SSPC	Steel Structures Painting Council
MPI	Magnetic Particle Inspection
DP	Dye Penetrant

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1 SCOPE

This specification covers the minimum requirements for design, manufacture, testing and supply of carbon steel ball valves of size DN 50 mm (2") and above and ASME pressure rating Class 150# thru 900# for use in onshore pipeline systems handling non-sour hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG).

2 REFERENCE DOCUMENTS

All valves shall be manufactured and supplied in accordance with the American Petroleum Institute (API) Specification 6D, latest edition (edition in force at the time of issue of enquiry), Specification for Pipeline and Piping Valves, with additions and modifications as indicated in the following sections of this specification.

Reference has also been made in this specification to the latest edition (edition in force at the time of issue of enquiry) of the following Codes, Standards and Specifications.

2.1 American Society of Mechanical Engineers (ASME)

B31.3	:	Process Piping.
B31.4	:	Pipeline Transportation System for Liquid and Slurries.
B 31.8	:	Gas Transmission and Distribution Piping Systems.
B16.5	:	Pipe Flanges and Flanged Fittings.
B16.10	:	Face to Face and End to End Dimensions of Valves.
B 16.25	:	Butt Welding Ends.
B 16.34	:	Valves-Flanged, Threaded and Welding Ends.
B 16.47	:	Large Diameter Steel Flanges.
Section VIII	:	Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels.
Section IX	:	Welding and Brazing Qualifications.

2.2 American Petroleum Institute (API)

1104	:	Specification for Welding of Pipelines and Related Facilities.

2.3 American Society for Testing and Materials (ASTM)

A370	:	Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
B 733	:	Auto catalytic (Electro less) Nickel - Phosphorus Coatings on Metal.

2.4 Manufacturers Standardization Society (MSS)

- SP-6 : Standard Finishes for contact faces of Pipe Flanges and Connecting – End Flanges of Valves and Fittings.
- SP-44 : Steel Pipeline Flanges.

2.5 Steel Structures Painting Council (SSPC)

- SSPC-VIS-I : Steel Structures Painting Council Visual Standard-Guide and Reference Photographs for Steel Surfaces prepared by Dry Abrasive Blast Cleaning.

- 2.6 In case of conflict between the requirements of this specification, API 6D and the Codes, Standards and Specifications referred above, the requirements of this specification shall govern.

3 MATERIALS

- 3.1 The material of major components of the ball valves shall be as indicated in Valve Data Sheet. Remaining components shall be as per Manufacturer's standard (suitable for the service indicated in the data Sheet) and shall be subjected to approval by Company. In addition, the material shall also meet the requirement specified hereinafter.

All process-wetted parts, metallic and non-metallic, sealant and lubricants shall be suitable for the service specified by the Company. Manufacturer shall confirm that all wetted parts are suitable for treated water/ seawater environment, which may be used during field testing.

Non-metallic parts of the valves (including O-rings, soft seals etc.) intended for hydrocarbon gas service shall be resistant to explosive decompression.

- 3.2 Carbon steel used for the manufacture of valves shall be fully killed.
- 3.3 The carbon equivalent ($CE_{I\!W}$) of valve end connections which are subject to further field welding by Company shall not exceed 0.43 on check analysis for each heat of steel used, as calculated by the following formula:

$$CE_{I\!W} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}$$

3.4 Charpy V-Notch Test Requirements

Charpy V-notch test on each heat of base material shall be conducted for all pressure containing parts such as Body, End Flanges, Stem and Welding Ends as well as Bolting materials for pressure containing parts.

Test procedure for Charpy V-Notch Test shall conform to ASTM A370.

For Carbon Steel, alloy steel & Stainless Steel (except Austenitic Grades) Materials, The impact test temperature shall be 0 °C or minimum design temperature indicated in valve

data sheet / MR, whichever is lower. The average absorbed energy value of three full sized specimens shall be 27 J (for materials with Specified Minimum Tensile Strength $\leq 100,000$ psi)/ 34 J (for materials with Specified Minimum Tensile Strength $> 100,000$ psi). The minimum impact energy value of any one specimen of the three specimens analysed as above, shall not be less than 22 J (for materials with Specified Minimum Tensile Strength $\leq 100,000$ psi)/ 26 J (for materials with Specified Minimum Tensile Strength $> 100,000$ psi).

For Low Temperature Carbon Steel Materials, the impact test temperature shall be as per requirement of Material Standard or minimum design temperature indicated in valve data sheet/MR, whichever is lower. The average absorbed energy value of three full sized specimens shall be 27 J (for materials with Specified Minimum Tensile Strength $\leq 100,000$ psi)/ 34 J (for materials with Specified Minimum Tensile Strength $> 100,000$ psi). The minimum impact energy value of any one specimen of the three specimens analysed as above, shall not be less than 22 J (for materials with Specified Minimum Tensile Strength $\leq 100,000$ psi)/ 26 J (for materials with Specified Minimum Tensile Strength $> 100,000$ psi).

Where the material specification requires impact values to be higher than specified in the above paragraphs, the higher values shall apply.

For duplex & super duplex stainless steel the Charpy V-Notch test values and test temperature shall be as per API 6D.

3.5 Hardness Test Requirements

For valves specified to be used for Gas service or LPG service, Hardness test shall be carried out as per ASTM A370 for each method of manufacture and each heat of steel used in the manufacture of valves. A full thickness cross section shall be taken for this purpose and the maximum hardness of the materials of valve components shall not exceed 248 HV₁₀.

3.6 Electroless Nickel Plating Requirements

For all such valves where Carbon Steel/Low temperature carbon steel is used as ball material, the ball shall have 75 micrometers (0.003 inches) thick Electro less Nickel Plating (ENP) as per ASTM B 733 with following classification:

- SC2, Type II, Class 2.

The hardness of plating shall be minimum 50 RC.

4 DESIGN AND CONSTRUCTION REQUIREMENTS

4.1 General

Valve design shall meet the requirements of API Specification 6D and shall be suitable for the service conditions indicated in the Valve Data Sheet. The ASME Boiler & Pressure Vessel Code, Section VIII, Div 1 shall be used to design the valve body. Allowable stress requirements shall comply the provisions of above code. Also, corrosion allowance indicated in Valve Data Sheet shall be considered in valve design; however, the minimum wall thickness shall not be less than the minimum requirement of ASME B16.34. The

manufacturer shall have valid license to use API monogram on valves manufactured as per API 6D.

4.2 Valve Installation

Valves shall be suitable for either buried or above ground installation as indicated in Valve Data Sheet/ Material requisition.

4.3 Valve Body

4.3.1 For above ground valve, valve body design shall be either fully welded or bolted type. For buried valves, valve body design shall be fully welded type only. Valve body joints with threads are not permitted.

4.3.2 Ball mounting shall be trunnion or pivot type only. Valve design shall minimize the possibility of debris ingress into the trunnion as far as practicable

4.4 Ball

Ball shall be of single piece, solid type construction.

4.5 Valve Bore Configuration

Valves shall be Full bore (FB) or Reduced bore (RB) as indicated in the Valve Data Sheet.

Full Opening Valve

Full bore valves shall be suitable for the passage of all types of pipeline pigs including instrumented intelligent pigs and regular cleaning, batching and scraper pigs on regular basis without causing damage to either the valve component or the pig. The full bore, valve shall provide an unobstructed profile for pigging operations in either direction. Full bore valves shall be designed to minimize accumulation of debris in the seat ring region to ensure that valve movement is not impeded. The bore of full bore butt-welded & flanged valves shall be in line with Connecting pipe as stated in valve data sheet or Valve MR, however in any case it shall not be less than the minimum required shown in Client Ball Valve specification & API 6D.

Reduced Opening Valve

The bore size of reduced bore valve shall correspond to that of a full-bore valve of smaller nominal diameter as indicated in Table- 4.5 below. For sizes of a particular rating not covered in API 6D, the bore size of the reduced bore valve shall be as per manufacturer`s Standard.

TABLE – 4.5			
Nominal Valve Size	Nominal Valve Size for Reduced Bore	Nominal Valve Size	Nominal Valve Size for Reduced Bore
DN mm (NPS inches)	DN mm (NPS inches)	DNmm (NPSinches)	DNmm (NPS inches)
50 (2)	40 (1.5)	600 (24)	500 (20)

80 (3)	50 (2)	650 (26)	550 (22)
100 (4)	80 (3)	700 (28)	600 (24)
150 (6)	100 (4)	750 (30)	600 (24)
200 (8)	150 (6)	800 (32)	650 (26)
250 (10)	200 (8)	850 (34)	700 (28)
300 (12)	250 (10)	900 (36)	750 (30)
350 (14)	250(10)	950 (38)	800 (32)
400 (16)	300 (12)	1000 (40)	850 (34)
450 (18)	350 (14)	1050 (42)	900 (36)
500 (20)	400 (16)	1200 (48)	1050 (42)
550 (22)	450 (18)		

4.6 Seat Design

The valves shall either be a soft seated valve or metal seated valve or with primary metal-to metal contact and secondary soft seats or seat design shall be as indicated in valve data sheet.

For soft seated valves, Metal seat rings may be provided with soft insert. The same shall be positively locked in position in Metal seat rings.

For valves with primary metal to metal contact and secondary soft seats, O-rings or other seals if used for drip tight sealing shall be encased in a suitable groove in such a manner that it cannot be removed from seat ring and there is no extrusion during opening or closing operation of valve at maximum differential pressure corresponding to valve class rating. The seat rings shall be so designed as to ensure sealing at low as well as high differential pressures.

4.7 Valves shall be designed to withstand a sustained internal vacuum of at least 1 (one) mille-bar in both open and closed positions.

4.8 Double Block & Bleed Design

Valves shall have double block and bleed feature to facilitate complete flush, drain and venting of the valve body cavity. Cavity relief pressure shall be as per API 6D.

4.9 Sealant Injection

Full bore valves of nominal valve size DN 200 mm (8") & above and Reduced Bore valves of nominal valve size DN 250 mm (10") & above, shall have provision for secondary sealant injection under full line pressure for seat and stem seals. All sealant injection connections shall be provided with block valve and an internal non-return valve. Valve design shall have a provision to replace the sealant injection fitting under full line pressure. Location and arrangement of sealant points shall be as per Fig 4.9.

4.10 Vent & Drain

Valves shall be provided with vent and drain connections. Location and arrangement of

vents and drains shall be as per Fig. 4.9. Body vent and drain shall be provided with valves (Ball or Plug type). Number and size shall be as per Fig. 4.9.

Valve design shall ensure repair of stem seals/ packing under full line pressure.

4.11 Support Foot

Full bore valves of nominal valve size DN 200 mm (8") & above and Reduced bore valves of nominal valve size DN 250 mm (10") & above, shall be equipped with support foot and lifting lugs unless specified otherwise. Tapped holes and eyebolts shall not be used for lifting lugs. Height of support foot shall be kept minimum. The location and size of support foot/ lifting lugs shall ensure unrestrictive operation of vent/ drain valves. The design of support foot shall be such that it shall take minimum double the weight of the valve assembly.

4.12 Valve design shall be such as to avoid bimetallic corrosion between carbon steel and high alloy steel components. Suitable insulation shall be provided as required.

4.13 The valve body cavity over-pressure shall be prevented by self-relieving seat rings/ assemblies. Valve Cavity relief pressure when added to the valve pressure rating shall not exceed 133% of the pressure rating of the valve at its maximum specified design temperature.

4.14 Valve Ends

Valve ends shall be either flanged/ or butt welded or one end flanged and one end butt welded as indicated in the Valve Data Sheet. Flanges of the flanged end cast/ forged body valves shall be integrally cast/ forged with the body of the valve. Face to face/ end to end dimensions shall conform to API 6D. Face-to-face and end-to-end dimensions for valve sizes not specified in API 6D shall be in accordance with ASME B 16.10. Face-to-face and end-to-end dimensions not shown in API 6D or in ASME B 16.10 shall be as per Manufacturer Standard and shall be subject to approval by Company.

Flanged ends, if specified, shall have flanges as per ASME B16.5 for valve sizes up to DN 600 mm (24") excluding DN 550 mm (22"), as per MSS-SP-44/ ASME B 16.47 Series A for valve sizes DN 550 mm (22") and for DN 650 mm (26 inches) and above. Flange face shall be either raised face or ring joint type (RTJ) as indicated in Valve Data Sheet. Flange face finish shall be serrated or smooth as indicated in Valve Data Sheet. In case of RTJ flanges, the groove hardness shall be minimum 140 BHN.

Butt weld end preparation shall be as per ASME B 16.25. The thickness of the pipe to which the valve has to be welded shall be as indicated in the Valve Data Sheet. In case difference exists between thickness of welding ends of valve and connecting pipe, the welding ends of valve shall have bevel preparation as per ASME B31.4 or ASME B31.8 as applicable.

In case of all Butt welded end valves (including soft seated valves or valves with primary metal to metal and secondary soft seats), actual yield strength of valve body shall not be less than $\frac{2}{3}$ rd of the specified minimum yield strength (SMYS) of the connecting pipe material.

For soft seated valves with Butt welded end, valves shall be provided with pup pieces on

either side of length 200 mm each for size up-to 8" & 250 mm for size 10" and above, with material as specified in valve data sheet. Length of pup piece shall be confirmed by manufacturer so as to avoid damage to seats during field welding or post weld heat treatment. Pup piece thickness shall be calculated for the class rating. Vendor shall provide for each type (considering size, grade and thickness of the pup pieces used for all offered valves) of pup piece, test rings (500 mm long) from pup piece material for field weld procedure qualification. Valves shall be tested along-with pup piece.

4.15 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 manufacturer shall furnish necessary field welding instructions and post-weld test procedure to demonstrate integrity and leak-tightness of valves after field welding operations.

4.16 POSITION INDICATORS

Valve shall be provided with ball position indicator and stops of rugged construction at the fully open and fully closed positions. For actuated valves, additionally mechanical means of position indicator shall be provided.

4.17 STEM EXTENSIONS

When stem extension requirement is indicated in Valve Data Sheet, the valves shall have the following provisions.

- a. Valves provided with stem extension shall have water proof outer casing. Length of stem extension shall be as indicated in Valve Data Sheet. The length indicated corresponds to the distance between centerline of the valve opening and the top of mounting flange for valve operating device (gear operator/ power actuator as applicable).
- b. In case of below Ground LTCS valves, Stem extension material shall be equivalent to stem material.
- c. Vent and drain connections and sealant injection lines shall be terminated adjacent to the valve operator by means of suitable piping anchored to the valve body. The pipe used shall be API 5L Gr. B/ ASTM A 106 Gr. B, with Sch 160 for carbon steel valves and ASTM A 333 Gr 6, with Sch 160 for Low temperature carbon steel valves or the material shall be as specified in valve data sheet. The material of fittings for Carbon Steel valve shall be ASTM A105/ ASTM A234 Gr. WPB and material for the fittings for low temperature carbon steel valves shall be ASTM A 350 Gr LF2 Cl 1 or the material shall be as specified in valve data sheet. The fittings and valve end shall be Socket welded ANSI class 6000# as per ASME B 16.11 (For piping class up to 600#) and BW end (For Piping Class 900#).
- d. Stem extension and stem housing design shall be such that the complete assembly will form a rigid unit giving positive drive under all conditions with no-possibility of free movement between valve body, stem extension or its operator.
- e. Outer casing of stem extension shall have 3/8" or 1/2" NPT plugs at the top and bottom, for draining and filling with oil to prevent internal corrosion.
- f. The Stem Extension shall be self-relieving.

4.18 OPERATING DEVICES

- a. Valves shall have a power actuator or manual operator as indicated in the Valve Data Sheet. In case of manual operator, valve sizes, $DN \leq 100$ mm (4") shall be wrench operated and valve sizes, $DN \geq 150$ mm (6") shall be gear operated. The length of wrench shall not be longer than twice the face to face or end to end dimension of the valve. Each wrench operated valve shall be supplied with wrench. Valve design shall be such that damage due to malfunctioning of the operator or its controls will only occur in the operator gear train or power cylinder and that damaged parts can be replaced without the valve cover being removed.
- b. The power actuator shall be in accordance with the Company Specification issued for the purpose and as indicated in the Valve and Actuator Data Sheet. Operating time shall be as indicated in Valve Data Sheet. Valve operating time shall correspond to full close to full open/ full open to full close under maximum differential pressure corresponding to the valve rating. For actuated valves, the actuator's rated torque output shall be 1.25 times the break torque required to operate the ball valve under the maximum differential pressure corresponding to the Valve Class Rating.
- c. 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. However, failing to meet above requirement, vendor shall offer gear operated valves. 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".
- d. Direction of operation of hand wheel or wrench shall be in clock-wise direction while closing the valve. Hand wheels shall not have protruding spokes.
- e. 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.

4.19 The tolerance on internal diameter and out of roundness at the ends for welded ends valves shall be as per connected pipe specification as indicated in the Valve Data Sheet.

4.20 LOCKING DEVICES

When indicated in Material Requisition/Data sheet/ Tender, valves shall have locking devices to lock the valve either in full open (LO) or full close (LC) positions. Locking devices shall be permanently attached to the valve operator and shall not interfere with operation of the valve.

4.21 WELDING

All welds shall be made by welders and welding procedures qualified in accordance with the provisions of ASME Section IX. The procedure qualification shall also include impact test and hardness test when required as per Clause 3.4 to 3.5 of this specification and shall meet the requirements as specified therein.

4.22 REPAIR WELDING

Repair by welding is not permitted for fabricated and forged body valves. However, repair

by welding as per ASME B16.34 is permitted for cast body valves. Such repairs shall be carried out at casting supplier's care only. Repair shall be carried out before any heat treatment of casting is done. Repair welding procedure qualification shall also include impact test and hardness test when required as per Clause 3.4 to 3.5 of this specification and shall meet the requirements as specified therein. Heat treatment and radiography shall be repeated after the weld repair.

- 4.23** No Casting is permitted for stem and stem extended material of all valve. Valve stem shall be capable of withstanding the maximum operating torque required to operate the valve against the maximum differential pressure corresponding to applicable class rating. The combined stress shall not exceed the maximum allowable stresses specified in ASME section VIII, Division 1. For power actuated valves, the valve stem shall be designed for maximum output torque of the selected power actuator (including gear box, if any) at valve stem.
- 4.24** Wherever specified for the part of valve in valve data sheet, minimum thickness of stelliting shall be 1.6mm
- 4.25** All Soft seated valves shall be fire safe design and qualified as per API 6FA/ API 607/ ISO 10497.
- 4.26** Soft-seated valves shall have antistatic device.

5 INSPECTION & TESTS

- 5.1** The Manufacturer shall perform all inspection and tests as per the requirements of this specification and the relevant codes, prior to shipment, at his works. Such inspection and tests shall be, but not limited to, the following:
- 5.2** All valves shall be visually inspected. The internal and external surfaces of the valves shall be free from any strikes, gouges and other detrimental defects. The surfaces shall be thoroughly cleaned and free from dirt, rust and scales.
- 5.3** Dimensional check on all valves shall be carried out as per the Company approved drawings.
- 5.4** Chemical composition and mechanical properties shall be checked as per this specification and relevant material standards, for each heat of steel used.
- 5.5** Non-destructive examination of individual valve material and component consisting of but not limited to castings, forgings, plates and assembly welds shall be carried out by the Manufacturer.
 - a. Body castings of all valves shall be radio graphically examined as per ASME B16.34. Procedure and acceptance criteria shall be as per ASME B 16.34. The extent of the radiography shall be as under:

Pressure Class Rating	Valve Size	Extent of Radiography
ANSI 150 # Class	≤ DN 600 mm (24")	Nil
	≥ DN 650 mm (26")	100%

ANSI 300 # Class	≤ DN 400 mm (16")	Nil
	≥ DN 450 mm (18")	100%
ANSI 600 # Class and above	All sizes	100%

Radiography shall be performed after the final heat treatment also.

All castings shall be wet magnetic particle inspected 100% of the internal surfaces. Method and acceptance shall, comply with ASME B 16.34.

- b. All valves, with body fabricated from plates or made by, forgings, shall be ultrasonically examined in accordance with the procedure and acceptance standard as per ASME B16.34.

All forgings shall be Wet magnetic particle inspected 100% of the internal surfaces. Method and acceptance shall comply with ASME B16.34.

- c. Bodies and bonnets made by welded assembly of segments of castings, forgings, plates or combinations thereof shall be examined, as applicable, by methods of 5.5 (a) for cast components or 5.5 (b) for forged components and plates.

5.6 Full inspection by radiography shall be carried out on all welds of pressure containing parts. Acceptance criteria shall be as per ASME B 31.4 or ASME B31.8 as applicable and API 1104.

5.7 Welds, which in Company's opinion cannot be inspected, by radiographic methods, shall be checked by ultrasonic or magnetic particle methods and acceptance criteria shall be as per ASME Sec. VIII , Division 1, Appendix 12 and, Appendix 6 respectively.

5.8 All finished wrought weld ends subject to welding in field shall be 100% ultrasonically tested for lamination type defects for a distance of 50 mm from the end. Laminations shall not be acceptable.

- a. Weld ends of all cast valves subject to welding in field shall be 100% radio graphically examined and acceptance criteria shall be as per ASME B16.34.

- b. After final machining, all bevel surfaces shall be inspected by dye penetrant or wet magnetic particle methods. All defects longer than 6.35 mm are rejected, as are the defects between 6.35 mm and 1.59 mm that are separated by a distance less than 50 times their greatest length. Rejectable defects must be removed. Weld repair of bevel surface is not permitted.

5.9 All valves shall be tested in compliance with the requirements of API 6D. During pressure testing, valves shall not have sealant lines and other cavities filled with sealant, grease or other foreign material: The drain, vent and sealant lines shall be either included in the hydrostatic shell test or tested independently. Test pressure shall be held for at least 30 minutes for both Shell & seat Test. No leakage is permissible during hydrostatic testing. The body cavity self-relieving feature meeting the requirements of clause 4.13 of this specification shall also be checked.

5.10 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.

5.11 Valves shall be subjected to Operational Torque Test as per API 6D (Annex I, Para I.6) under hydraulic pressure equal to maximum differential pressure corresponding to the applicable ANSI class rating of valve. It shall be established that the force required to operate the valve does not exceed the requirements stated in section 4.18 (C) of this specification.

5.12 Power actuated valves shall be tested after assembly of the valve and actuator, at the valve Manufacturer's works. At least five Open-Close-Open cycles without internal pressure and five Open-Close-Open cycles with maximum differential pressure corresponding to the valve rating shall be performed on the valve actuator assembly. The time for Full Open to Full Close shall be recorded during testing. If required, the actuator shall be adjusted to ensure that the opening and closing time is within the limits stated in Valve Data Sheet.

Hand operator provided on the actuator shall also be checked after above testing, for satisfactory manual over-ride performance.

These tests shall be conducted on minimum one valve out of a lot of five (5) valves of the same size, rating and the actuator model/ type. In case, the tests do not meet the requirements, retesting/ rejection of the lot shall be decided by the Company's Inspector.

5.13 Subsequent to successful testing as specified in clause 5.11 and 5.12 above, one (1) valve out of the total ordered quantity shall be randomly selected by the Company Representative for cyclic testing as mentioned below:

- a. The valve shall be subjected to at least 100 Open-Close-Open cycles with maximum differential pressure corresponding to the valve rating.
- b. Subsequent to the above, the valve shall be subjected to hydrostatic test and supplementary air seat test in accordance with clause 5.9 and 5.10.

In case this valve fails to pass these tests, the valve shall be rejected and two more valves shall be selected randomly and subjected to testing as indicated above. If both valves pass these tests, all valves manufactured for the order (except the valve that failed) shall be deemed acceptable. If either of the two valves fails to pass these tests, all valves shall be rejected or each valve shall be tested at the option of manufacturer.

Previously carried out test of similar nature shall be considered acceptable if the same has been carried out by Manufacturer in last two years. Valves of two sizes below and two sizes above the size of valve previously tested, and rating similar or one rating lower of valve tested previously, shall be qualified.

5.14 Checks shall be carried out to demonstrate that the dissimilar metals used in the valves are successfully insulated as per the requirement of clause 4.12 of this specification.

5.15 Anti-Static testing for soft seated valves in accordance with L.5 of API 6D.

5.16 Company reserves the right to perform stage wise inspection and witness tests as indicated in clause 5.1 above at Manufacturer's works prior to shipment. Manufacturer shall give reasonable access and facilities required for inspection to the Company's

Inspector. Company reserves the right to require additional testing at any time to confirm or further investigate a suspected fault. The cost incurred shall be to Manufacturer's account.

In no case shall any action of Company or his inspector shall relieve the Manufacturer of his responsibility for material, design, quality or operation of valves.

Inspection and tests performed/ witnessed by the Company's Inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and tests.

6 TEST CERTIFICATES

Manufacturer shall submit the following certificates in accordance with EN 10204 3.2.

- a. Mill test certificates relevant to the chemical analysis and mechanical properties of the materials used for the valve construction as per the relevant standards.
- b. Report on heat treatment carried out.
- c. Test certificates of hydrostatic and pneumatic tests complete with records of timing and pressure of each test.
- d. Test reports of radiograph and ultrasonic inspection, MPI and DP Inspection
- e. Test report on operation of valves conforming to clause 5.11, 5.12 and 5.13 of this specification.
- f. All other test reports and certificates as required by API 6D and this specification.

The certificates shall be considered valid only when signed by Company's Inspector. Only those valves which have been certified by Company's Inspector shall be dispatched from Manufacturer's works.

7 PAINTING

Valve surface shall be thoroughly cleaned, freed from rust and grease and applied with sufficient coats of corrosion resistant paint. Surface preparation shall be carried out by shot blasting to SA-2 ½ / SSPC-SP10. For Coastal area, painting shall be suitable for industrial marine environment. For the valves to be installed underground, when indicated in Valve Data Sheet, the external surfaces of buried portion of the valve shall be painted with 100% Solid high build epoxy with a minimum dry film thickness of 1000 microns or 1.5 mm thick polyurethane coating.

8 MARKING & SHIPMENT

- 8.1** All valves shall be marked as per API 6D. The units of marking shall be metric except nominal diameter, which shall be in inches.
- 8.2** Valve ends shall be suitably protected to avoid any damage during transit. All threaded and machined surfaces subject to corrosion shall be well protected by a coat of grease or other suitable material. All valves shall be provided with suitable protectors for flange faces, securely attached to the valves. Bevel ends shall be protected with metallic or high impact plastic bevel protectors.
- 8.3** All sealant lines and other cavities of the valve shall be filled with sealant before shipment.

- 8.4** Packaging and shipping instructions shall be as per API 6D.
- 8.5** The serial number of each valve indicated on its name plate shall appear on all required documentation in accordance with EN 10204 3.2.
- 8.6** Name Plate material shall be minimum stainless steel. Marking shall be as per MSS-SP-25
- 8.7** All valves shall be transported with ball in fully opened condition
- 8.8** On packages, following shall be marked legibly with suitable marking ink:
- Order Number
 - Manufacturer's Name
 - Valve size and rating
 - Tag Number
 - Serial Number

9 SPARES & ACCESSORIES

- 9.1** Manufacturer shall furnish list of recommended spares and accessories for valves required during start-up and commissioning and supply of such spares shall be included in the price quoted by Manufacturer.
- 9.2** Manufacturer shall furnish list of recommended spares and accessories required for two years of normal operation and maintenance of valves and price for such spares shall be quoted separately.

10 DOCUMENTATION

Documentation to be submitted by Manufacturer to Company is summarized below. Number of Copies (Hard copies / soft copies etc.) shall be as indicated in CONTRACT document.

- 10.1** At the time of bidding, Manufacturer shall submit the following documents:
- Reference list of similar ball valves manufactured and supplied in last seven years indicating all relevant details including project, year, client, location, size, rating, service etc.
 - Torque curves for the power actuated valves along with the break torque, running torque for the valve stem and maximum allowable stem torque.
 - Copy of valid API 6D Certificate.
 - Fire Safe test certificate qualifying the valves as per API 6FA/ API 607/ ISO 10497 carried out in last 10 years shall be furnished.
 - Details of support foot including dimensions and distance from valve centreline to bottom of support foot.
 - List of recommended spares required during start-up and commissioning & 2 years of normal operation and maintenance.

10.2 After placement of order, the Manufacturer shall submit the following drawings, documents and specifications for Company's approval:

- a. General arrangement & detailed sectional drawings showing all parts with reference numbers and material specifications, overall dimensions and features. Number of turns of hand wheel required for operating the valve from full open to full close position for Gear Operated valves, painting/ coating scheme, Complete dimensional details of support foot (where applicable), shall be indicated in the GA.

Manufacture of valves shall commence only after approval of the above documents. Once the approval has been given by Company, any changes in design, material and method of manufacture shall be notified to Company whose approval in writing of all changes shall be obtained before the valve is manufactured.

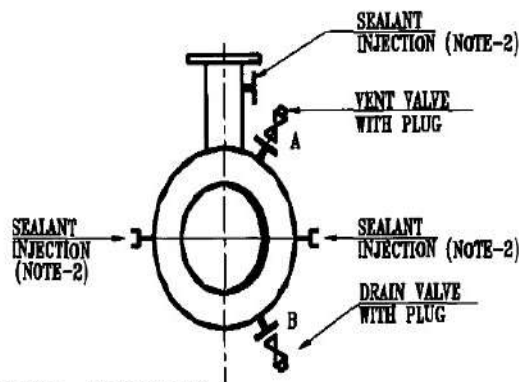
10.3 Within 30 days from the approval date, Manufacturer shall submit to Company the approved drawings, documents and specifications as listed in clause 10.2 above.

10.4 Prior to shipment, Manufacturer shall submit to Company following:

- a. Test certificates as per clause 6.0 of this specification.
- b. Manual for installation, erection, maintenance and operation instructions including a list of recommended spares for the valves.

10.5 All documents shall be in English language only.

ABOVE GROUND INSTALLATION



FULL BORE VALVES

VALVE SIZE, DN(mm)	A, DN(mm)	B, DN(mm)
50 TO 150	-	15
200 TO 800	15	25
650 & ABOVE	15	40

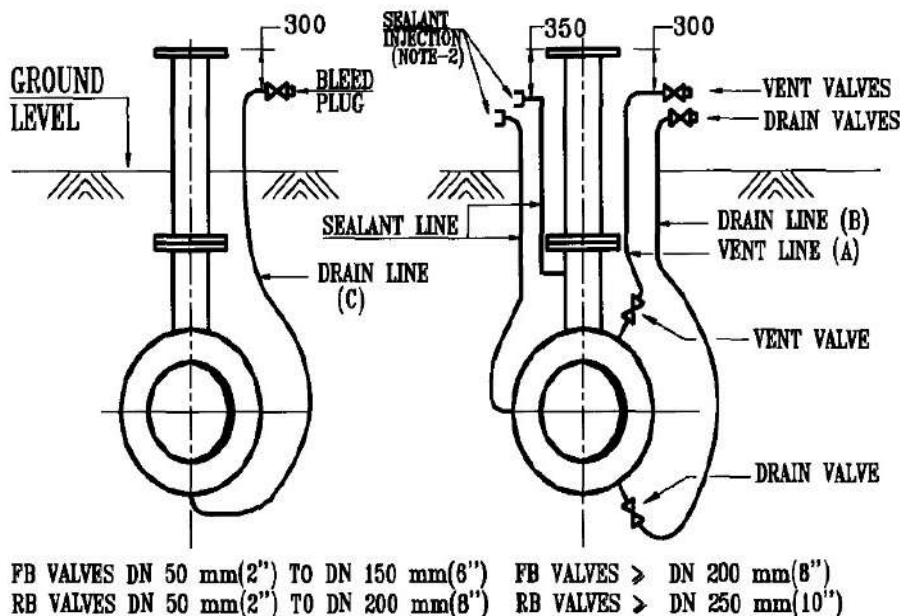
REDUCED BORE VALVES

VALVE SIZE, DN(mm)	A, DN(mm)	B, DN(mm)
50 TO 200	-	15
250 TO 750	15	25
ABOVE 750	15	40

NOTES:-

- 1 ALL VALVES (BALL OR PLUG) AND PLUGS FOR A AND B SHALL BE APPROVED BY THE PURCHASER.
- 2 SEALANT POINTS SHALL BE PROVIDED FOR FULL BORE VALVES OF NOMINAL VALVE SIZE 200 mm (8") & ABOVE AND REDUCED BORE VALVES OF NOMINAL VALVE SIZE, DN 250 mm (10") AND ABOVE ONLY. SEALANT LINES SHALL HAVE PROVISION TO REPLACE THE SEALANT INJECTION FITTING UNDER FULL LINE PRESSURE. SEALANT LINES SHALL HAVE BLOCK VALVE & INTERNAL NON RETURN VALVE.
- 3 ALL VENT/DRAIN CONNECTION SHALL BE WELDED WITH THE BODY.

UNDERGROUND INSTALLATION



FULL BORE (FB) VALVES

VALVE SIZE, DN(mm)	A, DN(mm)	B, DN(mm)	C, DN(mm)
50 TO 150	-	-	15
200 TO 300	25	25	-
350 TO 600	25	25	-
650 & ABOVE	40	40	-

REDUCED BORE (RB) VALVES

VALVE SIZE, DN(mm)	A, DN(mm)	B, DN(mm)	C, DN(mm)
50 TO 200	-	-	15
250 TO 400	25	25	-
450 TO 750	25	25	-
800 & ABOVE	40	40	-

NOTES:-

- 1 ALL VALVES (BALL OR PLUG) AND PLUGS FOR A AND B SHALL BE APPROVED BY THE PURCHASER.
- 2 SEALANT POINTS SHALL BE PROVIDED FOR FULL BORE VALVES OF NOMINAL VALVE SIZE 200 mm (8") & ABOVE AND REDUCED BORE VALVES OF NOMINAL VALVE SIZE, DN 250 mm (10") AND ABOVE ONLY. SEALANT LINES SHALL HAVE PROVISION TO REPLACE THE SEALANT INJECTION FITTING UNDER FULL LINE PRESSURE. SEALANT LINES SHALL HAVE BLOCK VALVE & INTERNAL NON RETURN VALVE.
- 3 ALL VENT/DRAIN CONNECTION IN BURIED SECTION SHALL BE OF WELDED CONSTRUCTION. ALL PIPING INCLUDING VALVE ENDS IN BURIED PORTIONS OF VENT & DRAIN SHALL BE WELDED TYPE.

FIGURE-4.9



VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION FOR PLUG VALVES

VCS – SS – PP - 2051

00	03.05.2022	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

ABBREVIATIONS:

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
BHN	Brinell Hardness Number
DN	Nominal Size
HAZ	Heat Affected Zone
LC	Lock Close (valve locked in full close position)
LO	Lock Open (valve locked in full open position)
MSS-SP	Manufacturers Standardization Society - Standard Practice
NDT	Non Destructive Testing
NPS	Nominal Pipe Size
RTJ	Ring Type Joint
SSPC	Steel Structures Painting Council
MPI	Magnetic Particle Inspection
DP	Dye Penetrant

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1.0 **SCOPE**

This Specification covers the minimum requirements for design, manufacture, testing and supply of carbon steel plug valves of size DN 50 mm (2") and above and ANSI pressure rating Class 150# thru 900# for use in onshore pipeline systems handling non-sour hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG).

2.0 **REFERENCE DOCUMENTS**

- 2.1 All valves shall be manufactured and supplied in accordance with the American Petroleum Institute (API) Specification 6D, Latest Edition with additions and modifications as indicated in the following sections of this specification.
- 2.2 Reference has also been made in this specification to the latest edition (edition enforce at the time of issue of enquiry unless specified otherwise) of the following Codes, Standards and Specification.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

B31.3	:	Process Piping.
B31.4	:	Pipeline Transportation System for Liquid Hydrocarbon & Other Liquids.
B 31.8	:	Gas Transmission and Distribution Piping Systems.
B16.5	:	Pipe Flanges and Flanged Fittings.
B16.10	:	Face to Face and End to End Dimensions of Valves.
B 16.25	:	Butt Welding Ends.
B 16.34	:	Valves-Flanged, Threaded and Welding Ends.
B 16.47	:	Large Diameter Steel Flanges.
Section VIII	:	Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels.
Section IX	:	Welding and Brazing Qualifications.

AMERICAN PETROLEUM INSTITUTE (API)

1104	:	Specification for Welding Pipelines and Related Facilities.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A370	:	Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

B 733 : Auto catalytic (Electroless) Nickel - Phosphorus Coatings on Metal.

MANUFACTURERS STANDARDIZATION SOCIETY (MSS)

SP-6 : Standard Finishes for Contact Faces of Pipe Flanges and Connecting – End Flanges of Valves and Fittings.

SP-44 : Steel Pipeline Flanges.

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

VIS-I : Visual Standard.

2.3 In case of conflict between the requirements of this specification, API 6D and the Codes, Standards and Specifications referred in clause 2.2 above, the requirements of this specification shall govern.

Order of precedence shall be as follows:

- Data Sheets
- This Specification
- API 6D Specification
- Other Referred Codes & Standards
- Manufacturer's Standard

3.0 MATERIALS

3.1 The Material for Construction of major components of the Plug valves shall be as indicated in Valve Data Sheet. Other components shall be as per Manufacturer's standard (suitable for the service conditions indicated in the Valve Data Sheet) and shall be subject to approval by Company.

All process-wetted parts, metallic and non-metallic, and lubricants shall be suitable for the service specified by the Company. Manufacturer shall confirm that all wetted parts are suitable for treated water/ seawater environment, which may be used during field testing.

3.2 Carbon steel used in the manufacture of valves shall be fully killed.

3.3 The carbon equivalent (CE) of valve end connections which are subject to further field welding by Company shall not exceed 0.45 on check analysis for each heat of steel used, as calculated by the following formula:

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

3.4 CHARPY V-NOTCH TEST REQUIREMENTS

3.4.1 For valves specified to be used for Gas service or LPG service, Charpy V-notch test, on each heat of base material shall be conducted as per API 6D, for all pressure containing parts such as body,

end flanges and welding ends as well as bolting material for pressure containing parts. Unless specified otherwise, the Charpy Impact test shall be conducted at 0°C or minimum design temperature indicated in valve data sheet / MR, whichever is lower. Test procedure shall conform to ASTM A 370. The average absorbed energy value of three full sized specimens shall be 27 J. The minimum impact energy value of any one specimen of the three specimens analyzed as above shall not be less than 22 J.

- 3.4.2 When Low Temperature Carbon Steel (LTCS) materials are specified in Valve Data Sheet or offered by Manufacturer, the Charpy V-notch test requirements of applicable material standard shall be complied with.

3.5 HARDNESS TEST REQUIREMENTS

For Valves specified to be used for Gas service or LPG service, Hardness test shall be carried out as per ASTM A 370 for each method of manufacture and each heat of steel used in the manufacture of valves. A full thickness cross section shall be taken for this purpose and the maximum hardness of the materials of valve components such as base material of body and principal parts of the valve such as plug, stem, etc shall not exceed 248 HV₁₀.

3.6 ELECTROLESS PLATING REQUIREMENTS

For all such valves where Carbon Steel is used as plug material, the plug shall have 75 micrometers (0.003 inches) thick Electroless Nickel Plating (ENP) as per ASTM B 733 with following classification:

- SC2, Type II, Class 2.

The hardness of plating shall be minimum 50 RC.

Manufacturer shall ensure that the adhesive strength of plating is sufficient so as to prevent peeling of plating during operation of the valve.

4.0 DESIGN AND CONSTRUCTION REQUIREMENTS

4.1 GENERAL

Valve design shall meet the requirements of API Specification 6D and shall be suitable for the service conditions indicated in the Valve Data Sheet. The valve body and other pressure containing parts shall be designed in compliance with ASME Boiler & Pressure Vessel Code, Section VIII, Div1. Allowable stress requirements shall comply the provisions of ASME B31.3. Also corrosion allowance indicated in Valve Data Sheet shall be considered in valve design. However, the minimum wall thickness shall not be less than the minimum requirement of ASME B16.34. The manufacturer shall have valid license to use API monogram on valves manufactured as per API 6D.

All process-wetted parts, metallic and non-metallic, shall be suitable for the fluids and service specified by the Purchaser

4.2 VALVE PATTERN

Valve pattern area shall be as specified in the following table:-

ANSI Pressure Rating	SIZE RANGE, DN MM (INCH)	PATTERN
Class 150 #	50-100 (2- 4)	Short
	150-300 (6 – 12)	Regular
	350(14) & above	Venturi
Class 300 #	50 -100(2 – 4)	Short
	150 - 250 (6 -10)	Regular
	300 (12) & above	Venturi
Class 600 #	50 - 250 (2 – 10)	Regular
	300 (12) & above	Venturi
Class 900 #	50 - 250 (2 – 10)	Regular
	300 (12) & above	Venturi

4.3 PLUG DESIGN

The valves shall have an inherent feature to ensure that under line pressure cannot cause taper locking of plug/ plug movement in to the taper, i.e. valves shall be of “Pressure-Balanced” design type.

4.4 Cover shall be bolted to the valve body and screwed connections are not acceptable.

4.5 Soft seats to achieve a seal between plug and body are not permitted.

4.6 SEALANT INJECTION REQUIREMENT

All valves shall have the provision for secondary sealant injection under full line pressure for seat and stem seals. All sealant injection connection shall be provided with an internal non-return valve. Valve design shall have a provision (e.g. Ball Type Check Valve/ Needle Valve) to replace the sealant injector fitting under full line pressure. Location and arrangement of sealant injection points shall be as per Fig - 4.6. Valves shall have vent and drain connections as per API 6D.

4.7 Valves shall be designed to withstand a sustained internal vacuum of at least 1 (one) milli-bar in both open and closed positions.

4.8 Valve design shall ensure repair of gland packing under full line pressure.

4.9 VALVE ENDS

a. Valve ends shall be either flanged/ or butt welded or one end flanged and one end butt welded as indicated in the Valve Data Sheet. Flanges of the flanged end cast/ forged body valves shall be integrally cast/ forged with the body of the valve. Face to face/ end to end dimensions shall conform to API 6D. Face-to-face and end-to-end dimensions for valve sizes not specified in API 6D shall be in accordance with ASME B 16.10. Face-to-face and end-to-end

dimensions not shown in API 6D or in ASME B 16.10 shall be as per Manufacturer Standard and shall be subject to approval by Company.

- b. Flanged ends, if specified, shall have flanges as per ASME B16.5 for valve sizes up to DN 600 mm (24") excluding DN 550 mm (22") and as per MSS-SP-44/ ASME B 16.47 Series A for valve sizes DN 550 mm (22") and for DN 650 mm (26") and above. Flange face shall be either raised face or ring joint type (RTJ) as indicated in Valve Data Sheet. Flange face finish shall be serrated or smooth as indicated in Valve Data Sheet. In case of RTJ flanges, the groove hardness shall be minimum 140 BHN.
- c. Butt weld end preparation shall be as per ASME B 16.25. The thickness of the pipe to which the valve has to be welded shall be as indicated in the Valve Data Sheet. Valves shall be without transition pups. In case difference exists between thickness of welding ends of valve and connecting pipe, the welding ends of valve shall have bevel preparation as per ASME B31.4 or ASME B31.8 as applicable.

4.10 POSITION INDICATORS

Valve shall be provided with Plug position indicator and stops of rugged construction at the fully open and fully closed positions.

4.11 VALVE INSTALLATION

Valves shall be suitable for either buried or above ground installation as indicated in Valve Data Sheet, material Requisition & P&IDs

4.12 LOCKING DEVICES

When indicated in Material Requisition, valves shall have locking devices to lock the valve either in full open (LO) or full close (LC) positions. Locking devices shall be permanently attached to the valve operator and shall not interfere with operation of the valve.

- 4.13 Valves of size NPS 8" and larger shall be equipped with lifting lugs. Tapped holes and eye bolts shall not be used for lifting lugs.

4.14 STEM EXTENSIONS

When stem extension requirement is indicated in Valve Data Sheet, the valves shall have the following provisions.

- a. Valves provided with stem extension shall have water proof outer casing. Length of stem extension shall be as indicated in Valve Data Sheet. The length indicated corresponds to the distance between centerline of the valve opening and the top of mounting flange for valve operating device (gear operator/ power actuator as applicable).
- b. Seat sealant injection lines shall be extended and terminated adjacent to the valve operator by means of suitable piping anchored to the valve body/ stem housing. The pipe used shall be API 5L Gr. B/ ASTM A 106 Gr. B, with Sch 160. Fittings shall be ASTM A105/ ASTM A 234 Gr. WPB, Socket welded ANSI class 6000.
- c. Sealant injection lines shall be extended and terminated adjacent to the valve operator in manner as indicated in (b) above

- d. Stem extension and stem housing design shall be such that the complete assembly will form a rigid unit giving positive drive under all conditions with no-possibility of free movement between valve body, stem extension or its operator.
- e. Outer casing of stem extension shall have 3/8" or 1/2" NPT plugs at the top and bottom, for draining and filling with oil to prevent internal corrosion.

4.15 The valve stem shall be capable of withstanding the maximum operating torque required to operate the valve against the maximum differential pressure as per the appropriate class. The combined stress shall not exceed the maximum allowable stresses specified in the ASME Section VIII Div 1.

For Power Actuated Valves, the valve stem shall be designed for maximum output torque of the selected power actuator (including gear box, if any) at the valves stem

The valve stem shall have anti-blowout feature with antistatic device. The valve stem may be integral with plug or be a separate component.

4.16 OPERATING DEVICES

- a. Valves shall have a power actuator or manual operator as indicated in the Valve Data Sheet. In case of manual operator, valve sizes, $DN \leq 100$ mm (4") shall be wrench operated and valve sizes, $DN \geq 150$ mm (6") shall be gear operated. Each wrench operated valve shall be supplied with wrench. Valve design shall be such that damage due to malfunctioning of the operator or its controls will only occur in the operator gear train or power cylinder and that damaged parts can be replaced without the valve cover being removed.
- b. The power actuator shall be in accordance with the Company Specification issued for the purpose and as indicated in the Valve and Actuator Data Sheet. Operating time shall be as indicated in Valve Data Sheet. Valve operating time shall correspond to full close to full open/ full open to full close under maximum differential pressure corresponding to the valve rating. For actuated valves, the actuator's rated torque output shall be at least 1.25 times the break torque required to operate the valve under the maximum differential pressure corresponding to the valve class rating.
- c. 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. Manufacturer shall also indicate the number of turns of hand wheel (In case of gear operators) required for operating the valve from full open to full close position. Operating device shall be designed for easy operation of valve under maximum differential pressure corresponding to the valve rating
- d. Direction of operation of hand wheel or wrench shall be in clock-wise direction while closing the valve. Hand wheels shall not have protruding spokes.
- e. 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.

4.17 WELDING

All welds shall be made by welders and welding procedures qualified in accordance with the provisions of ASME Section IX, except that only positions 5G and 2G shall qualify all-positional welding. The procedure qualification shall also include impact test and hardness test when

required as per Clause 3.4 and 3.5 of this specification and shall meet the requirements as specified therein.

4.18 REPAIR WELDING

Repair by welding is not permitted for fabricated and forged body valves. However repair by welding as per ASME B16.34 is permitted for cast body valves. Such repairs shall be carried out at casting supplier's care only. Repair shall be carried out before any heat treatment of casting is done. Repair welding procedure qualification shall also include impact test and hardness test when required as per Clause 3.4 and 3.5 of this specification and shall meet the requirements as specified therein.

4.19 The tolerance on internal diameter and out of roundness at the ends for welded ends valves shall be as per connected pipe specification as indicated in the Valve Data Sheet

5.0 INSPECTION AND TESTS

5.1 The Manufacturer shall perform all inspection and tests as per the requirements of this specification and the relevant codes, prior to shipment, at his works. Such inspection and tests shall be, but not limited to, the following:

5.2 All valves shall be visually inspected. The internal and external surfaces of the valves shall be free from any strikes, gouges and other detrimental defects. The surfaces shall be thoroughly cleaned and free from dirt, rust and scales.

5.3 Dimensional check on all valves shall be carried out as per the Company approved drawings.

5.4 Chemical composition and mechanical properties shall be checked as per this specification and relevant material standards, for each heat of steel used.

5.5 Non-destructive examination of individual valve material and component consisting of but not limited to castings, forgings, plates and assembly welds shall be carried out by the Manufacturer.

a. Valve castings of all valves shall be radiographically examined at the cover and body portion, seat location, flanged body ends and circumference of ends to be field welded as per ASME B 16.34. Procedure and acceptance criteria shall be as per ASME B 16.34. The extent of the radiography shall be as under:

PRESSURE CLASS RATING	VALVE SIZE	EXTENT OF RADIOGRAPHY
ANSI 150 # Class	All Sizes	Nil
ANSI 300 # Class	≤ DN 400 mm (16")	Nil
	≤ DN 450 mm (18")	100%
ANSI 600 # Class above	All Sizes	100%

All castings shall be wet magnetic particle inspected 100% of the internal surfaces. Method and acceptance shall, comply with ASME B 16.34.

b. All forgings shall be by ultrasonic method. Inspection procedure and acceptance shall comply with Annexure E of ASME B16.34.

5.6 Areas, which in Company's opinion cannot be inspected, by radiographic methods, shall be checked by ultrasonic or magnetic particle methods and acceptance criteria shall be as per ASME Sec. VIII (2007 edition), Division 1, Appendix 12 and Appendix 6 respectively.

5.7 Weld ends of all cast valves subject to welding in field shall be 100% radiographically examined and acceptance criteria shall be as per ASME B16.34.

After final machining, all bevel surfaces shall be inspected by dye penetrate or wet magnetic particle methods. All defects longer than 6.35 mm are rejected, as are the defects between 6.35 mm and 1.59 mm that are separated by a distance less than 50 times their greatest length. Rejectable defects must be removed. Weld repair of bevel surface is not permitted.

All finished wrought weld ends subject to welding in field shall be 100% ultrasonically tested for lamination type defects for a distance of 50 mm from the end. Laminations shall not be acceptable.

5.8 All valves shall be tested in compliance with the requirements of API 6D. The drain, vent and sealant lines shall be either included in the hydrostatic shell test or tested independently. Test pressure shall be held for duration mentioned in API 6D. Hydrostatic shell testing shall ensure that the whole of the shell is subjected to the test pressure. If necessary, the empty shell shall be pressure tested prior to assembly of the plug. The drain, vent and sealant lines shall be either included in the hydrostatic shell test or tested independently

5.9 No leakage is permissible during hydrostatic testing. After pressure testing and acceptance, valves shall be thoroughly drained and dried. Drying of valves internal shall be with compressed air and lint free rags. The internal surfaces shall be coated with suitable water dispelling anti-corrosion fluid. To ensure total coverage, the valve shall be placed in the half open position, filled with the fluid and drained.

5.10 A supplementary air seat test as per API 6D shall be carried out for all valves. No leakage is allowed. Test pressure shall be held for at least 15 minutes.

5.11 Manufacturer who intends bidding must submit at bid stage, certificate and report for successful fire safe tests for all types of valves in accordance with BS:6755 (Part-II)/ API 6FA, as applicable in Valve Data Sheet. Failure to comply with the requirement shall be a cause of rejection of the offer

5.12 Valves shall be subjected to an Operational Torque Test as per API 6D under hydraulic pressure equal to maximum differential pressure corresponding to the applicable ANSI class rating of valve. For manually operated valves, testing shall confirm that the torque required to operate the valve does not exceed 4.16 (c) of this specification.

5.13 Power actuated valves shall be tested after assembly of the valve and actuator, at the valve Manufacturer's works. At least five Open-Close-Open cycles without internal pressure and five Open-Close-Open cycles with maximum differential pressure corresponding to the valve rating shall be performed on the valve actuator assembly. The time for Full Open to Full Close shall be

recorded during testing. If required, the actuator shall be adjusted to ensure that the opening and closing time is within the limits stated in Valve Data Sheet.

Hand operator provided on the actuator shall also be checked after above cyclic testing, for satisfactory manual over-ride performance.

These tests shall be conducted on minimum one valve out of a lot of five (5) valves of the same size, rating and the actuator model/ type. In case, the tests do not meet the requirements, retesting/ rejection of the lot shall be decided by the Company's Inspector.

- 5.14** Company reserves the right to perform stage wise inspection and witness tests as indicated in clause 5.1 above at Manufacturer's works prior to shipment. Manufacturer shall give reasonable access and facilities required for inspection to the Company's Inspector. Company reserves the right to require additional testing at any time to confirm or further investigate a suspected fault. The cost incurred shall be to Manufacturer's account.

In no case shall any action of Company or his inspector shall relieve the Manufacturer of his responsibility for material, design, quality or operation of valves.

Inspection and tests performed/ witnessed by the Company's Inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and tests.

6.0 TEST CERTIFICATES

Manufacturer shall submit the following certificates in accordance with EN10204 3.2.

- a. Mill test certificates relevant to the chemical analysis and mechanical properties of the materials used for the valve construction as per the relevant standards.
- b. Report on heat treatment carried out.
- c. Test certificates of hydrostatic and pneumatic tests complete with records of timing and pressure of each test.
- d. Test reports of radiograph and ultrasonic inspection, MPI and DP Inspection.
- e. Test report on operation of valves conforming to clause 5.0 of this specification.
- f. All other test reports and certificates as required by API 6D and this specification.

The certificates shall be considered valid only when signed by Company's Inspector. Only those valves which have been certified by Company's Inspector shall be dispatched from Manufacturer's works.

7.0 PAINTING

Valve surface shall be thoroughly cleaned, freed from rust and grease and applied with sufficient coats of corrosion resistant paint. Surface preparation shall be carried out by shot blasting to SP-6 in accordance with "Steel Structures Painting Council - Visual Standard SSPC-VIS-1". For the valves to be installed underground, when indicated in Valve Data Sheet, the external surfaces of buried portion of the valve shall be painted with three coats of suitable coal tar epoxy resin with a minimum dry film thickness of 300 microns.

Manufacturer shall indicate the type of corrosion resistant paint used, in the drawings submitted for approval

8.0 MARKING & SHIPMENT

- 8.1** All valves shall be marked as per API 6D. The units of marking shall be metric except nominal diameter, which shall be in inches. Marking shall be done by die-stamping on the bonnet or on the housing. However, for buried valves the marking shall be done on the above ground portion of the stem housing only.
- 8.2** Valve ends shall be suitably protected to avoid any damage during transit. All threaded and machined surfaces subject to corrosion shall be well protected by a coat of grease or other suitable material. All valves shall be provided with suitable protectors for flange faces, securely attached to the valves. Bevel ends shall be protected with metallic or high impact plastic bevel protectors.
- 8.3** All sealant lines and other cavities of the valve shall be filled with sealant before shipment.
- 8.4** Packaging and shipping instructions shall be as per API 6D.
- 8.5** On packages, following shall be marked legibly with suitable marking ink:
- a. Order Number
 - b. Manufacturer's Name
 - c. Valve size and rating
 - d. Tag Number
 - e. Serial Number

9.0 SPARES AND ACCESSORIES

- 9.1** Manufacturer shall furnish list of recommended spares and accessories for valves required during start-up and commissioning and supply of such spares shall be included in the price quoted by Manufacturer.
- 9.2** Manufacturer shall furnish list of recommended spares and accessories required for two years of normal operation and maintenance of valves and price for such spares shall be quoted separately.

10.0 DOCUMENTATION

- 10.1.** The Manufacturer shall supply documentation in accordance with the Vendor Data Requirements List (VDRL) as attached with Purchase Order/ Material requisition. If not mentioned below minimum documentation shall be followed.

At the time of bidding, the bidder shall submit the following documents:

- a) General arrangement/ assembly drawings showing all features and relative positions & sizes of vents, drains, gear box & other external parts together with overall dimensions.

- b) Sectional drawing showing major parts with reference numbers and material specification.
- c) Reference list of similar plug valves manufactured and supplied in last five years, indicating all relevant details including project, year, client, location, size rating, service, etc.
- d) Torque curves for the power actuated valves along with break torque and maximum allowable stem torque. In addition, sizing criteria and torque calculations shall also be submitted for power actuated valves.
- e) Descriptive technical catalogues of the Manufacturer.
- f) Copy of valid API 6D certificate, wherever applicable.
- g) Details of support foot, including dimensions and distance from valve centre line to bottom of support foot.
- h) Quality Assurance Plan enclosed with this tender duly signed, stamped and accepted.

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

10.2. Within two weeks of placement of order, the manufacturer shall submit six copies of, but not limited to, the following drawings, documents and specifications for approval :

- a) Design drawings and relevant calculations for pressure containing parts and other principle parts.
- b) Detailed sectional arrangement drawing showing all parts with reference numbers and materials specification.
- c) Assembly drawings with overall dimensions & clearances required and showing all features. Drawing shall also indicate the numbers of turns of handwheel (in case of gear operator) required for operating the valve from full open to full close position and the painting scheme.
- d) Welding, heat treatment, testing and quality control procedures.
- e) Details of corrosion resistant paint to be applied on the valves.
- f) Design calculation for pressure containing parts.

Manufacture of valves shall commence only after approval of the above documents. Once approval has been given by Purchaser, any change in design, material and method of manufacture shall be notified to the Purchaser, whose approval in writing for all changes shall be obtained before the valves are manufactured.

10.3. Within 30 days from the approval date, Manufacturer shall submit one reproducible and six copies of the approved drawings, documents and specification as listed in clause 10.2 of this specification.

10.4. Prior to shipment, Manufacturer shall submit one reproducible and six copies of following

t certificates as listed in clause 7.0 of this specification.

- b) Manual for installation, erection instructions, maintenance and operation instructions, including a list of recommended spares for the valves

10.5. All documents shall be in English Language.

11.0 GUARANTEE

11.1 Manufacturer shall guarantee that the materials and machining of valves and fittings comply with the requirements in this specification and in the Purchase Order.

11.2 Manufacturer is bound to replace or repair all valve parts which should result defective due to inadequate engineering or to the quality of materials and machining.

11.3 If valve defect or malfunctioning cannot be eliminated, Manufacturer shall replace the valve without delay.

11.4 Any defect occurring during the period of Guarantee shall be attended to by making all necessary modifications and repair of defective parts free of charge to the Purchaser as per the relevant clause of the bid document.

11.5 All expenses shall be to Manufacturer's account.

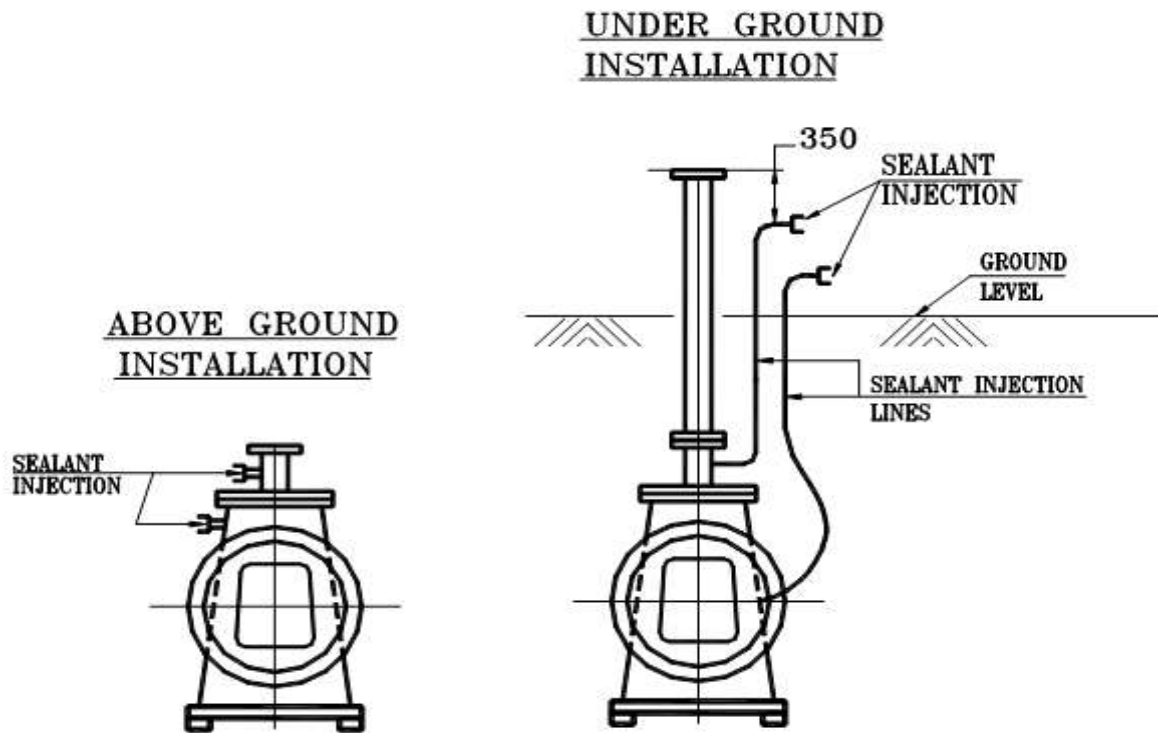


FIGURE- 4.6



VCS QUALITY SERVICES PRIVATE LIMITED

STANDARD SPECIFICATION FOR STAINLESS STEEL – MULTI TUBES FOR CNG STATION

VCS – SS – PI - 0012

00	04.06.2019	ISSUED AS STANDARD	PNS	SM	AD
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ABBREVIATIONS:

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
BHN	Brinell Hardness Number
HAZ	Heat Affected Zone
MSS-SP	Manufacturers Standardization Society - Standard Practice
SSPC	Steel Structures Painting Council



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1.0 INTRODUCTION

The Concept of Stainless-Steel Bundle Tubes / Multi tubes is to be used for construction of CNG Station. The Proposal is to replace the conventional method of connecting between Compressor Priority panels to Dispenser with SS tubes of 6-meter length and having connection with Ferrule fitting of two adjacent SS tubes and many other open joints with valves and fittings. As these tubes are connected with multiple joints, these tubes have to be installed within the Concrete duct which is kept open to atmosphere. All this leads to compromise the safety of tubes, and CNG station. It is also observed that over the time, the possibility of open SS fittings get damage is more, which lead for gas leakage. The leakage within SS fittings also leads for commercial losses due to shut down of CNG Station.

2.0 SCOPE

This document is prepared to define the technical requirement of Stainless-Steel Bundle / Multi flexible tubes with PE protection. This document also provides the Installation guidelines for contractor.

3.0 ADVANTAGES OF BUNDLE / MULTIFLEXIBLE TUBES

- a) The Bundle Tube length is available for more than 2000 Meters, so No joints between compressors to Dispenser tubes.
- b) Can install underground which neglect the damage or corrosion of tubes avoiding further the gas leakage.
- c) Cost saving due to not requirement of concrete duct, chambers, SS fittings and etc.
- d) Good Control over LUAG and which can lead to saving of Gas Consumption.
- e) Maintenance free installation.

4.0 TECHNICAL SPECIFICATION FOR PIPING COMPONENTS

a) CODES AND STANDARDS:

EN 10217-7 (metric) ASTM A269 (imperial) AISI 304

ISO 1127

DIN VED 0207 ASTM D1248

b) HYDRAULIC ANALYSIS OF SS TUBES:

Stainless steel (SS 316L / SS 316 Ti) tube for compressor discharge/ storage bank/ priority panel/ dispenser inlet tube design conditions: 330 barg & (-) 100 / 85 deg C) and for daughter station inlet design conditions of 350 barg & 100 deg C.



Standard Tube Size (mm), (Note-2)	Tube OD (mm)	Tube Thickness (mm)	Remarks
6	6	1	Note -1
10	10	1.5	-
12	12	2	-
16	16	2.5	-
20	20	3	-
25	25	3	-
30	30	4	-
38	30	5	-

Note:

Multi flexible tube bundle containing SS tubes of 10 mm OD each shall be used for Underground portion of daughter station inlet and between priority panel & NGV- ½ Dispensers with deviation (if any) w.r.t. to maximum economic velocity limit for CNG application.

c) TUBE SIZING IN LINE WITH HYDRAULIC ANALYSIS:

As per hydraulics report, size of the compressor final discharge tubing, priority panel tubing and dispenser tubing including the controlling device in the line shall be minimum as shown below.

Station	Line Description	Flow rate (SCMH)	Operating Pressure (barg)	Operating Temp. (deg. C)	Minimum Recommended Line Size	Remark
Mother Station	Individual Compressor Discharge Line & Each Storage Bank (NGV-1) Inlet/Outlet Line	1500	300	40	16 mm OD - SS tube	-
	Storage Bank (NGV-2) Inlet/Outlet Line	3000	300	40	25 mm OD - SS tube	-



	NGV-1 Dispenser each inlet tube	250	200	40	10 mm OD - SS tube	-
	NGV-2 Dispenser inlet tube	3000	250	40	25 mm OD - SS tube	Note-2
Online station	Compressor Discharge Line and Each Storage Bank Inlet/ Outlet Line	1000	300	40	16 mm OD-SS tube	-
	NGV-1 Dispenser each inlet tube	250	200	40	10 mm OD-SS tube	-
Daughter Station (Option- 1)	Station Inlet Line	4200	200	10-60	38 mm OD-SS tube	Note-3
	Direct Filling Line to Priority Panel	1000	250	10-60	30 mm OD-SS tube	-
	Compressor Discharge Line and Each Storage Bank Inlet / Outlet line	4200	300	40	25 mm OD- SS tube	-
	NGV-1 Dispenser each inlet tube	250	200	40	10 mm OD -SS tube	-
Daughter Station option-2)	Station Inlet Line & Direct Filling Line to Priority Panel from Trailer	1000	200-250	10-60	30 mm OD-SS tube	Note-4
	Compressor Discharge Line and Each Storage Bank Inlet/ Outlet Line	1000	300	40	16 mm OD - SS tube	-
	NGV-1 Dispenser each inlet tube	250	200	40	10 mm OD - SS tube	-

Notes:

1. Multi core flexible SS tubes of 10 mm OD each shall be used from sequential panel to dispensers in order to use existing provision to route via existing ducts to minimize excavation works. The deviation from economical maximum velocity limit is mutually



accepted for this case of CNG application.

2. Two nos. of multi core flexible SS tubes of 10 mm OD each shall be used for underground portion from decanting pillar to inlet system (up to 38 mm SS tube) inside the compressor enclosure. As maximum size available for the design conditions is 38mm SS tube, 38mm SS tube is considered for further station inlet system up to compressor. The deviation from economical maximum velocity limit is mutually agreed for this case of CNG application.
3. Two nos. of multi core flexible SS tubes of 10 mm OD each shall be used for underground portion from decanting pillar up to 30mm SS tube inside the compressor enclosure. The deviation from economical maximum velocity limit is mutually accepted for this case of CNG application.
4. Material grade for SS tube is SS 316L / SS 316Ti.
5. Line sizing shall be minimum as per specified in document.
6. The venting system shall be designed as per the design recommendation by Vendor. Vents from the compressor package shall be routed to the safe height.
7. Numbers of NGV-1 dispensers indicated are minimum. Actual number depends on company dispensing requirement. Accordingly, number of set of priority valves, tubes from priority valves to inlet of dispenser and valves/instrumentation inside the dispenser etc., shall be considered.

5.0 TUBING AND TUBE FITTINGS

- I. Multi Tube Bundle (3 X 10 mm OD Stainless steel tubes) of following specifications shall be provided between dispensers and priority panel located near compressor enclosure.
- II. Tube material shall be Stainless Steel series –316 L / Ti conforming to ASTM-A269. The process followed is longitudinal welded austenitic steel tubes to maintain the continuous length of tube.
- III. HP Bundle tubes are twisted stainless steel tubes which are coated with a plastic sheathing.
- IV. **Brief Technical Specification of Multi tubes is as follows:**
 - Design Pressure (@ 70 °C): 300 Bar
 - Test Pressure (@ 20 °C): 430 Bar
 - Burst Pressure under Hydraulic testing– 1100 Bar.
 - Filler Sheath (EPDM) thickness: 1 mm Outer Jacket (PE-LD HM2) thickness: 1.8mm
 - Min. bending radius with an automatic bending machine: 125 mm
 - Flame behaviour of outer jacket: IEC 332/3 Cat. A/F
 - Operating temperatures of outer jacket :-25°C / +80°C
 - Natural Bending Radius – 10 X diameter of SS tube
 - Multi Core Bundle Tubes will be supplied in coil form packed within Drums as per customer requirement.



- V. Delivery Line: Multi-tube bundle (10 mm OD x 1.2 mm WT, 3 Core), coated with a plastic sheathing.
- VI. Return Line: Single tube (10 mm OD x 1.2 mm WT, 1 Core), coated with a plastic sheathing. (If required)
- VII. All tubes are 100% Eddy current tested acc. to DIN EN 10246 3 after the welding process at the production. The orbital welding is carried out at every 300-meter length to maintain the continuity of tube length as per client requirement.
- VIII. All high-pressure double ferrule fitting & 2 / 3-way ball valves shall be from company approved makes & shall be SS 316L / Ti material.
- IX. All, multi-tube bundles, shall be suitably identified as per applicable codes and practices.
- X. Actual numbers of dispensers depend on the number of dispensers for CNG NGV-1/ cars filling in each station.

6.0 BUNDLE TUBE / MULTI TUBES INSTALLATION PHILOSOPHY

As a minimum, 2 nos. of NGV-1 type dispensers (2 filling hoses / dispenser) and 4 nos. of NGV-2 type dispensers (2 filling hoses / dispenser) have been considered for arriving at the quantity. In short 1 number of Multi tube (3 X 10mm OD tubes) to be proposed to carry gas from Priority panel to each hose of dispenser. The High bank, Medium bank and low bank connection from priority panel will be directly connected inside the dispenser of High, medium and low bank connection of each bank.

Bundle Tube (3 nos. tube, 1 no. from each high, medium and low bank) from Cascade to dispenser shall be used. The Multi tubes can be laid underneath the paved surface in depth of 60-80 cm without using a conduit or also at the outside of buildings. The additional and suitable fittings may be used at priority panel and inside dispenser to make the provision of Multi tube connection.

All tubes are 100% Eddy – current tested acc. To DIN EN 10246-3 after the welding process at the production.

7.0 STORAGE TO DISPENSER TUBING

Storage to dispenser tubing shall mainly comprise of bundled SS tubes (3 nos. tube, 1 no. from each high, medium and low bank), from cascade banks to the dispenser. The Multi tubes can be laid underneath the paved surface outside of buildings.

SS tubes shall be covered with protective sheath for underground application.

8.0 TRAINING

Training for COMPANY personnel shall be planned just before CNG station start-up or commissioning by competent trainers from MANUFACTURER/ VENDOR'S office. The awareness shall be provided to company officers to understand the concept of Multi tube connections.

9.0 APPROVALS

Inspection certificate acc. DIN EN 10204 3.1 issued by TUV Nord – Germany.



10.0 ADDITIONAL CERTIFICATES OF TUBE BUNDLES

1. LRS Type Approval Certificate Extension 98/200 23 (E1).
2. Det Norske Veritas Schweisszulassung ESN-06-5970 Rev 1.
3. Schweißzulassung RW TÜV gemäß AD-2000 Merkblatt HP2/1, EN 288-3.
4. ABS Product Design Assessment Certificate 01-HG2 42690/1-PDA.
5. CCS Certificate of works approval BJW-95010006.
6. DNV Manufacturing survey arrangement R1747.
7. Bureau Veritas SMS.W. II/3567/A.O.
8. Attachments: Typical CNG Station layout for installation of SS Bundle tubes.



VCS QUALITY SERVICES PRIVATE LIMITED

STANDARD SPECIFICATION FOR STAINLESS STEEL TUBE LAYING AND TESTING

VCS – SS – PI – 0015

00	10.07.2019	ISSUED AS STANDARD	AK	DG	AD
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1.0 SCOPE OF WORK AND TECHNICAL SPECIFICATION

This specification covers the minimum requirements for design, manufacture and supply of Stainless-steel tube laying and testing for city gas distribution.

1.1 Laying of SS Tube

Laying, testing and commissioning of SS tubes and fittings complete with all supports. The MS Angle and U-clamps (galvanised) / other fixing arrangement shall be procured and installed by the contractor. Payment shall be at the rate for the work set out in the agreed Schedule of Rates.

Contractor shall engage approved subcontractor for this specialized work.

1.2 Scope of Works: For Laying, Testing & Commissioning of SS Tubing

Generally, the following shall constitute the Contractor's scope of work but not limited to as given herein:

- 1.2.1 SS tubes shall be clamped to the MS Angle at every 1000 mm using P clamps of SWAGELOK make / any other approved make / SS – 308 clamps with EPDM cushion. The practice of flattening tubes for clamping purposes shall not be permitted.
- 1.2.2 MS Angle and U-clamps (galvanised) shall be procured from approved manufacturers and through a QAP including stage inspection and pre dispatch inspection of the materials By VCS (To be isolated by rubber gaskets).
- 1.2.3 Tubes shall be bend using tube benders only and any hot bending will be totally rejected. Tubes shall be cut using pipe cutting device. Hot cutting is not allowed.
- 1.2.4 Carrying out pneumatic testing and purging with nitrogen as per approved procedures; providing all tools, tackles, instruments, manpower and other related accessories for carrying out the testing of tubes.
- 1.2.5 Start-up and commissioning assistance.
- 1.2.6 Handing over the completed works to Client for their operation/ use purposes.
- 1.2.7 Any other work not specifically mentioned herein, but required for the satisfactory completion/ operation/ safety/ statutory/ maintenance of the works shall also be covered under the scope of work and has to be completed by the Contractor within specified schedule at no extra cost to Client.

2.0 INSTALLATION PROCEDURE

2.1 TUBE END PREPARATION

- 2.1.1 Cut the ends square with a hacksaw and a suitable guide. Tube cutters are satisfactory for most tube materials but tend to work harden stainless steel. As such proper care shall be exercised while cutting the SS tubes to avoid the hardening.
- 2.1.2 Burrs must be removed inside and outside for proper entry into fitting to prevent contamination and/ or restricted flow. 'Swagelok' de burring tool shall be used.
- 2.1.3 Remove all fittings, chips, and grit before attachment of fittings.



2.2 ASSEMBLY

- 2.2.1 Tube line fabrication must be accurate so that the tube end easily enters the fitting in proper alignment. Do not force an improperly fitted tube line into the fittings.
- 2.2.2 Ensure that the tube end is bottomed against the shoulder in the fitting body. This is necessary to prevent movement of the tube while the nut forces the ferrule to grip the tube and to seal through any imperfections that may exist on the outside tube surface.
- 2.2.3 Never permit the fitting body to rotate during tube end make-up, use two wrenches. Assemble port connectors to components first and hold with a wrench while making up the tube joint. All types of union bodies must be held while each of the tube ends is made up.
- 2.2.4 Never attempt to make up by torque.
- 2.2.5 Always turn the nut the prescribed amount regardless of torque required. Fitting end plugs required only 1- ¼ turn from finger tight make up in all sizes.

3.0 REMAKE OF FITTINGS

A disassembled joint can be remade, simply by retightening the nut to the position of the original make up. For maximum number of remakes, mark the fitting and nut before disassembly. Before retightening, make sure the assembly has been inserted into the fitting until the ferrule(s) seats in the fitting. Retighten the nut by hand. Rotate the nut with a wrench to the original position as indicated by the previous marks lining up. (A noticeable increase in mechanical resistance will be felt indicating the ferrule is being re-sprung into sealing position.) Then snug the nut 1/12 turn (1/2 hex flat) past the original position.

4.0 REFERENCE SPECIFICATION, CODES AND STANDARDS

The Contractor shall carry out the work in accordance with this specification, VCS'S Engineering Standards, ASME B 31.8 - Gas Transmission and Distribution Piping Systems, Oil Industry Safety Directorate (OISD) norms. Should the Contractor find any discrepancy, ambiguity or conflict in or between any of the Standards and the contract documents, then this should be promptly referred to the Engineer-in- Charge (EIC) for his decision, which shall be considered binding on the contractor.

5.0 SCOPE OF SUPPLY

In general, the following tubes & fittings shall be supplied:

- i) ¾" OD SS Tube of 0.095 wall thick min.
- ii) ½" OD SS Tube of 0.083 wall thick min.
- iii) Double Compression Ferrule Fittings of sizes ¾", ½", 3/8" & ¼". iv SS Valves of suitable sizes.

1.1.1 Supply by The Contractor at His Own Cost As Part Of This Specification:

The procurement and supply of MS Angle with U- clamps at the appropriate time of all the materials and consumables except for the materials specifically enlisted under Owner's scope of supply, shall be entirely the Contractor's responsibility and its rates of execution shall be inclusive for all these items, as follows but not limited to these:

- i) Bolts and nuts for supports, U-bolts with nuts, P-clamps for tubes, anchor bolts of various sizes for fixing to concrete structure.
- ii) Bitumen paints primer and solvents.
- iii) All material for minor civil works like grouting etc.,
- iv) Minor structural steel for fabrication of tube/ tray supports like MS plates, GI plates, flats, pipe etc., v Pumps, compressor, Corrosion Inhibitor for water used for hydrostatic



testing, including water for testing, inert gas for purging. vi All items not expressly mentioned in the Contract but which are necessary for the satisfactory completion and performance of the Work under this Contract.

Note: Samples of all the consumables items / test certificates required to be approved by EIC.



ENERGISING QUALITY

VCS QUALITY SERVICES PRIVATE LIMITED

STANDARD SPECIFICATION FOR SEAMLESS FITTINGS AND FLANGES {SIZE UPTO DN 400MM (16")}

VCS – SS – PL - 0025

00	23.06.2017	ISSUED AS STANDARD	AS	SM	AD
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ABBREVIATIONS:

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
BHN	Brinell hardness number
HAZ	Heat Affected Zone
MSS-SP	Manufacturers Standardization Society - Standard Practice
RTJ	Ring Type Joint
SSPC	Steel Structures Painting Council
CE	Carbon Equivalent
LTCS	Low Temperature Carbon Steel
LPG	Liquefied Petroleum Gas



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1.0 SCOPE

This Technical specification specifies the minimum requirements for the design, manufacture and supply of following carbon steel flanges (such as welding neck flanges, blind flanges, spectacle blinds, spacers and blind etc.) and seamless fittings (such as tees, elbows, reducers, caps, outlets etc.) size DN up to 400 mm (16") to be installed in onshore pipeline systems handling non-sour hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG).

2.0 REFERENCE DOCUMENTS

Reference has been made in this specification to the latest edition (edition enforce at the time of issue of enquiry unless specified otherwise) of the following Codes, Standards and Specification.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

B31.4	:	Pipeline Transportation system for liquid Hydrocarbon & other liquids.
B 31.8	:	Gas Transmission and Distribution Piping Systems.
B16.5	:	Pipe Flanges and Flanged Fitting.
B16.9	:	Factory made Wrought Butt Weld Fittings.
B 16.11	:	Forged Steel Fittings, Socket welding and Threaded.
B 16.48	:	Steel Line Blanks.
Section VIII	:	Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels.
Section IX	:	Welding and Brazing Qualifications.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A370	:	Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

MANUFACTURERS STANDARDIZATION SOCIETY (MSS)

SP-25	:	Standard Marking System for Valves, Fittings, Flanges and Unions.
SP-97	:	Forged Carbon Steel Branch Outlet Fittings- Socket Welding, Threaded and Butt Welding Ends

In case of conflict between various requirements of this specification and the requirements of above referred Codes and Standards, more stringent requirement shall apply unless otherwise agreed by Purchaser.



3.0 MATERIALS

The Material of flanges & fittings shall be as indicated in purchase requisition. In addition, the material shall also meet the requirements specified hereinafter.

3.1 The Carbon Steel used for the manufacture of flanges and fittings shall be fully killed.

3.2 The carbon equivalent (CE) shall not exceeding 0.45, based on check analysis calculated in accordance with following.

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

3.3 For flanges and fittings specified to be used for gas service or LPG service, Charpy V-notch test shall be conducted on each heat of steel. Unless specified otherwise, the Charpy V-notch test shall be conducted at 0° C in accordance with the impact test provisions of ASTM A 370 for flanges and MSS-SP-75 for all fittings.

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

When Low Temperature Carbon Steel (LTCS) materials are specified for flanges and fittings in Purchase Requisition, the Charpy V-notch test requirements of applicable material standard shall be complied with.

3.4 For flanges and fittings specified to be used for Gas service or LPG service, Hardness test shall be carried out as per ASTM A 370 for each heat of steel used. A full thickness cross section shall be taken for this purpose and the maximum hardness of base metal, Weld metal and heat affected zone shall not exceed 248 HV₁₀.

3.5 In case of RTJ (Ring Type Joint) flanges, the groove hardness shall be minimum 140 BHN. Ring Joint flanges shall have octagonal section of Ring joint.

4.0 DESIGN AND MANUFACTURE

4.1 Flanges such as weld neck flanges and blind flanges shall conform to the requirements of ASME B 16.5.

4.2 Spectacle blind and spacer & blind shall conform to the requirements of ASME B 16.48.

4.3 Fittings such as tees, elbows, reducers, etc. shall be seamless type and shall conform to ASME B 16.9 for sizes DN 50mm (2") to DN 400mm (16") (both sizes included) and ASME B 16.11 for sizes DN 15mm(1½") & below.

4.4 Fittings such as weldolets, sockolets, nippolets, etc. shall be manufactured in accordance with MSS-SP-97.

4.5 Repair by Welding on flanges and fitting is not permitted.

4.6 All butt weld ends shall be beveled as per ASME B 16.5/ASME B 16.9/MSS-SP-97 as applicable

4.7 Type, face and finish of flanges shall be as specified in purchase requisition. The



interpretation of range of face finish shall be as follows:

Serrated Finish/125 AARH	:	Serration with 125 to 250 μ in AARH.
63 AARH	:	32 to 63 μ in AARH.

4.8 Flanges and fittings manufactured from bar stock are not acceptable.

5.0 INSPECTION AND TESTS

The Manufacture shall perform all inspections and tests in accordance with the requirements of this specification and the relevant codes, at his works, prior to shipment. Such inspection and testing shall include, but not be limited to, the following:

5.1 TESTING OF MATERIALS

Chemical composition and mechanical tests including yield strength, ultimate tensile strength, impact test, elongation and hardness shall be carried out for each heat of steel used as per the applicable standard as referred to in this specification.

5.2 VISUAL INSPECTION AND DIMENSIONAL CHECK

All flanges and fittings shall be visually inspected. The internal and external surface of the flanges and fittings shall be free from any strikes, gauges and other detrimental defects.

Dimensional checks shall be carried out on finished products as per ASME B 16.5 for flanges, ASME B 16.48 for spacers and blinds and ASME B 16.9/MSS-SP-97 as applicable for fittings and as per this specification.

5.3 NON-DESTRUCTIVE EXAMINATION

All finished wrought weld ends subject to welding in field, shall be 100% tested for lamination type defects by ultrasonic test. Any lamination larger than 6.35 mm shall not be acceptable.

5.4 The Purchaser reserves the right to perform stage wise inspection and witness tests as indicated above, at the Manufacturer's works, prior to shipment. The Manufacturer shall give reasonable notice of date and time for such inspection and shall provide reasonable access and facilities required for inspection, to the Purchaser's Inspector.

The Purchaser reserves the right to require additional testing, at any time, to confirm Or further investigate a suspected fault. All costs incurred shall be for the Manufacturer's account. In no case shall any action of the Purchaser, or his Inspector, relieve the Manufacturer of his responsibility for material, design, quality, or Performance of the materials concerned. Inspection and tests performed/witnessed by the Purchaser's Inspector shall in no way relieve the Manufacturer of his obligation to perform the required inspection and tests.

6.0 PAINTING

Once all inspection and test have been carried out all external surface shall be thoroughly cleaned to remove grease, dust & rust. Standard mill coating shall be applied on external surface to protect against corrosion during transmit and storage. The coating shall be removable type in field.



7.0 MARKING

All Flanges & fittings shall be stamped with the requirements of applicable dimensional manufacturing standard. The marking shall also include following:

- PO Number.
- Item Code.

8.0 TEST CERTIFICATES

Manufacturer who intends bidding for fittings must possess the records of a successful proof test, in accordance with the provision of ASME 16.9/MSS-SP-75, as applicable.

Manufacturer shall furnish the following certificates:

- Test certificates relevant to the chemical analysis and mechanical properties, including hardness of the materials used for manufacture of flanges and fittings in accordance with the requirement of relevant standards and this specification.
- Test reports on radiography, ultrasonic and magnetic particle examination.
- Certificates for each fitting stating that it is capable of withstanding without leakage a test pressure, which results in a hoop stress equivalent to 100% of the specified minimum yield strength for the pipe with which the fitting is to be attached without impairment of serviceability.

9.0 PACKING & SHIPPING

Ends of all fittings and weld neck flanges shall be suitable protected to avoid any damage during transit. Metallic or high impact plastic bevel protected shall be provided for flanges and fittings. Flanges face shall be suitably protected to avoid any damage during transit.

10.0 DOCUMENTATION

The Manufacturer shall supply documentation in accordance with the Vendor Data Requirements List (VDRL) as attached with Purchase Order.



ENERGISING QUALITY

VCS QUALITY SERVICES PRIVATE LIMITED

STANDARD SPECIFICATION

FOR SS FITTINGS

VCS – SS – PI – 0014

00	10.07.2019	ISSUED AS STANDARD	AK	DG	AD
REV. No	DATE	Purpose	Prepared By	Checked By	Approved By



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1.0 GENERAL

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 has been appointed as Engineering Project Management Consultant by M/s HPOIL to provide engineering consultancy services for setting up "CITY GAS DISTRIBUTION FACILITIES AT NAGALAND GA"

2.0 SCOPE OF SUPPLY

- 2.1** The scope of this specification covers the requirement of design, manufacture, inspection, testing at works/ marking/ packaging/ and supply of high-pressure SS Ferrule Fittings.
- 2.2** All codes & Standards for manufacturing, testing, inspection etc. shall be of latest edition.

3.0 CODES & STANDARDS

Applicable Codes and Standards to be followed are as under but not limited to the following:

Bar Stock : ASME SA-479-316 or DIN 4401 or BS:970-316-S31
Forging : ASME SA-182-316 or DIN 4401 or BS:970- 316-S31
Thread : NPT ANSI B 1.20.1

In case of any conflict between this job specification and other document, the following order of precedence shall apply:

- Job Specification
- International Standards/ Codes Applicable.

Any discrepancy, ambiguity or conflict in or between any of the standards, specifications codes and the contract documents should be promptly referred to Owner / Owner's Representative for his decision, which shall be binding on the bidder.

4.0 TECHNICAL SPECIFICATION

All the items shall be suitable for compressed Natural Gas service and meet following specifications:

Testing shall be as per ASTM F 1387

4.1 Materials

4.1.1 Fittings shall be manufactured from the following materials:

- i) Bar stock shall be as per BS: 970-316-S31, EIN 1.4401 or ASME 479-316.
- ii) Forgings shall be as per BS: 970-316-S31, EIN 1.4401 or ASME SA- 182-316

4.1.2 The fittings end connections shall be compatible to tube of hardness $\leq Rb80$

4.1.3 All component parts of the fittings shall be of the same material.



4.1.4 The ferrule material shall be able to withstand an atmosphere of Natural Gas, oil and moisture without rusting.

4.2 Design & Manufacture

4.2.1 All fittings shall be designed in conformance with the requirements of ASME B31.3 and applicable standards. Area classification applicable for all items shall be Class-1, Division-1, Group-D as per NEC or Zone-1 Group- IIA/ IIB as per IS/ IEC specification or equivalent specification. Fittings shall be designed so that all parts/ components meet the requirements for the specified area classification.

4.2.2 The SS fittings shall be of flareless design and four-piece construction, consisting of front and rear ferrules, nut and body suitable for use on SS tubes conforming to ASTM A269 TP316.

4.2.3 Fittings shall be rated for at least the design pressure as stipulated in the material requisition. The design of fittings shall ensure that they shall be capable of holding full tube burst pressure after only one and a quarter turn pulls up of the nut

4.2.4 The threaded ends of fittings shall be NPT as per ANSI B1.20.1. Especially male threads are to be made by

Cold rolling method & shall be protected by plastic end caps.

4.2.5 The fittings shall hold the tube with collecting action producing a firm grip on the tube without substantially

reducing the tube wall thickness.

4.2.6 Fittings shall not torque the tubing during original or subsequent make-up of the connection and should use

geometry for inspection before and after make up the fittings shall not require disassembly for inspection

before or after makeup.

4.2.7 All tube fittings shall be guageable for sufficient pull up after one and a quarter turn. All tube fittings shall have a guageable shoulder and there will be no radius at the point where the shoulder meets the neck of the fitting body.

4.2.8 The gap inspection gauge shall be easily insertable at finger tight position of nut. The gap inspection gauge shall not be insertable between the nut and shoulder of the fitting after completing only one and a quarter turn pull up of the nut.

4.2.9 The tube seat counter bore in the body shall be faced flat 90° to the axis of the tubing to minimize tube expansion and subsequent galling.

4.2.10 The sealing and gripping power of the fitting shall be controlled such that the action between ferrules will overcome commercial variations in tubing wall thickness, hardness, diameter and installer skill.

4.2.11 The seal contact areas of the fittings body shall have a machined finish of 32 Ra or better.

4.2.12 The fittings body shall have no machined stop or shoulder to preclude additional tightening in subsequent make-up.

4.2.13 Front Ferrule

i) The front ferrule shall affect a long, smooth repeatable seal by contact with body and a grip hold



on the tube surface

ii) The front ferrule shall always remain in a sprung condition to compensate for thermal stresses and to

accomplish repeated make and break

iii) Front ferrule which is wetted part shall not be hardened by HT.

iv) The sealing cone of body where front ferrule sits shall be finished to remove tool marks & to give extra

smooth surface for proper seating.

4.2.14 Rear Ferrule

i) The rear ferrule shall collect the tubing surface, improving the performance of the tubing in systems of high impulse or vibration

ii) The rear ferrule shall have a machine recess on the inside diameter and shall have complete surface hardening so as to substantially reduce the required pull up torque. Both the requirements i.e. complete surface hardness and machined recess shall be met for all rear ferrules.

iii) Rear ferrule which grips the tubing & not typical wetted part shall be significantly Hardened than the tubing upto RC 60 Hardness.

iv) Rear ferrule shall not be hardened at the edge by HT and should be case hardened.

v) For hardening of back ferrule multiple process shall not be used.

4.2.15 Nuts shall have silver plated threads to act as a lubricating agent to avoid galling and to reduce

tightening torque.

5.0 INSPECTION AND TESTING

The manufacturer shall submit typical type test reports for the following test carrier out on random

samples of two ferrule fittings

i) Hydraulic burst pressure test

ii) Helium leak test under 0.0002 PSIA negative pressure, leaks into assembly greater than 4.0×10

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atm-cc/sec being unacceptable

iii) Gas pressure test for 25 Remakes at 5000 Psig. No leakage should be detectable even after 25

remakes.

iv) Impulse & vibration testing as per ASTM F1387.

6.0 TEST REPORTS AND CERTIFICATES

6.1 The manufacturer shall supply material compliance certificates conforming that the raw material for fittings



conforms to the requirements of ASME Section-II and ASME Section-III sub section NB, NC and ND.

- 6.2** The manufacturer shall furnish test procedure and typical test reports of all tests conducted on fittings as per the requirements of clause 5

7.0 MARKING, PACKING & SHIPMENT

- 7.1** Heat code traceability number shall be stamped or etched on both body and nut of each fitting
- 7.2** Replacement nuts and ferrules shall be packaged in a manner so as to allow safe and simple replacement.
- 7.3** All the items shall be suitably wrapped and packaged to with stand rough handling during ocean shipment and inland journey.
- 7.4** Item shall be properly tagged and package separately to facilitate easy identification.
- 7.5** Items shall be wrapped and packaged in such-a-way that they can be preserved in original as new condition.

8.0 DOCUMENTATION

Following test certificates shall be furnished along with shipment

- Test certificate of visual, chemical, mechanical testing (incl. tensile, hardness) and hydro test reports with 3.1 certificate as per EN10204.
- Manufacturers standard shop inspection & test report for all items.
- The test report for specified tests – type approval as per LR/ASTM F1387/PNV.
- Third party inspection report as applicable to meet the requirements of specified codes & standards as applicable.



ENERGISING QUALITY

VCS QUALITY SERVICES PRIVATE LIMITED

STANDARD SPECIFICATION FOR SS VALVES

VCS – SS – PI – 0016

00	10.07.2019	ISSUED AS STANDARD	AK	DG	AD
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1. GENERAL

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 has been appointed as Engineering Project Management Consultant by M/s HPOIL to provide engineering consultancy services for setting up "CITY GAS DISTRIBUTION FACILITIES AT NAGALAND GA"

2. SCOPE

- a) The scope of the bidder includes but not limited to manufacture, supply, inspection & testing at work shop marking, packing, handling and dispatch of SS Ball Valves, as per quantities given in SOR and complying all the specifications mentioned.
- b) All codes and standards for manufacture, testing, inspection etc. shall be of latest edition.
- c) Owner reserves the right to delete or order additional quantities during execution of order, based on unit rates and other terms & conditions in the original order.

3. CODES & STANDARDS

Applicable Codes and Standards to be followed are as under but not limited to the following:

1. MSS SP-99 : Instrument Valves
2. ASME/ASTM B 31.3 : Chemical Plant and Petroleum Refinery Piping

4. PRECEDENCE CONFLICT RESOLUTION

In case of any conflict between this specification, Codes & Standards and other document, the following order of precedence shall apply:-

1. Job Specification.
2. International Standards/ Codes Applicable.

5. DEVIATIONS

- a) Technical deviations, if any, required by bidder shall be separately furnished again each clause giving reasoning for each deviation. Bidder to note that except the deviation furnished by them, Bidder's offer shall be deemed to be in total conformity with the enquiry / tender specifications.

6. SPECIFICATIONS OF 2 WAY SS BALL VALVES

- a) Valves should be manufactured from following materials
 - i. The valve body will be made out of material conforming to ASTM A 479 Gr. SS 316/ASTM A351 CF3M.



ii. Material of construction of ball shall conform to ASTM A 276 Gr. SS 316.

- b) All ball valves shall be designed in conformance with the requirements of ASME B31.3, MSS SP-99 and other applicable standards. Area classification applicable for all items shall be Class 1, Division 1, Group D as per NEC or Zone-1, Group IIA/IIB as per IS/IEC specification or equivalent specification. All parts components shall meet the requirements for the specified area classification.
- c) Valves shall be rated for a maximum pressure rating of 6000 psig and shall be capable of operation between Design Temperature range of -400F to +2500F.
- d) Valves shall have spring loaded PEEK seats allowing seal-ability over the full pressure range at any port and low operating torque over the full range of pressure and temperatures.
- e) Valve shall have Nylon handle. Handle shall indicate the direction of flow.
- f) All valves should be full bore to ensure no pressure drop.

7. DOCUMENTATION

- a) The Valve Manufacturer shall submit factory test reports for the following tests carried out on each Valves.
 - i. Hydrostatic seat leak test shall be carried out with de-ionized water. There shall be no
 - ii. detectable seat leakage at 1.1 times the rated pressure of the valve.
 - iii. Gas pressure test for seat shall be carried out with nitrogen at 1000 psig. There shall be no detectable external leakage. Maximum allowable seat leakage shall be 0.1 std-cc/min.

8. OTHER REQUIREMENT

- a) Manufacturer should conform that valves are approved by Rail Road Commission of Texas, LP Gas Division under regulation for compressed natural gas or ANSI / AGA NGV 3.1 1995, CAN / CGA-12-3- M95 "Fuel Systems Components for Natural Gas Powered Vehicles" by "Canadian and Association" Spares and Accessories.
- b) Manufacturer shall furnish a list of recommended spares and accessories for valves required during startup and commissioning.

9. MARKINGS, PACKING AND SHIPMENT

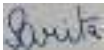
- a) Heat code shall be marked on valve body to facilitate traceability.
- b) All items shall be suitably wrapped and packaged to withstand rough handling during ocean shipment and inland journey.
- c) Each item shall be properly tagged and packaged separately to facilitate easy identification.
- d) All items shall be wrapped and packaged in such a way that they can be preserved in their original, as new condition.



VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION FOR INSTRUMENT TUBE FITTINGS

VCS-SS-IN-5803_02

					
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**STANDARD SPECIFICATION
FOR INSTRUMENT TUBE FITTINGS**

**DOCNO: VCS-SS-IN-5803
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00	23.05.2018	Neha Dev	Udit Manichanda	K.Prasanth	Anupam Das	
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		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:

- 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 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.



ENERGISING QUALITY

VCS QUALITY SERVICES PRIVATE LIMITED

STANDARD SPECIFICATION FOR CO₂ TYPE EXTINGUISHER

VCS-SS-ME-3003

01	01.11.2019	SS	RNR	RNR	SK
00	20.03.2019	SS	RNR	RNR	SK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

ABBREVIATIONS:

kg : Kilogram
IS : Indian Standard
M.S. : Mild Steel

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1.0 SCOPE

This standard lays down requirements regarding material, shape, construction, method of operation performance and tests of portable fire extinguisher of carbon dioxide type. The extinguisher shall be supplied along with CO2 gas duly charged.

2.0 REFERENCES

IS: 2878 & IS: 307

3.0 MATERIAL, SHAPE, CONSTRUCTION, METHOD OF OPERATION, PERFORMANCE, CONTENTS AND TESTS

3.1 The material, shape, construction, method of operation, performance and test shall comply with IS: 2878.

3.2 Nominal size.

3.2.1 The extinguisher shall be of following nominal sizes in kg: 2, 3 and 5.0 for portable type and 7, 9 and 22.5 for trolley mounted.

3.3 Contents

3.3.1 Carbon dioxide gas used shall conform to IS: 307 and extinguisher shall be filled as per Clause no.4.0 of IS: 2878

4.0 APPROVALS

A clearance/ approval certificate for filling the extinguisher from "Chief Controller Explosive" Govt. of India, Nagpur shall be submitted for each cylinder.

5.0 MARKING

Each extinguisher shall be clearly and permanently marked as per IS: 2878 along with IS: certification mark and purchaser's name

6.0 ACCESSORIES

Each extinguisher shall be supplied with M.S. bracket, wood screws and spanner as may be necessary. The details of the bracket shall be submitted with the offer.

7.0 INSPECTION

Authorized representative shall have access at all reasonable time to the manufacturer's works where extinguishers ordered are being manufactured and or tested.



ENERGISING QUALITY

VCS QUALITY SERVICES PRIVATE LIMITED

STANDARD SPECIFICATION FOR PORTABLE FIRE EXINTGUISHER

VCS-SS-ME-3006

01	01.11.2019	SS	RNR	RNR	SK
00	21.03.2018	SS	RNR	RNR	SK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By



**STANDARD SPECIFICATION
FOR
PORTABLE FIRE EXINTGUISHER**

**DOCNO: VCS-SS-ME-3006
Rev No : 01**

ENERGISING QUALITY

ABBREVIATION

MS	MILD STEEL
IS	INDIAN STANDARD
PESO	PETROLEUM EXPLOSIVE SAFETY ORGANISATION

CONTENTS

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1.0 SCOPE

This standard lays down requirements regarding material, shape, construction, method of operation, performance and tests of portable fire extinguisher of Carbon Dioxide type, Dry Chemical Powder Type Fire Extinguisher and water based or foam based (Gas Pressure) Fire Extinguishers.

The extinguisher shall be supplied along with respective extinguishing media duly charged.

2.0 CODES AND STANDARDS

IS:5	Colors for ready mixed paints and enamels
IS: 2932	Enamel, synthetic, exterior; a) undercoating, b) finishing - specification
IS: 4308	Dry Chemical Powder for Fighting Band C Class Fires
IS: 4861	Dry Chemical Powder for Fighting Fires in Burning Metals
IS: 4989	Foam concentrate for producing mechanical foam for firefighting specification
IS: 14609	Dry Chemical Powder for Fighting A, B, C Class Fires
IS: 15222	Carbon dioxide as the extinguishing media for fire protection - Specification
IS: 15683	Portable Fire Extinguishers, Performance and Construction - Specification

Note: Latest Edition of all standard documents shall be followed

3.0 MATERIAL OF CONSTRUCTION & BASIC REQUIREMENT

- 3.1 The material, shape, construction, method of operation, performance, contents and test shall comply with IS: 15683.
- 3.2 Carbon dioxide used in extinguishers shall comply with IS: 15222
- 3.3 Dry powder conforming to IS: 14609, IS. 4308 or IS: 4861 shall be used for charging the extinguishers.
- 3.4 The extinguishing media for water or / and foam based fire extinguishers shall be pure water or water with additives such as wetting agents, viscosity increasing agents, flame retardants or foaming agents etc. as per the requirement. Foam concentration shall be as per the requirements specified in IS: 4989.

4.0 APPROVALS

Portable extinguishers shall have approval from PESO, Government of India



5.0 COLOR & MARKING

The color of extinguisher bodies shall be Red conforming to shade no.536 or 538 of IS: 5. The paint shall conform to IS: 2932. Each extinguisher shall be clearly and permanently marked with the information specified in IS: 15683, along with IS certification mark and purchaser's name.

6.0 ACCESSORIES

Each extinguisher shall be supplied with MS bracket, screws and spanner as may be necessary. The details of the bracket shall be submitted with the offer.

7.0 INSPECTION

Owner's / VCS authorized representative shall have access at all reasonable times to vendor's works where Extinguishers are being manufactured and/or tested. Vendor shall arrange for all tests and inspection facilities for checking material, design and fabrication, workmanship, finish, performance (operating performance and performance required for test fires), and testing as per IS: 15683.

INFORMATION REQUIRED FROM VENDOR

Following information shall be furnished by the vendor along with the supply of extinguisher:

Instruction book(s) - Instruction book(s) for guidance of the user including both the operating and normal maintenance procedures shall be supplied. The book(s) shall include an itemized and illustrated part list/spare parts list giving reference number of all the wearing parts.

Approval certificate from PESO as described in clause 4.



ENERGISING QUALITY

VCS QUALITY SERVICES PRIVATE LIMITED

STANDARD SPECIFICATION FOR 50 KG & 75 KG CAPACITY DRY CHEMICAL POWDER EXTINGUISHER

VCS-SS-ME-3005

01	01.11.2019	SS	RNR	RNR	SK
00	23.02.2018	SS	RNR	RNR	SK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

ABBREVIATION

DCP	Dry Chemical Powder
IS	Indian Standard
OISO	Oil Industry Safety Directorate
PESO	Petroleum Explosive Safety Organization (formerly known as CCOE)

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1.0 SCOPE

This specification lays down the requirements regarding material, shape, construction, chemical charges, anticorrosive treatment, painting and test for trolley mounted dry powder fire extinguishers of capacities 50 kg and 75 kg.

2.0 CODES AND STANDARDS

IS: 10658	Specification for Higher Capacity Dry Powder Fire Extinguisher (Trolley Mounted).
OISD-GDN-115	Guidelines on Fire Fighting, Equipment and Appliances in Petroleum Industry.

Note: - Latest Edition of all standard documents shall be followed.

3.0 DESIGN REQUIREMENTS

- 3.1 The method of expulsion of dry powder shall be by means of pressure produced from compressed or liquefied gas from gas cylinder attached to the body or gas cartridge attached to the cap.
- 3.2 The total capacity of the dry powder extinguisher when filled for the various capacities shall be as under:

Nominal Size (Kg)	Dry Powder content (Kg. minimum.)
50	50
75	75

- 3.3 Discharge hose length shall be 5.0 M.
- 3.4 The expellant gas shall be CO₂ unless otherwise specified.

4.0 MATERIAL OF CONSTRUCTION

- 4.1 The material of construction shall be as per IS: 10658 Standard Specification for Higher Capacity Dry Powder Extinguisher (Trolley Mounted).
- 4.2 Construction, anticorrosive treatment, painting, test requirement, wheeled carriage and other design criteria shall be as per IS: 10658.

5.0 SAFETY CLIP

Safety Clip should be provided to prevent accidental actuation of piercing mechanism.

6.0 MARKING

Each extinguisher shall be clearly and permanently marked with the information specified in IS:10658 along with the BIS certification mark and purchaser's name.

7.0 APPROVALS AND INSPECTION

A clearance/approval certificate from the PESO, Nagpur shall be submitted for each N2 cylinder I gas cartridge supplied with the DCP extinguishers.

VCS or its authorised representatives shall have access at all reasonable times to the manufacturer's works where the extinguishers are being manufactured or being tested.

8.0 INFORMATION REQUIRED FROM VENDOR

8.1 The vendor shall furnish the following information along with the offer and for approval prior to fabrication.

- General arrangement of trolley mounted extinguisher showing plan and elevation.
- Fabrication details and plate thickness calculation for pressure vessel.
- Catalogues for all bought out items with Model No. If any.

8.2 Following information shall be furnished by the vendor along with the supply of extinguisher:

- Instruction book(s) - Instruction book(s) for guidance of the user including both the operating and normal maintenance procedures shall be supplied.
The book(s) shall include an itemized and illustrated part list/spare parts list giving reference number of all the wearing parts.
- Duly approved final drawings listed in clause 8.1.
- A clearance/approval certificate from PESO as described in clause 7.



ENERGISING QUALITY

VCS QUALITY SERVICES PRIVATE LIMITED

STANDARD SPECIFICATION

FOR

LCV FILLING POST

VCS – SS – PL – LCV-001

00	23.08.2024	ISSUED AS STANDARD	AS	SM	AD
REV. No	DATE	Purpose	Prepared By	Checked By	Approved By

**ABBREVIATIONS:**

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
BHN	Brinell Hardness Number
DN	Nominal Size
HAZ	Heat Affected Zone
LC	Lock Close (valve locked in full close position)
LO	Lock Open (valve locked in full open position)
MSS-SP	Manufacturers Standardization Society - Standard Practice
NDT	Non Destructive Testing
NPS	Nominal Pipe Size
RTJ	Ring Type Joint
SSPC	Steel Structures Painting Council
MPI	Magnetic Particle Inspection
DP	Dye Penetrant



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3.0 APPLICABLE CODE & STANDARDS	Error! Bookmark not defined.



1. SPECIFICATION OF LCV POST

- Supply of LCV post shall be suitable for operating at pressure of 255 kg/cm² (g).
- The tubing shall be seamless SS 316 fully annealed (Bright Annealed) conforming to ASTM A 269 with maximum hardness of RB 80 or less and suitable for bending and flaring. The tubes shall be fully annealed (bright annealed), 3/4" OD with a 3/4" SS 2-way Ball valve at inlet and 3/4" OD end connection suitable for connecting with 3/4" OD SS Tube. Any open ends on Fittings and vents shall be provided with caps/ dust plugs.
- One CNG flexible electrically conductive fill hoses with QRC connection.
- Vendor should also include supply of breakaway coupling, suitable for NGV Industry, in fill line hose shall be 1/2" ID, with MAWP 4532 psig & service pressure rated to 3600 psig. And at least 4.5 Meter long. End Connection of main and vent hose shall be SAE (JIC) 37° female swivel 1 1/16-12 UNF.
- LCV filling hose (Synflex/Parker/Eaton) with Breakaway (OPW/PARKER/WEH/Staubli) & Quick Release Coupling (QRC) (01 set per LCV package) shall be in bidder's scope of supply.
- Supply of Electrically conductive hose 1/2" ID filling Hose shall be of minimum 4.5 mtrs. Long and shall have 1/2" Parker make Quick Release Coupling (QRC) Connected to it to be provided by the bidder. Long refilling Hose (3.5 Mtr. before Break Away + 1 Mtr. After Break Away) should be provided with protective guard. Hose crimp to be provided with protective sleeve.
- High pressure hose with SS spring retainer and Protection guard having size 1/2" ID and 4.5 Mtr. Length (i.e. 3.5Mtr. before Break Away + 1Mtr. After Break Away), Coriolis mass flow meter & Quick Release Coupling (QRC) should be provided. Mass flow meter should be installed vertically direction with proper supporting in powder coated MS Box.
- Hose crimp should be of SS and have protection sleeve over it to avoid short Circuit with battery terminal.
- Filling post to be supplied with 4" Pressure Gauge for pressure monitoring of CNG. Supply & Installation of Filling Post (150 MM wide & 3mtr in height), height of vent shall be at least 3.5 meters from Ground level and valves given for operation and vent of LCV post shall be up to a maximum height of 1.8 meters. Complete Hose Assembly with Breakaway / QRC shall be in bidder's scope.
- 4" glycerine filled pressure gauge (range 0 to 400 kg/cm²). If any item such as clamps, fittings/valves, and tube is not listed above i.e. required to complete the assembly of LCV fill post, same shall be supplied by bidder.
- Pressure gauge end connection shall be Min. 1/4" NPTM connection type.
- Hose will be installed with a 3/4" SS Three Way Ball Valve or SS 3 Way Block. Bidder to select end connection of Hose accordingly.
- If any item such as clamps, fittings/valves, tube is not listed above i.e. required to complete the assembly of LCV fill post, same shall be supplied by bidder.



- Complete erection, installation and commissioning of LCV fill post is in the bidder's scope which include Grouting and fixing of Post on the foundation. (Foundation will be prepared by client based on drawing provided by vendor).
- LCV post to be fabricated by ISMC150 and 3mtr height. Hose will be installed with 1/4" or 1/2" SS Three Way Ball Valve with 3/4 "OD end connector.
- It is not the intent of Purchaser to specify every piece of equipment / item but nevertheless any item not specifically mentioned but required as per Good Engineering Practice and for the safe & trouble free operation of the LCV unit Deemed to have been specified & shall be in the scope of Bidder without any implication in the price or schedule.
- The vendor should provide proper hose holster holder for hanging the hose assy. System during frequent operation at site.

2. PAINTING & PROTECTION

- Packing shall be sufficiently robust to withstand rough handling during road shipment & Sling points shall be clearly indicated on crates.
- Painting of Internal process piping should be as per international colour.
- 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 as per ISO 8501-1/ SIS-05 59 00.
- The paint shall be chosen, primed and applied to have a service life of ten years the exterior of equipment and enclosure box is required to be corrosion Free for Ten years.

Painting/power coating (Primer & Finish Coat) Following primer and finish coats to be applied on the canopy and all structural parts as a minimum:-

A. Primer: Two component epoxy zinc phosphate primer with minimum volume solids of 59% an initial cure of 75 minutes at 25 deg. C and a weight of around 2.52 Kg / Litre.

No. of Coats: 1

DFT: 75 (micron) each

B. Primer : Two component intermediate coat with epoxy high build MIO (Micaceous iron oxide) of minimum volume solids of 80% an initial cure of 60 minutes at 25 deg. C a weight of around 2.1 kg/ litre.

No. of Coates: 1

DFT: 100 micron

C. Finish Coat: Acrylic Polyurethane paint

No. of Coats: 50 (micron) each coat

Total DFT: 100

Total DFT after application of primer and paint shall be 275 (micron) minimum.

3. APPLICABLE CODE & STANDARDS

- The design, construction, manufacture, supply, testing and other general requirements of the LCV post should be strictly in accordance with applicable codes, and should comply fully with relevant National & International standards, Indian Electricity Act, Indian Electricity Rules, regulations of Insurance Association of India and Factories Act while carrying out work as per this specification.
- The Vendor without any additional cost and delivery implications should carry out any



modification suggested by the statutory bodies either during drawing approval or during inspection, if any. The following codes and standards (versions/ revisions valid on the date of order) are referenced to & made part of specification:

NFPA52: Standards for CNG Vehicular Fuel Systems

NGV 4.1/ AGA 2-92: Requirements for CNG Dispensing Equipment for Vehicles

NGV 4.2/ AGA 1-93: Requirement for Hoses for NGVs and Fuel Dispensers.

ANSI / NGV1: Compressed Natural Gas Fuelling Connection Devices Standard for Fuelling Nozzles and Receptacles.

NGV4 / AGA: Requirements for Breakaway Devices for CNG Vehicle Fuelling Dispensers and Fuelling Hoses.

IS 5572: Classification of Hazardous areas (other than Mines) for Electrical Installations

IS5571: Guide for selection of Electrical Equipment's for hazardous area

OISD179: Safety requirements for Compression, Storage, Handling and Refuelling of CNG for use in Automotive Sector.

OISD 113: Classification of areas for Electrical Installations at Hydrocarbon Processing and Handling facilities.

NFPA-52: 1992, ANSI, ASTM, NEC, NEMA, ASNZ, OIML, Indian Electricity Rules, Indian Explosives Act. Australian / New Zealand Refuelling Standard. AG901 / NZS 5425

OIML TC8/SC7: Recommendation with regards to CNG dispenser
The Standards of Weights and Measures Act

The Standards of Weights and Measures (Enforcement) Act,
The Consumer Protection Act, 1986.

The standards of Weights and Measures (General), Amendment Rules, 2009 Part
(Compressed Gaseous Fuel (CNG) Measuring Systems for Vehicle.



Energising Quality

PROJECT NUMBER: C261162



DATA SHEET FOR INSULATING JOINT

TOTAL SHEET

05

DOCUMENT NO

C261162

CGD

PL

DS

2001

C1

07.01.2026

ISSUED FOR CLIENT REVIEW

PT

PA

DK

REV

DATE

DESCRIPTION

PREP

CHK

APPR



CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

IJ Material Requisition (MR).	C251155-CGD-PL-MR-2001
IJ Specification No.	VCS-SS-PP-2029
DESIGN DATA FOR INSULATING JOINT FOR CS LINE	
Service, Design Life (Minimum)	Natural Gas, 25 yrs.
Size (OD), mm	114.3 (4")
Design Pressure	49 kg/cm ²
ANSI Rating / Design Factor	300# / 0.4
Design Temperature (°C)	-29 to 65
Corrosion Allowance (mm)	0.5
Design Code (Pipeline / Insulating Joint)	ASME B31.8 / ASME Sec VIII Div -I
End Connection/End Finish	Butt weld ends. Bevelled as per Line pipe Specification /API 5L
Insulating Joint type	Monolithic
Installation	Above ground
Piggability	Non Piggable
Bevel end protection	Required, metallic or high impact plastic bevel protectors;
TESTING	
Charpy Impact Test	Required, at (-)29° C
Hardness Test	Required, maximum hardness of base metal, weld metal & HAZ of all the pressure containing parts shall not exceed 248 HV10
Di-Electric test	5 KV AC, 50 Hz For One Minute Minimum
Insulation Resistance Test	Min. 25 Mega Ohms, when checked with 500-1000 v dc
Hydrostatic Test	At 75 Kg/Cm ² for Minimum Time 15 Minute
Pneumatic Test	7 Kg/cm ² for minimum Time 10 Minutes.
Internal Vacuum Sustainability	Five (5) Millibar for 5 minutes.
Torsional Test	Required, as per Manufacturer Std
Chemical Test	Required, as per Specification

	DATA SHEET FOR INSULATING JOINT	Document No.	Rev
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Allowable Force and Moments	Vendor to Specify
Dimensional Check	Required, as per Specification & Approved Drawings/ITP
Visual Inspection	Required, As per Specification & Approved ITP
Other Testing	Required, As per Specification
NDE	- Wet MPI on 100% Forged Surfaces (MSS SP 53) 100% RT of Butt Weld (API 1104) 100% UT / MPI of fillet welds (As per ASME SEC. VIII) , Refer spec for Fillets Thickness 100 % UT of Finished Bevel Ends - DP of Butt Weld - 100%

SURFACE PREPARATION, PAINTING & MARKING

Surface Preparation	Shot Blasting to SP10 in accordance with "Steel Structures Painting Council- Visual Standard SSPC-VIS-I
Painting (Internal Coating)	Two-pack (solvent free) non-conducting epoxy compound (cold or hot curing). Total DFT –200 micron. Shade Brown
Painting- External (Non-conducting epoxy :3 Layer Paint System)	Primer: Two Pack Non-Conducting Epoxy, (Total DFT – 200 -micron) Finish Coat: Polyurethane Epoxy – DFT 100-micron, Shade Orange, The coating shall end approximately 75mm from the ends of the joint.
Final Colour Shade	Canary Yellow
Marking	On stainless-steel name plate as per Specification

INSULATING JOINT MATERIAL (EQUIVALENT OR SUPERIOR)

Part	Material of Construction	
	Specified	Offered
Body	ASTM A105 CHARPY	
Pups	API 5L Gr X-52, PSL-2 THK. 6.4 mm	
Epoxy resin Filler Material	CIBA Araldite CY-220 & Araldite HT-951 hardener.	

	DATA SHEET FOR INSULATING JOINT	Document No.	Rev
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Spacing Ring (Insulating Ring)	Epoxy glass fiber reinforced laminate (comply with ASTM D 709 Type TV, Group G-11 properties) Average dielectric strength shall be minimum 15 KV. (Compressive Strength $\geq$ 450 MPa)	
Sealing Ring /Gasket	Hardness test, Viton ASTM D2000 or as per Vendor Recommendation	
Sealant Material	Cold Curing Thermosetting Resin + Hardner. (Compressive Strength $\geq$ 150 Mpa)	
Test Lugs	IS2062	
External Coat	Aliphatic Polyurethane-300 Micron DFT	
Internal Coat	High Solids Epoxy-300 Micron DFT	
Double Seal Requirement	Yes	

CONNECTING PIPE DETAILS

S. No.	Outside Diameter, OD mm (inch)	Wall Thickness, (mm)/ Schedule	Material
1	114.3 (4")	6.4	API 5L Gr. X-52 PSL-2

Notes:

- The internal diameter of Insulating Joint shall be uniform through out the entire length and shall not be less than specified internal diameter of connecting Pipeline.
- Insulating joint shall comply the requirement of Project Specification VCS-SS-PP-2029.
- The Charpy Impact temperature shall be (-)29° C as specified in data sheet and shall supersede the temperature requirement specified in Specification
- For the welding end, the out of roundness and tolerance on internal diameter at pipe ends shall be same as diameter tolerance for the pipe ends indicated in line Pipe Specification & API 5L.

	DATA SHEET FOR INSULATING JOINT	Document No.	Rev
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5. Insulating Joint shall be suitable for all type of pigging operation.
6. Insulating Joint shall be monolithic boltless.
7. Vendor to ensure that all material specified herein/ offered is suitable for specified fluid type & design & operating Condition.
8. All applicable test (Impact, hardness, Chemical, mechanical etc) shall also be carried out on pup piece.
9. Overall isolating joint's length shall be such that the heat generated by field welding is not detrimental to the insulating, filler materials, and internal/external coating.
10. Vendor shall furnish the allowable forces & moments for the axial, lateral & transverse (i.e., X, Y & Z) directions
11. Manufacturing shall not commence until materials, dimension (including the calculation sheet), drawings, manufacturing process and welding procedure qualification selected by the Manufacturer are approved by COMPANY.
12. Manufacturer shall ensure that the wall thickness (W.T.) of all parts of insulating joint shall be adequate to sustain design pressure and selected W.T. shall be suitable for welding with W.T. of connected pipeline.

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		CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA					
CLIENT		HPOIL GAS PRIVATE LIMITED					
PMC		VCS QUALITY SERVICES PVT. LTD.					
DATA SHEET : BALL VALVE (LESS THAN 2.0 INCH) SOCKET WELDED							
GENERAL SPECIFICATION							
Process Fluid	NG		ANSI Pressure Rating		800#		
Design Temperature	(-)29°C to 65°C		Design Pressure		49 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				
VALVE DESIGN CONDITIONS							
Corrosion Allowance	1.5 mm		Design Factor		0.4		
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: 210 kg/cm ² & 30 Minutes			Seat: 155 kg/cm ² & 30 Minutes			
Pneumatic Test Pressure & Time	7 kg/cm ² & 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.							
C261162-00-PP-DS-2001A							
		D1	07.01.2026	PT	PA	DK	ISSUED FOR BID
SHEET NO.	1 OF 2	REV	DATE	PRPD	CHKD	APVD	REMARKS



DATA SHEET : BALL VALVE (LESS THAN 2.0 INCH) SOCKET WELDED

Valve Painting Specification :

Valve Painting Specification :

NOTES :

[illegible]

Digitally signed by Bivek Kumar
Singh
Date: 2026.03.24 13:16:26 IST

		CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA					
CLIENT		HOGPL (HPOIL GAS PVT. LTD.)					
PMC		VCS QUALITY SERVICES PVT. LTD.					
DATA SHEET : GLOBE VALVE (LESS THAN 2.0 INCH) SOCKET WELDED							
GENERAL SPECIFICATION							
Process Fluid	NG	ANSI Pressure Rating		800#			
Design Temperature	(-)29°C to 65°C	Design Pressure		49 barg			
Size, Inch (DN)	Less than 2" (50)						
Valve Type	Rising Stem						
End Connection Type	Socket Welded	Design Standard		BS 5352			
Face Finish	Not Applicable	Locking Arrangement					
VALVE DESIGN CONDITIONS							
Corrosion Allowance	1.5 mm	Design Factor		0.4			
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						
Bonnet (Bolted)	ASTM A105						
Disc (Loose Plug/ Ball Type)	SS316 + Stellite						
Stem (Rising)	13% Cr Steel (No Casting)						
Body Seat Ring	SS316 + Stellite						
Stem Packing (Renewable with valve open on stream)	Corrosion inhibited die formed flexible graphite with braided anti extrusion rings						
Hand Wheel (Rising)	Malleable Iron/ Cast Steel/ Fab. Steel						
Bonnet Gasket	Spiral Wound SS316 + Grafoil						
Body Studs/ Nuts	ASTM A193 Gr. B7/ A194 Gr. 2H						
TESTING REQUIREMENT							
Hydrostatic Test Pressure & Time	Body: 210 kg/cm ² & as per BS 5352			Seat: 155 kg/cm ² & as per BS 5352			
Pneumatic Test Pressure & Time	7 kg/cm ² & as per BS 5352						
Hardness Test	248 HV10 max.						
Charpy Impact Test @ Temperature	Yes (at -29°C)						
Fire Safe Test	API 607 / ISO10497						
DOCUMENT NO.							
C261162-00-PP-DS-2001B							
		D1	07.01.2026	PT	PA	DK	ISSUED FOR BID
SHEET NO.	1 OF 2	REV	DATE	PRPD	CHKD	APVD	REMARKS

 Energising Quality		DATA SHEET OF FE/BW, AG & UG, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 300# , PIPING CLASS - 30HC, SPLIT /WELDED BODY DESIGN		DOC. NO.: C261162-00-PP-DS-2001C		
				No. of Pages : 02	Revision	
					C1	
		07.01.2026				
Location		-		MR No.		
Sr. No.		-		P.O No.		
		#				
1	GENERAL	Valve Manufacturer				
2		Tag Numbers / Material Requisition Item No.				
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 P& ID		
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		Refer 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)		Note -20		
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)		Refer Material Requisition		
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, AG & UG, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 300# , PIPING CLASS - 30HC, SPLIT /WELDED BODY DESIGN		DOC. NO.: C261162-00-PP-DS-2001C		
				No. of Pages : 02	Revision	
					C1 07.01.2026	
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(Powercrete 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					

 Energising Quality		DATA SHEET OF FLANGED / BW, AG & UG, GLOBE VALVE DN 50 TO DN 200 (NPS 2" TO NPS 8"), RATING 300# , PIPING CLASS - 30HC		DOC. NO.: C261162-00-PP-DS-2001D		
				No. of Pages : 02	Revision	
					C1	
				07.01.2026		
Location		-		MR No.		
SR.NO		-		P.O No.		
				#		
1	GENERAL	Valve Manufacturer				
2		Tag Numbers / Material Requisition Item No.				
3		Company's Specification No.		VCS-SS-PP-2504		
4		Category		-		
5		Pipeline Line No		Not Required		
6		Class		30HC		
7	DESIGN AND TEST REQUIREMENTS	Size		DN 50 (NPS 2") to DN 200 (NPS 8")		
8		Type of Valve		Rising Stem, Plug type disc, OS & Y , Straight Pattern		
9		Type of Port (Full / Reduced)		Not Applicable		
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		
17		Design Standards		BS 1873, ASME 16.34 & API 598		
18		End Connection Standard		ASME B16.5 - Flanged End ASME B16.25 - Butt Welded End		
19		ASME Class		300#		
20		Stem Extension Requirement		Note - 15		
21		Length of Stem Extension (If required, Note - 15)		Note - 15		
22		Orientation of Stem		Perpendicular to Valve Axis		
23		Type of Valve Operator		As per Standard Specification		
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) (Integrally welded to the BW valve on each side)		Not Applicable		
27		Pup Piece Size / Material Grade / Schdeule/ Thickness		Note - 19		
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	Body : 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- 16 & 17)		API 6FA / ISO10497		
34		Anti Static Testing Requirement		As per BS-1873 Latest Edition		
35		Hardness Test		248 HV10 max		
36		Painting (Note-14)		As per specification (Suitable for Highly Corrosive Environment)		
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 200 (NPS 8")		
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 FLANGED / BW, AG & UG, GLOBE VALVE DN 50 TO DN 200 (NPS 2" TO NPS 8"), RATING 300# , PIPING CLASS - 30HC			DOC. NO.: C261162-00-PP-DS-2001D		
					No. of Pages : 02	Revision	
						C1	
Location		-		MR No.		-	
SR.NO		-		P.O No.		#	
55	VALVE MATERIAL	Part Description	Material Specified		Material Offered (By Bidder)		
56		Body (Forged / Cast)	ASTM A216 GR. WCB/ASTM 105				
57		Bonnet (Bolted Type)	ASTM A216 GR. WCB/ASTM 105				
58		Disc (Plug Type)	Hard faced (Trim 5), Loose Plug, Conical				
59		Stem (Rising)	SS - 304 / SS - 316 (NO CASTING)				
60		Body Seat Ring	STELLITED-6				
61		Gland / Stem Packing	Corrosion inhibited die formed flexible graphite with braided anti-extrusion ring (Renewable with valve open on stream)				
62		Bonnet Gasket	Soft Iron (Max 90 BHN)/ Graphite with Braided Anti Extrusion Ring				
63		Body Stud	ASTM A 193 Gr. B7				
64		Body Nut	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:						
74		1. This Data Sheet shall be read in conjunction with Tender Documents & Specifications.					
75		2. Dimension / Input Data as & where marked " * " shall be supplied by Vendor.					
76		3.All tests shall be carried out as per BS 1873 & BSEN 12266 part-1.					
77		4. Gland packing assembly shall permit repair of gland packing under full line pressure.					
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-2504) requirement at 0°C					
84		11. Design of Welded Valves shall be such that during field welding operation, the soft or plastic components of valve are not liable to be damages.					
85		12. Gasket Material Graphite Shall Be Provided With Corrosion Inhibitor.					
86		13. Valve wall thickness shall be as per ANSI B16.34 / API 623. Manufacturer shall have valid API 623 license to use API monogram. API monogram is required.					
87		14 .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 (Powercrete R-95) with a minimum dry film thickness of 1000 microns or 1.5 mm thick polyurethane coating					
88		15. Stem extension length shall be finalized during drawing approval stage after award of order.					
89		16. For Metal Seated Valves, Bidder to Confirm that in offered valves, there shall not be any external leakage during fire and valve is capable of handling fire for the mentioned time as specified in API 6FA/ ISO 10497/API 6FD. Bidder also to confirm that in case of fire, the valve shall be unseated from the closed position against the high test pressure and moved to the fully open position i.e. In case of fire, valve shall complete one open-close cycle. For Soft Seated Valves, Bidder to carry out Fire Safe Design & test as per API 6FA/ ISO 10497/API 6FD.					
90		17. The offered valve shall deemed to have been fire-tested if vendor submit Fire Test Certificate (Approved & Certified by Governing TPIA) of earlier tested valve of similar design & size.(Qualification Size as per API 6FA/ ISO 10497/API 6FD Codes)					
91		18. Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.					
92	19. 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.						



VCS QUALITY SERVICES PVT. LTD.

INSPECTION AND TEST PLAN FOR ASSORTED PIPES

VCS – ITP – PP – 2021

01	19/12/2021	SR	MC	HK	GW
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					
		MB	MC	AD	SK	
01	19/12/2021					Revised as Marked
		SR	MC	HK	GW	

ABBREVIATIONS:			
CE	Carbon Equivalent	NDT	Non-Destructive Testing
HT	Heat Treatment	PO	Purchase Order
DCN	Dispatch Clearance Note	PMI	Positive Material Identification
IC	Inspection Certificate	PR	Purchase Requisition
IR	Inspection Report	TC	Test Certificate
IRC	Inspection Release Certificate	TPI or TPIA	Third Party Inspection Agency
ITP	Inspection and Test Plan	VDR	Vendor Data Requirement
MPT / MT	Magnetic Particle Testing		
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 item))			

1. SCOPE

This Inspection and Test Plan covers the minimum testing requirements of small sizes and Assorted length Pipes.

2. REFERENCE DOCUMENTS:

PO/PR/ Standards referred there in/ Job specifications /Approved documents.

3. INSPECTION AND TEST REQUIREMENTS:

SL. NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
1.0	Pipe Inspection						
1.1	Pipe Inspection	Chemical & Mechanical Properties	100%	Test Certificates and marking on pipe (EN 10204 Type 3.2)	-	H	R
2.0	Final Inspection (In case of non-availability of 3.2 Certificate)						
2.1	Hydrostatic Testing	Leak Check	100%	Test Report	-	H	R
2.2	1) Visual 2) Dimension 3) Marking w.r.t MTC	Surface Condition, Straightness, End Finish, Bevel Angle, Root Face, Outer Dia., Thickness, Length, End Finish, Marking etc	100%	Inspection Report	-	H	RW

SL. NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
2.3	PMI Check	Chemical Check	As Per Spec.	Inspection Report	-	H	RW
2.4	Identification of Test Samples	Product Chemical, Mechanical, Impact and Other test as applicable	As Per Spec. / Code	Test Reports	-	H	H
2.5	Product Analysis	Chemical Composition	As Per Spec. / Code	Test Reports	-	H	R
2.6	Destructive Testing	Mechanical, Impact, and Other test as applicable	As Per Spec. / Code	Test Reports	-	H	H
2.7	PMI Check	Chemical Check	As Per Spec. / Code	Inspection Report	-	H	RW
2.8	Final Stamping	Stamping Of Accepted Pipes	Stamping of Pipes	Inspection Report	-	H	H

SL. NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
3.0	Painting						
3.1	Rust Preventive Coating & Colour Coding	Visual Inspection & Colour Coding	100%	Inspection Report	-	H	-
4.0	Documentation & IC						
4.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Vendor TC/IR/IRC/DCN/DRGS. /VDR (Note-1)	-	H	-

NOTES (As applicable):

- Items shall be accepted based on EN 10204 type 3.2/3.1 certification as specified in material requisition.
- 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 FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW) VCS – ITP – PP – 2005

01	19/12/2021	SR	MC	HK	GW
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By
UNCONTROLLED COPY		:	If printed		
CONTROLLED COPY		:	If in soft and signed		



**INSPECTION AND TEST PLAN
FOR
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

**DOC NO: VCS-ITP-PP-2005
Rev No : 01**

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	22/04/2020					
		MB	MC	AD	SK	
01	19/12/2021					Revised as Marked
		SR	MC	HK	GW	



**INSPECTION AND TEST PLAN
FOR
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

**DOC NO: VCS-ITP-PP-2005
Rev No : 01**

ABBREVIATIONS:			
CE	Carbon Equivalent	PMI	Positive Material Identification
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
NDT	Non-Destructive Testing		
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 item)]			



**INSPECTION AND TEST PLAN
FOR
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

**DOC NO: VCS-ITP-PP-2005
Rev No : 01**

1.0 SCOPE:

This Inspection and Test Plan covers the minimum testing requirements of Forged, Seamless & Welded Fittings.

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	Heat Treatment / NDT	Documented Procedures	100%	Procedure Documents	-	H	R
1.2	WPS, PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	-	H	W- New R- Existing
2.0	Material Inspection						
2.1	Raw Material Identification (Billets, Rounds, Pipes, Coil, Plates, etc.)	Chemical and Mechanical Properties, Size & Steel making practice etc	100%	Mill test certificate, Vendor's Inspection Report	-	H	R

**INSPECTION AND TEST PLAN
FOR
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

**DOC NO: VCS-ITP-PP-2005
Rev No : 01**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
3.0	In Process Inspection						
3.1	Welding	Welding Parameters as per WPS / PQR	100%	Inspection Reports	-	H	-
3.2	Heat Treatment	Stress Relieving, Normalising, Tempering, Solution Annealing, Stabilization Heat Treatment etc. as applicable	100%	HT chart	-	H	R
3.3	RT For Fittings As Applicable	Weld defects	PR / Purchase Specification	RT films & Reports	-	H	R (RT film review)
3.4	Identification of Test Samples	Product Chemical, Mechanical, Impact, Hardness and other test as applicable	One/Heat/Lot	Test Reports	-	H	H

**INSPECTION AND TEST PLAN
FOR
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

**DOC NO: VCS-ITP-PP-2005
Rev No : 01**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
3.5	Product Analysis	Chemical Composition	PR/ Purchase Specification	Test Reports	-	H	R
3.6	Destructive Testing	Mechanical, Impact, Hardness and Other test as applicable	One/Heat/Lot	Test Reports	-	H	H
3.7	MPT/LPT	Surface & Internal Imperfections	PR/ Purchase Specification	NDT Reports	-	H	R
4.0	Final Inspection						
4.1	Visual and Dimensional Inspection (VDI)	Surface finish, Dimensions, Marking etc	100%	Inspection report	-	H	RW
4.2	PMI Check	Chemical Check	As Per Spec./Code	Inspection report	-	H	RW

**INSPECTION AND TEST PLAN
FOR
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

**DOC NO: VCS-ITP-PP-2005
Rev No : 01**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
4.3	Final Stamping	Stamping of accepted Items	100%	Inspection report	-	H	H
5.0	Painting						
5.1	Rust Preventive Coating & Colour Coding	Visual Inspection & Colour Coding	100%	Inspection report	-	H	-
6.0	Documentation & IC						
6.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Vendor TC & IC	-	H	H
7.0	Final Documentation and Submission of Reports	Compilation of IR/IRC/DCN/MTC/DRGS. /VDR	100%	Compliance Certificate (Note-1)	-	H	-



**INSPECTION AND TEST PLAN
FOR
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

**DOC NO: VCS-ITP-PP-2005
Rev No : 01**

NOTES (As applicable):

1. If the certification is specified as EN 10204 Type 3.1 in Datasheet / 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 BALL VALVE VCS – ITP – PP – 2007

04	27/05/2022	SR	MC	HK	GW
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	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					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

**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
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 PLUG VALVES VCS – ITP – PP – 2009

00	27/04/2022	SR	MC	HK	GW
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	27/04/2022					Issued as standard ITP
		SR	MC	HK	GW	

**INSPECTION AND TEST PLAN
FOR
PLUG VALVE**

DOC NO: VCS-ITP-PP-2009
Rev No : 00

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)]			

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

**INSPECTION AND TEST PLAN
FOR
PLUG VALVE**

DOC NO: VCS-ITP-PP-2009
Rev No : 00

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, Cover, Plug, Stem)	Chemical, Mechanical, Heat Treatment, NDT & Other Properties as applicable	100%	Test Certificates	H	R	W (Note-1)
2.2	Castings & Forgings (Body, Cover, Plug, Stem)	Visual & Dimension	100%	Inspection Report	H	H	-
2.3	Body, Cover and Plug 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
PLUG VALVE**

DOC NO: VCS-ITP-PP-2009
Rev No : 00

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	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

**INSPECTION AND TEST PLAN
FOR
PLUG VALVE**

DOC NO: VCS-ITP-PP-2009
Rev No : 00

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.

INSPECTION AND TEST PLAN FOR GATE/GLOBE/CHECK VALVES VCS –ITP –PP –2008

02	27/05/2022	SR	MC	HK	GW
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	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>R. Jain</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)]			

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

**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
2.0	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

Digitally signed by Divak Kumar

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Date: 2026.03.24 13:16:26 IST

**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

Digitally signed by Divak Kumar

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Date: 2026.03.24 13:16:26 IST

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.



VCS QUALITY SERVICES PVT. LTD.

INSPECTION AND TEST PLAN FOR SEAMLESS LINE PIPES UP TO 16"

VCS – ITP – PP – 2015

03	19/12/2021	SR	MC	HK	GW
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
0	14.05.2019					Issued as Standard
		BS	MV	AD	SK	
1	19.11.2019					Re-Issued as Standard
		SS	MC	AD	SK	
2	15.05.2020					Document formatting, Doc numbering updated from VPC-PL-ITP-025 to VCS-ITP-PP-2015 other detail update as marked
		SS	MC	AD	SK	
3	19.12.2021	<i>Rajinikanth</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	Revised as Marked
		SR	MC	HK	HK	

ABBREVIATIONS:			
CE	Carbon Equivalent	MTC	Material Test Certificate
HT	Heat Treatment	NDT	Non-Destructive Testing
IC	Inspection Certificate	PO	Purchase Order
IGC	Inter Granular Corrosion	PMI	Positive Material Identification
ITP	Inspection and Test Plan	TC	Test Certificate
MPT/MT	Magnetic Particle Testing	TPI or TPIA	Third Party Inspection Agency
MPS	Manufacturing Process Specification	UT	Ultrasonic Testing
MR	Material Requisition	VDR	Vendor Data Requirement
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 item])			

1.0 SCOPE:

This Inspection and Test Plan covers the minimum testing requirements of Seamless Pipes up to 16" (Including 16")

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	MPS	Documented Procedures	100%	Procedure Documents	-	H	R
2.0	Raw Material Procurement						
2.1	Raw Material Inspection	Chemical & Mechanical Properties, Method of manufacturing, Heat Treatment Condition etc.	100%	Mill Test Certificates (EN 10204-3.2)	H	H (Note-3)	R (Note-3)



**INSPECTION AND TEST PLAN
FOR SEAMLESS LINE PIPES**

**DOC NO: VCS-ITP-PP-2015
Rev No : 03**

SL. NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
3.0	In Process Inspection						
3.1	First Day Production test	All testing requirement as per PR/ MPS	As per PR/ MPS	Test Report	-	H	H
3.2	Raw material Inspection	Marking & Correlations with Test Certificates	100%	Inspection Reports	-	H	-
3.3	Heat Treatment	Heat Treatment time and temperature	100%	HT Graph / Record	-	H	R
4.0	Final Inspection						
4.1	Hydrostatic Testing	Leak & pressure Drop, Calibration of Gauges/ Recorder	100%	Inspection Report	-	H	RW (Min.5%)

SL. NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
4.2	Calibration of UT system	Run with calibration pipe	1) Beginning of each shift 2) After Breakdown /Maintenance	Inspection Report	-	H	W
4.3	Pipe UT	Lamination & other defects	100%	Inspection Report	-	H	RW (Min.5%)
4.4	Pipe End UT MPT as applicable	Lamination & other defects	100%	Inspection Report	-	W	RW (Min.1%)
4.5	Final visual and dimension	1. Visual Examination 2. Dimensional Check Surface Condition, Straightness, End Finish, Bevel Angle, Root Face, Outer Dia., Thickness, Length, End Finish, Marking etc.	100%	Inspection Report	-	H	RW (Min.5%)
4.6	Lot Testing	1. Chemical Analysis 2. Tensile Tests 3. Macro & Hardness Tests 4. Impact Tests and other applicable test	As per MPS/API 5L/Spec.	Inspection Report	-	H	W

SL. NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
4.7	Non-conforming product/stage	Repair / Retest /Reject	100%	Inspection Report	-	H	W
4.8	Marking/Stencilling	Pipe No, Acceptance No., Heat. No., Size, Weight, Grade, Thickness, Colour Code etc as per MPS	100%	Inspection Report	-	H	RW (Min.5%)
5.0	PAINTING						
5.1	Rust Preventive Coating & Colour Coding	Visual & Colour Coding as applicable	100%	Inspection Report	-	H	-
6.0	Documentation & IC						
6.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Manufacturer TC & IC (Note-4)	-	H	H

SL. NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
6.2	Final documents as per PR/MR	Verification & compilation of inspection & test records for submission to customer	100%	Final dossier (Note-4)	-	H	H

NOTES (As applicable):

1. 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.
2. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in /Job Specification /Approved Documents.
3. Raw Material shall be inspected at Mills (Sub vendors works) by TPIA appointed by Vendor.
4. Items shall be EN 10204 Type 3.2 Certified based on this ITP/MR/PR for the Pipe (Final product).



VCS QUALITY SERVICES PVT. LTD.

INSPECTION AND TEST PLAN FOR FLANGES & SPECTACLE BLINDS VCS – ITP – PP – 2003

01	19/12/2021	SR	MC	HK	GW
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	22/04/2020					
		MB	MC	AD	SK	
01	19/12/2021	<i>R. Ganesan</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	Revised as Marked
		SR	MC	HK	GW	

ABBREVIATIONS:			
CE	Carbon Equivalent	NDT	Non-Destructive Testing
DCN	Dispatch Clearance Note	PO	Purchase Order
HT	Heat Treatment	PR	Purchase Requisition
IC	Inspection Certificate	RT	Radiography Testing
IR	Inspection Report	TC	Test Certificate
IRC	Inspection Release Certificate	TPI or TPIA	Third Party Inspection Agency
ITP	Inspection and Test Plan	UT	Ultrasonic Testing
MPT/MT	Magnetic Particle Testing	VDR	Vendor Data Requirement
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 Flanges, Spectacle Blinds & Drip Rings.

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	Heat Treatment, NDT and Other Procedures	Documented Procedures	100%	Procedure Documents	-	H	R
2.0	Material Inspection						
2.1.	Raw Material Inspection	Chemical, Mechanical, Properties	100%	Test Certificates	-	H	R
3.0	In Process Inspection						

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
3.1	Heat Treatment	Stress Relieving, Normalising, Tempering, Solution Annealing, Stabilization Heat Treatment etc. as applicable	100%	HT Chart	-	H	R
3.2	Identification of Test Samples	Product Chemical, Mechanical, Impact and Other test as applicable	One/Heat/Lot	Test Report	-	H	H
3.4	Product Analysis (As applicable)	Chemical Composition	As per PR/Purchase Specification	Test Reports	-	H	R
3.5	Destructive Testing	Mechanical, Impact and Other test as applicable	One/Heat/Lot	Test Reports	-	H	H
3.6	MPI	Surface & Internal Imperfections	As per PR/Purchase Specification	NDT Reports	-	H	R
4.0	Final Inspection						
4.1	Final Inspection	1. Visual 2 Dimensions 3. Hardness 4. Marking etc	100%	Inspection Report	-	H	W

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
4.2	PMI Check	Chemical	As per Spec.	Inspection Report	-	H	RW
4.3	Final Stamping	Stamping Of Accepted Flanges & Spectacle Blinds	Stamping of Valves which are witnessed by TPIA.	Inspection Report	-	H	H
5.0	Painting						
5.1	Rust Preventive Coating & Colour Coding	Visual & Colour Coding as applicable	100%	Inspection Report	-	H	-
6.0	Documentation & IC						
6.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	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 Datasheet / 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.



VCS QUALITY SERVICES PVT. LTD.

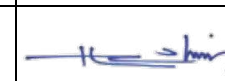
INSPECTION AND TEST PLAN FOR INSULATING JOINTS VCS – ITP – PP – 2006

02	19/12/2021	<i>R. Srinivasan</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

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

**INSPECTION AND TEST PLAN
FOR
INSULATING JOINTS**

DOC NO: VCS-ITP-PP-2006
Rev No : 02

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	06/06/2017					Issued as Standard
		GS	ADE	AD	SK	
01	22/04/2020					Document formatting, numbering updated from VCS-SD-ITP-006 to VCS-ITP-PP-2006 .
		MB	MC	AD	SK	
02	19/12/2021	<i>Rajinikanth</i>				Revised as Marked
		SR	MC	HK	GW	

**INSPECTION AND TEST PLAN
FOR
INSULATING JOINTS**

DOC NO: VCS-ITP-PP-2006
Rev No : 02

ABBREVIATIONS:			
CE	Carbon Equivalent	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
ITP	Inspection and Test Plan	TPI or TPIA	Third Party Inspection Agency
MPT/MT	Magnetic Particle Testing	UT	Ultrasonic Testing
MTC	Material Test Certificate	VDR	Vendor Data Requirement
NDT	Non-Destructive Testing	WPQ	Welders Performance Qualification
PMI	Positive Material Identification	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)]			

1.0 SCOPE:

This Inspection and Test Plan covers the minimum testing requirements of Insulating Joints.

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	Documented procedures	100%	Procedure Documents	-	H	R-Existing W-New
2.0	Material Inspection						

**INSPECTION AND TEST PLAN
FOR
INSULATING JOINTS**

DOC NO: VCS-ITP-PP-2006
Rev No : 02

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
2.1	1) Forging 2) Pup Piece	Chemical / Mechanical Properties, NDT, HT and other requirement as per purchase specification.	100%	MTC & Inspection Record	H	W	W
2.2	Gasket, Insulating Ring, Filling Material, etc.	As per material spec./code	100%	MTC & Inspection Record	H	H	R
3.0	In Process Inspection						
3.1	Welding	Welding Parameters, NDT (as applicable)	100%	NDT Records/RT films	-	W	R
4.0	Final Inspection						
4.1	Hydro Testing, Air Leak test, Vacuum test (As applicable)	Leak Check	100%	Test Report	-	H	H

**INSPECTION AND TEST PLAN
FOR
INSULATING JOINTS**

DOC NO: VCS-ITP-PP-2006
Rev No : 02

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
4.2	Visual and Dimension Check	Visual and Dimension Check	100%	Inspection Report	-	H	RW
4.3	Dielectric Test	Insulating Resistance	100%	Inspection Report	-	W	W
5.0	Painting						
5.1	Final painting (as applicable)	Paint Scheme, Visual & Paint thickness check	100%	Inspection Report	-	H	R
6.0	Documentation & IC						
6.1	Stamping and review of inspection documents, issue of IC	Review of documents for compliance as per PR.	100%	IC	-	-	H

**INSPECTION AND TEST PLAN
FOR
INSULATING JOINTS**

DOC NO: VCS-ITP-PP-2006
Rev No : 02

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
7.0	Review of final documentation	Compilation of documents as per VDR attached with PR records for submission to customer	100%	Dossier/Completion Certificate (EN 10204 Type 3.2)	-	H	H

NOTES (As applicable):

1. Items shall be EN 10204 Type 3.2 Certified.
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.

STANDARD DRAWINGS



M/s. VCS QUALITY SERVICES
PVT. LTD.

SPECTACLE BLIND FLANGE

DRAWING NO.

SD-PI-001

SHEET NO.

1 OF 1

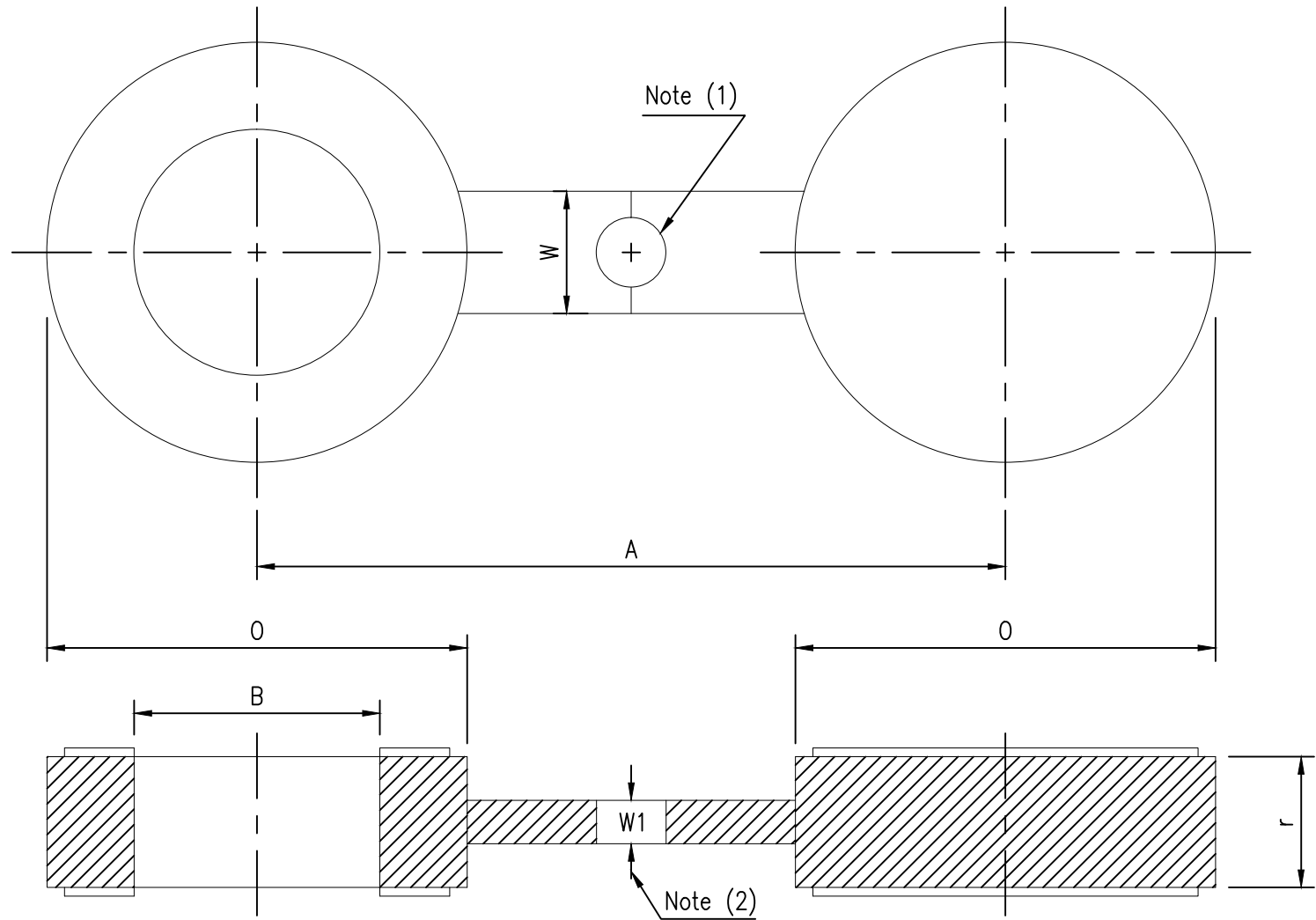


TABLE-4 DIMENSIONS OF CLASS 600 RAISED FACE FIGURE 8 BLANKS

NPS	INSIDE DIAMETER B, in.	OUTSIDE DIAMETER O, in.	CENTERLINE DIMENSION A, in.	THICKNESS r, in.	WEB WIDTH W, in.
1/2	0.62	2.00	2.62	0.25	1.50
3/4	0.82	2.50	3.25	0.25	1.50
1	1.05	2.75	3.50	0.25	2.25
1¼	1.44	3.12	3.98	0.38	2.25
1½	1.68	3.62	4.50	0.38	2.62
2	2.16	4.25	5.00	0.38	2.25
2½	2.64	5.00	5.88	0.50	2.62
3	3.26	5.75	6.62	0.50	2.62
3½	3.76	6.25	7.25	0.62	3.00
4	4.26	7.50	8.50	0.62	3.00
5	5.30	9.38	10.50	0.75	3.38
6	6.36	10.38	11.50	0.88	3.38
8	8.33	12.50	13.75	1.12	3.75
10	10.42	15.62	17.00	1.38	4.12
12	12.39	17.88	19.25	1.62	4.12
14	13.62	19.25	20.75	1.75	4.50
16	16.62	22.12	23.75	2.00	4.88
18	17.62	24.00	25.75	2.12	5.25
20	19.58	26.75	28.50	2.50	5.25
24	23.50	31.00	33.00	2.88	6.00

NOTES:

- (1) Hole size (where required due to bolt spacing) shall be the same as the flange bolt hole. and located such that it will not interfere with bolting between two flanges.
- (2) The thickness of the web (or tie bar) dimension W1 shall be 0.25 in. minimum.

0	10.05.17	ISSUED WITH TENDER	US		DK		AD	
REV. NO.	DATE	SUBJECT OF REVISION	PREP		CHKD		APPD	



M/s. VCS QUALITY SERVICES
PVT. LTD.

ANCHOR FOR BARE PIPE
SIZE 2" THRU 24"
TYPE-G5 (FOR OFFSITE)

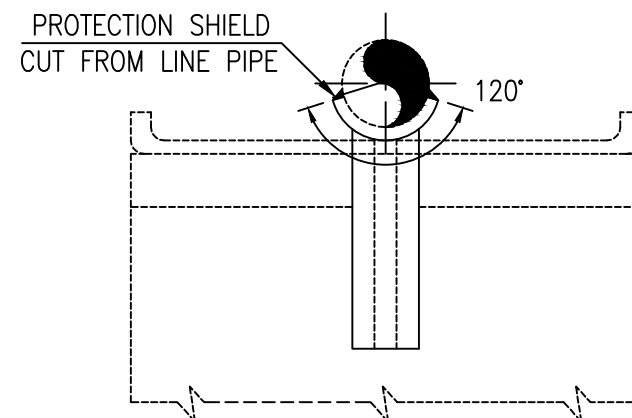
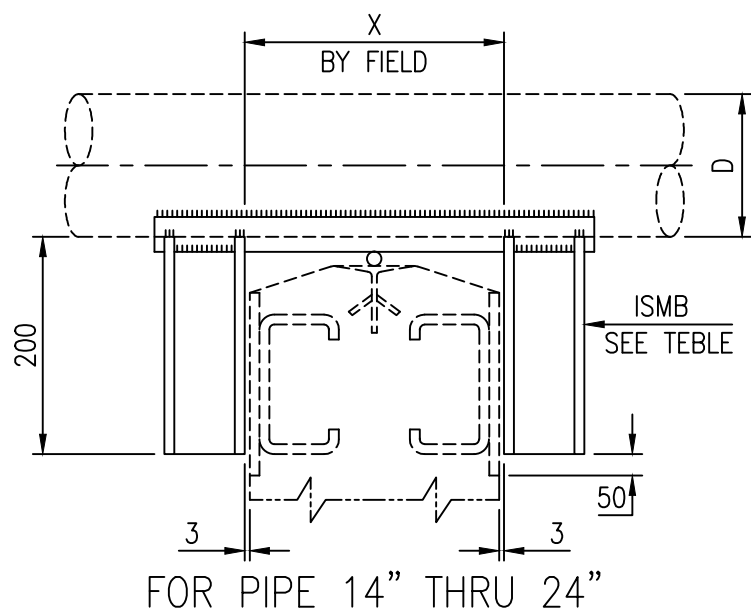
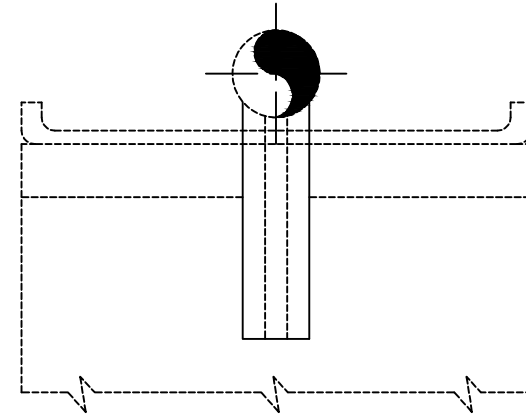
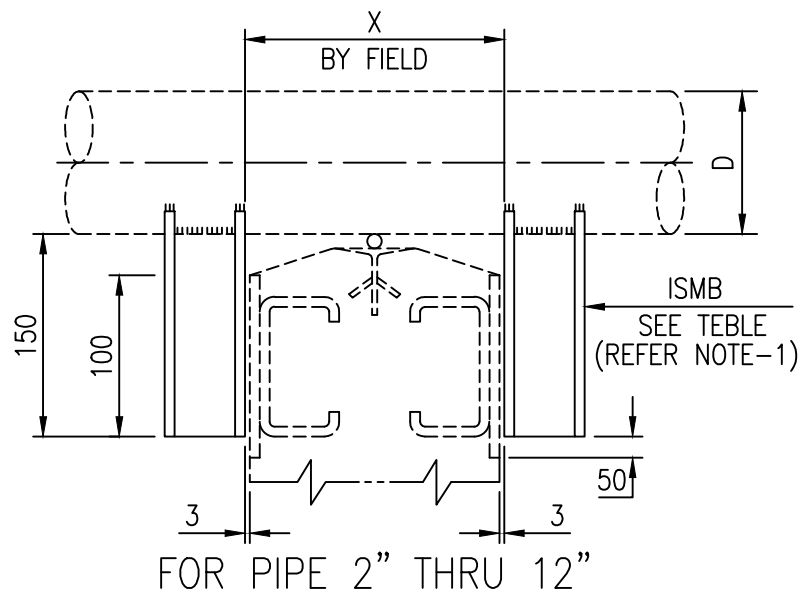
DRAWING NO.

SD-PI-002

SHEET NO.

1 OF 1

D	8	10	12	14	16	18	20	24
I BEAM	150				200			250



G4 - D
NOM. PIPE DIA. IN INCHES
TYPE

SYMBOL

NOTE:-

- FOR SUPPORTING DETAILS FOR PIPE SIZE 2" THRU 6", REFER STD. 00004-PL-PI-STD-009

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



M/s. VCS QUALITY SERVICES
PVT. LTD.

CROSS GUIDE FOR BARE
PIPE SIZE 2" THRU 24"
TYPE-G4 (OFFSITE)

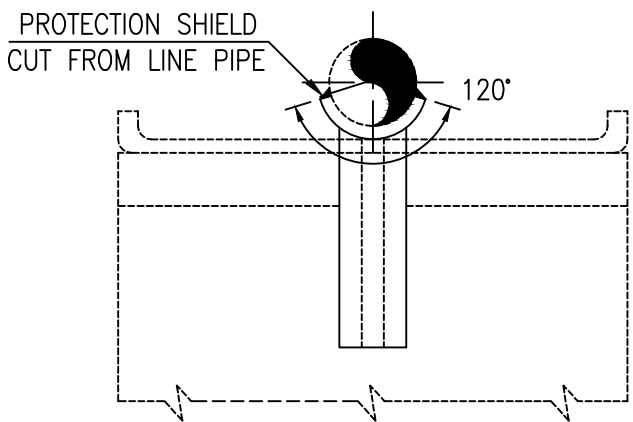
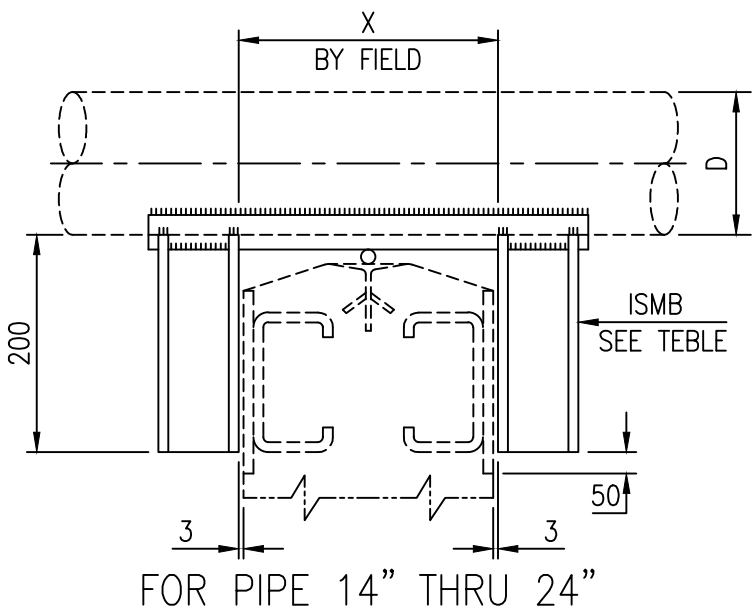
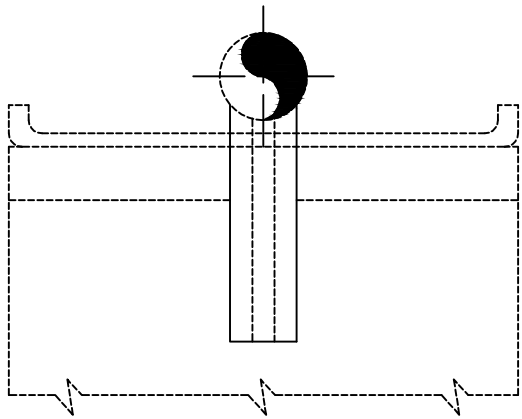
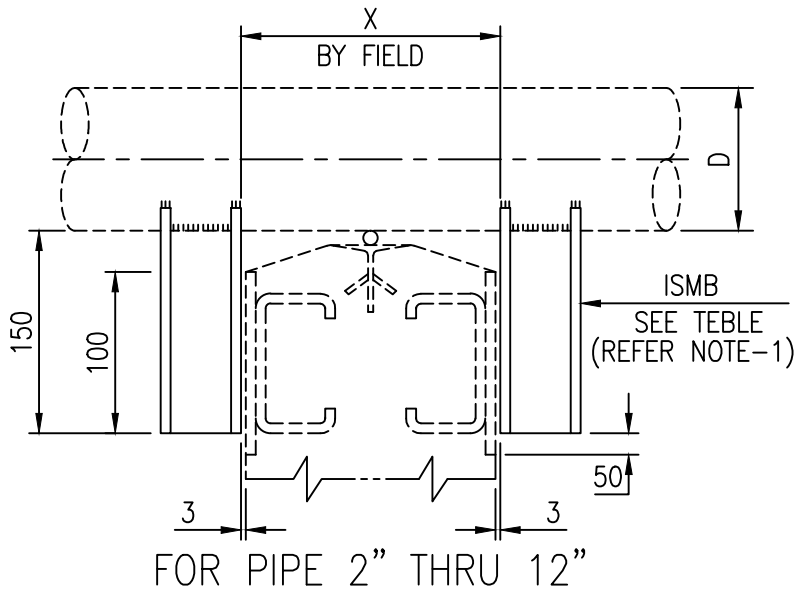
DRAWING NO.

SD-PI-003

SHEET NO.

1 OF 1

D	8	10	12	14	16	18	20	24
I BEAM	150				200		250	



G4 - D
NOM. PIPE DIA. IN INCHES
TYPE

SYMBOL

NOTE:-

- FOR SUPPORTING DETAILS FOR PIPE SIZE 2" THRU 6", REFER STD. STD.00004-PL-PI-STD-009

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



M/s. VCS QUALITY SERVICES
PVT. LTD.

CROSS GUIDE FOR BARE
PIPE SIZE 2" THRU 24"
TYPE-G3

DRAWING NO.

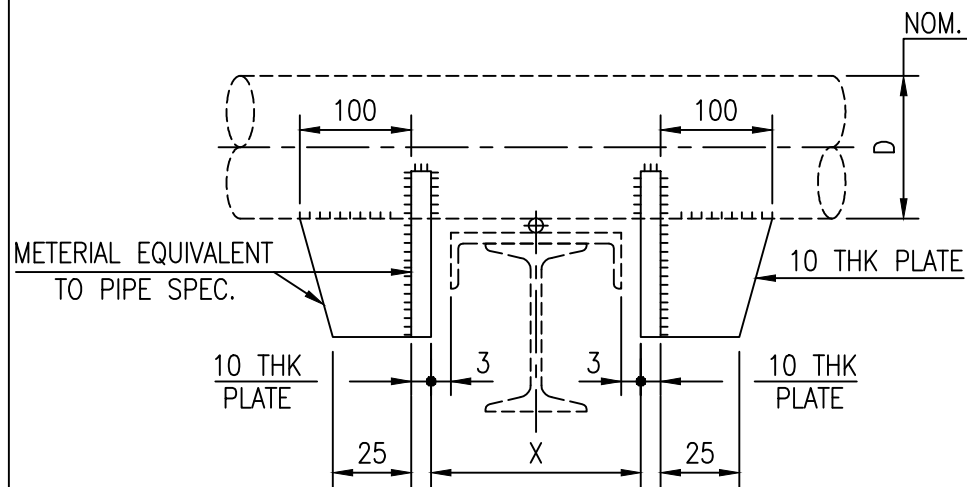
SD-PI-004

SHEET NO.

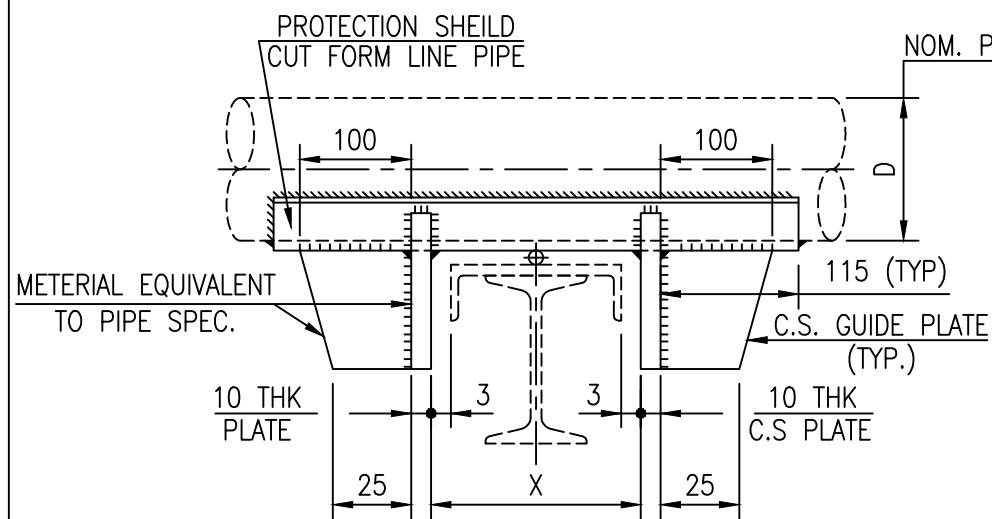
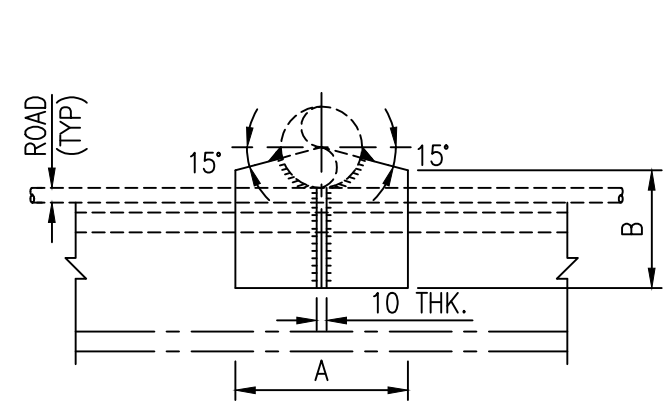
1 OF 1

CROSS GUIDE

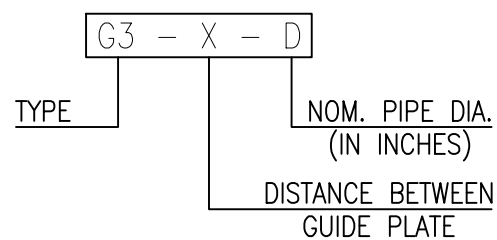
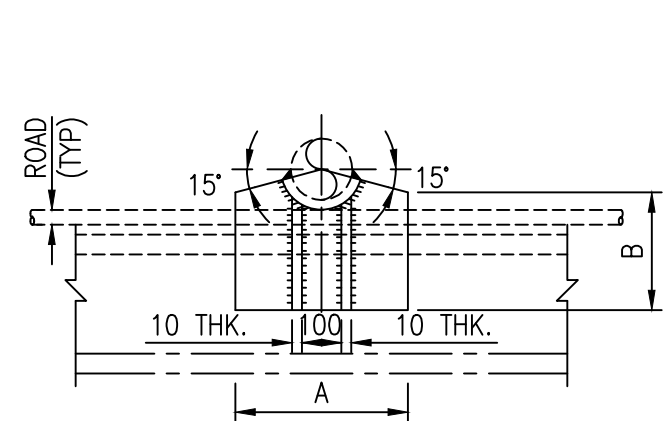
D	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	22"	24"
A	100	130	154	208	280	314	364	396	446	498	548	598	650
B	67	78	86	106	131	145	163	175	193	212	231	248	268



CROSS GUIDE 2" THRU 12"



CROSS GUIDE 14" THRU 24"



SYMBOL

NOTE:-

1. PROTECTION SHIELD SHALL BE CUT FROM LINE PIPE.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



M/s. VCS QUALITY SERVICES
PVT. LTD.

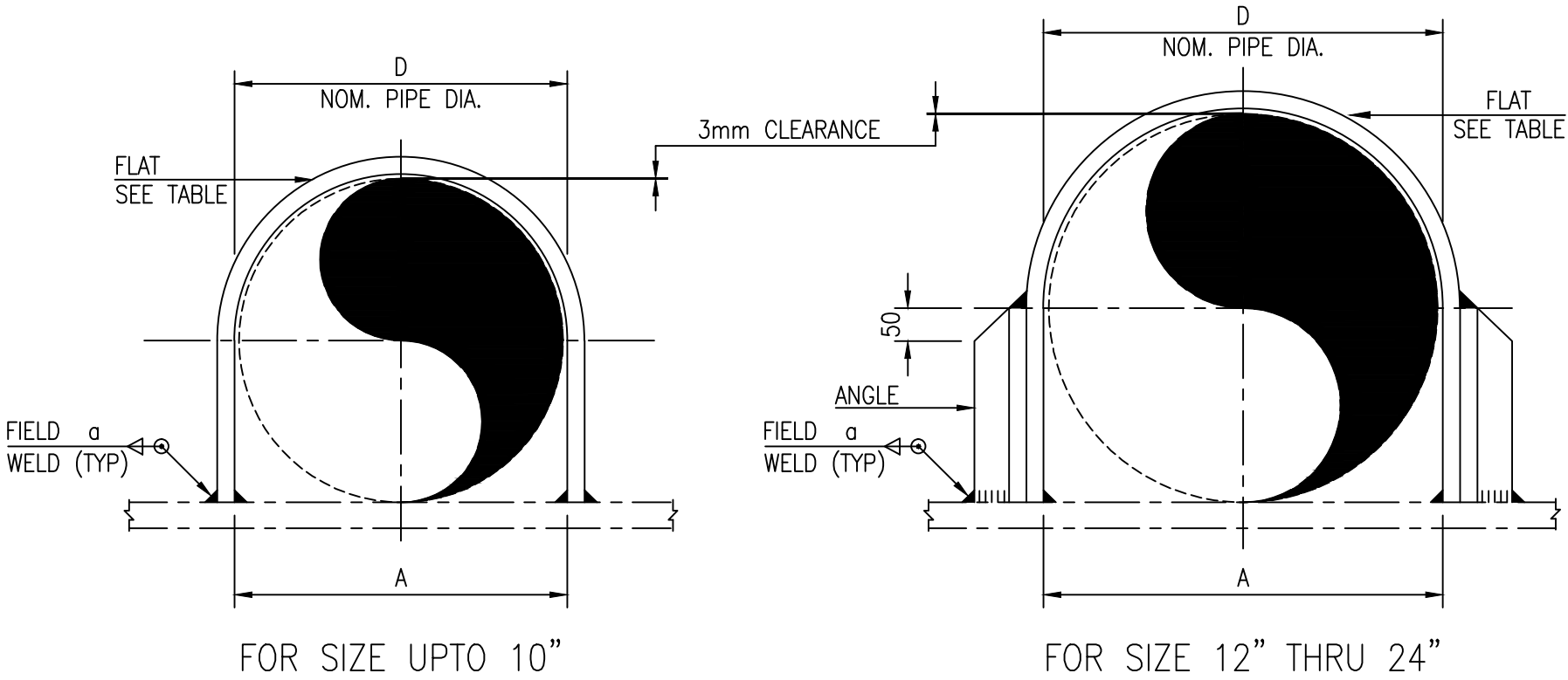
GUIDE SUPPORT FOR BARE PIPE
SIZE 1/2" THRU 24" TYPE-G1

DRAWING NO.

SD-PI-005

SHEET NO.

1 OF 1



D	A	a	FLAT SIZE	ANGLE SIZE
1/2"	26	6	40 x 6	-
3/4"	33			
1"	40			
1 1/4"	48			
1 1/2"	55			
2"	65			
2 1/2"	80			
3"	95	10	50 x 10	-
3 1/2"	107			
4"	120			
5"	146			
6"	174			
8"	225	10	65 x 12	75x75x10
10"	278			
12"	328			
14"	362	10	75 x 12	90x90x10
16"	412			
18"	463			
20"	515			
24"	616			

G1 - D
TYPE NOM. PIPE DIA. (INCH)
SYMBOL

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



M/s. VCS QUALITY SERVICES
PVT. LTD.

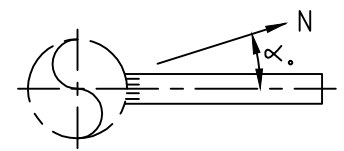
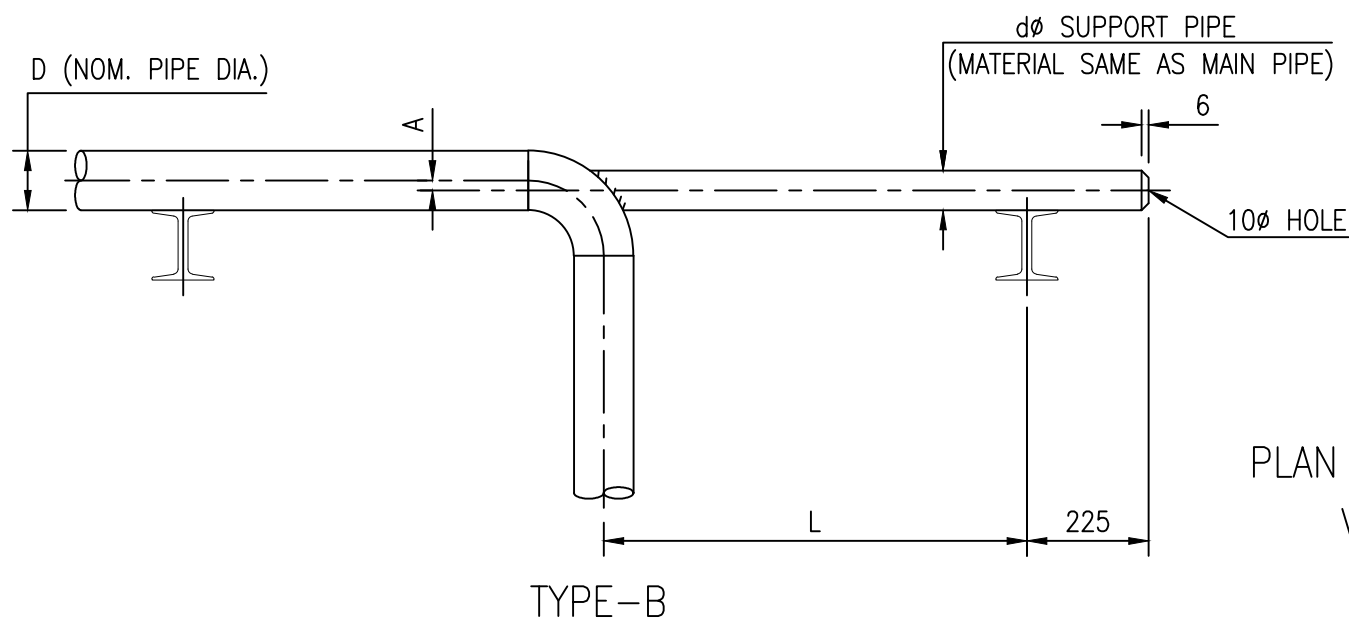
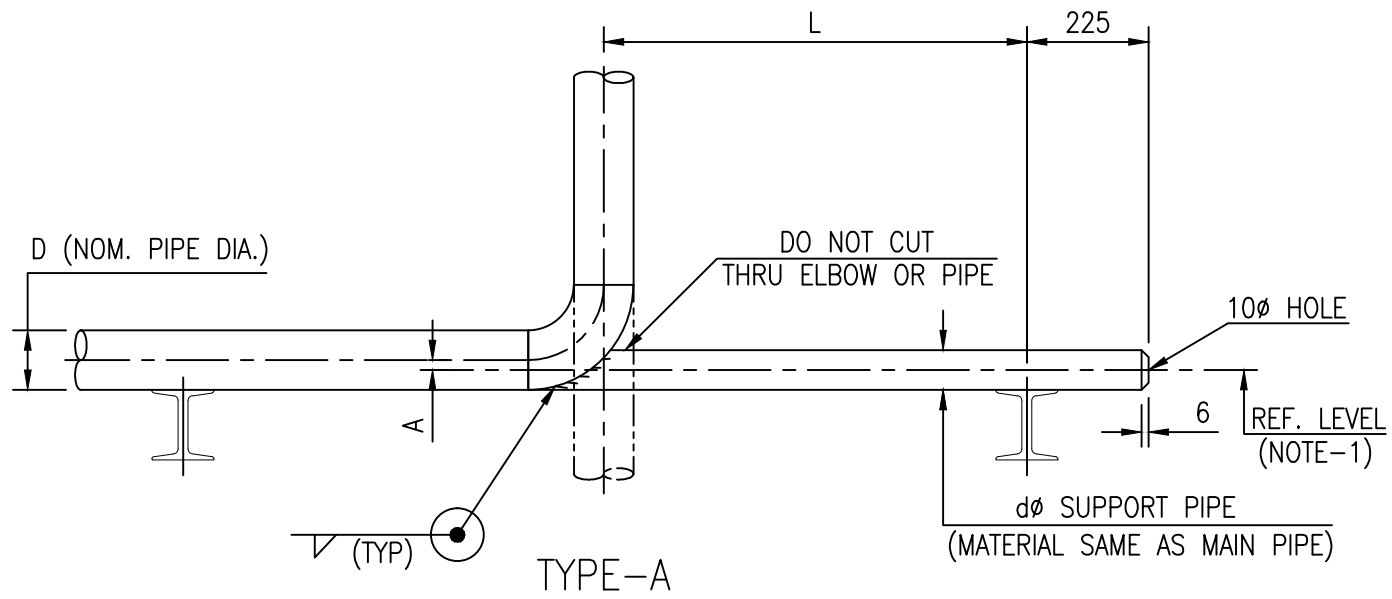
DUMMY PIPE SUPPORT FOR
BARE PIPE SIZE 2" THRU 24"
TYPE-B-39

DRAWING NO.

SD-PI-006

SHEET NO.

1 OF 1

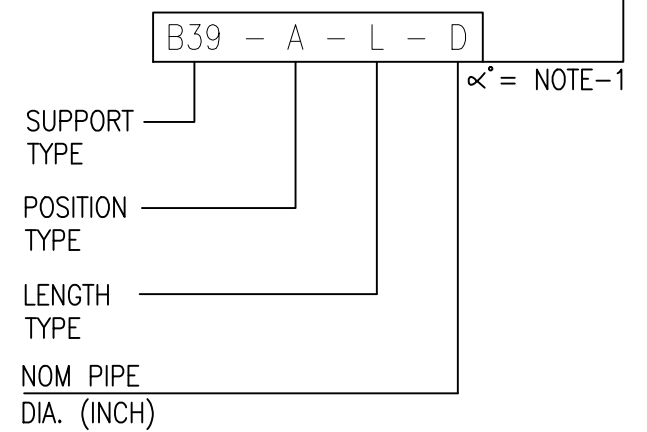


PLAN FOR SUPPORT ON
VERTICAL PIPE

FOR L, 1500 OR LESS		
D	d (NOTE 2)	A
2"	2"-SCH.40	-
3"	2"-SCH.40	15
4"	3"-SCH.40	13
6"	3"-SCH.40	40
8"	4"-SCH.40	52
10"	6"-SCH.40	52
12"	6"-SCH.40	78
14"	8"-SCH.40	68
16"	8"-SCH.40	94
18"	8"-SCH.40	119
20"	10"-SCH.40	118
24"	10"-SCH.40	168

FOR L, OVER 1500		
D	d (NOTE 2)	A
2"	2"-SCH.40	-
3"	2"-SCH.40	15
4"	3"-SCH.40	13
6"	4"-SCH.40	27
8"	6"-SCH.40	25
10"	8"-SCH.40	27
12"	8"-SCH.40	52
14"	10"-SCH.40	41
16"	10"-SCH.40	67
18"	10"-SCH.40	92
20"	12"-SCH.40	92
24"	12"-SCH.40	143

REFER LEVEL
(NOTE-1)



SYMBOL

NOTES:-

1. REF. LEVEL & α° TO BE GIVEN IN CASE SUPPORT IS WELDED TO VERTICAL PIPE.
2. IN CASE SIZE AND/OR SCH. OF SUPPORT PIPE (d) LISTED IN THE TABLE IS NOT AVAILABLE USE NEXT HIGHER SIZE AND/OR NEAREST EQUIVALENT THICKNESS AVAILABLE.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



M/s. VCS QUALITY SERVICES
PVT. LTD.

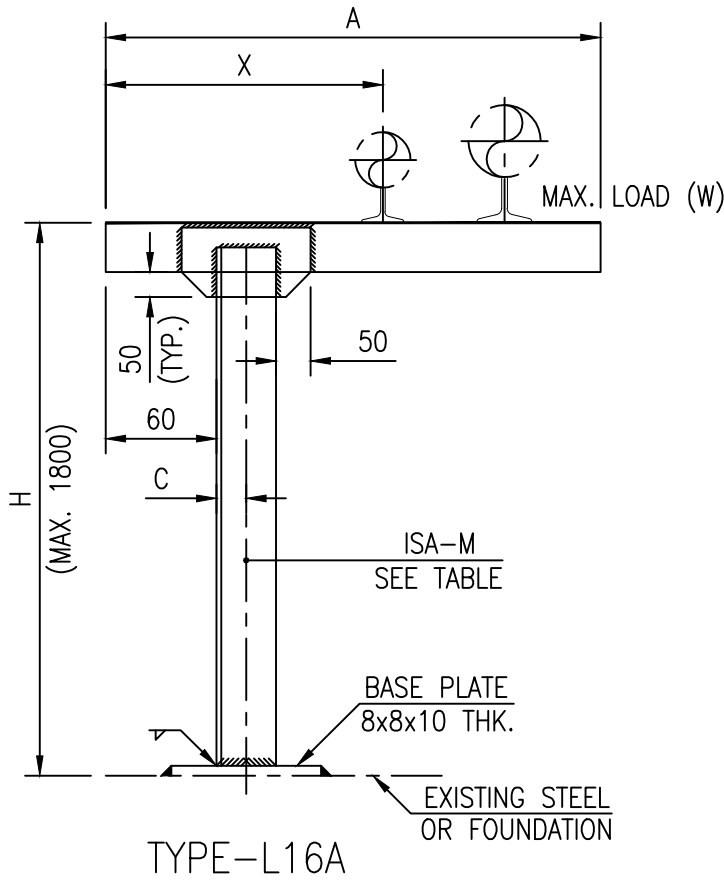
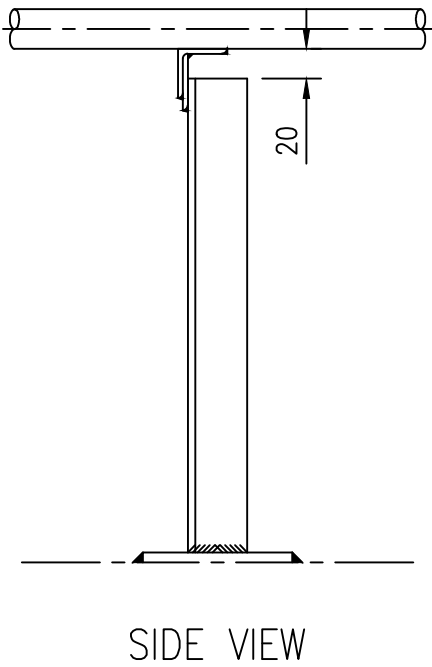
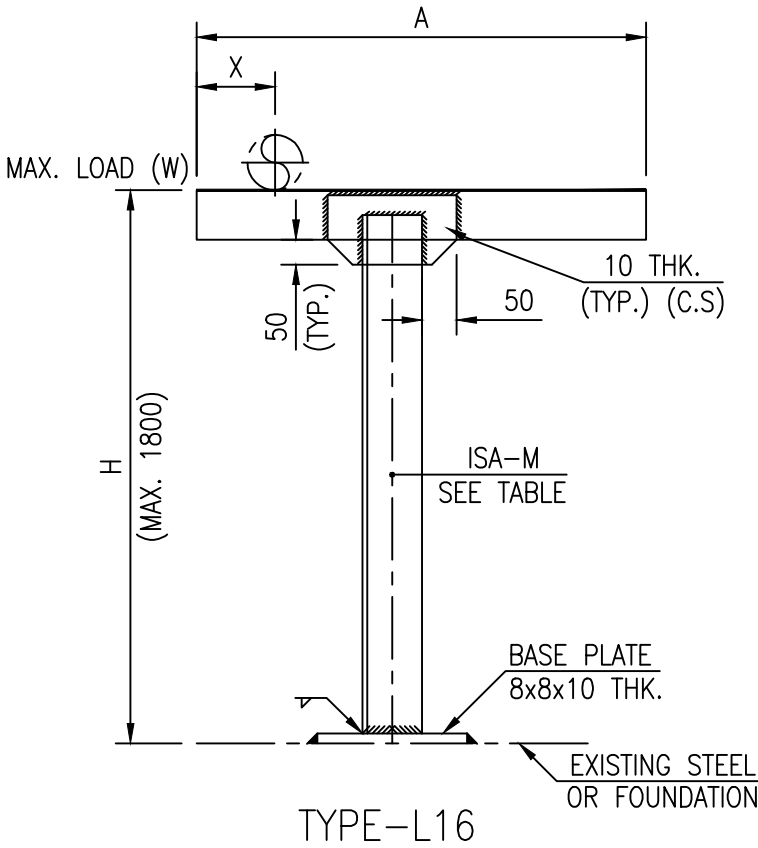
LOW SUPPORT STANCHION
TYPE-L16 AND L-16A

DRAWING NO.

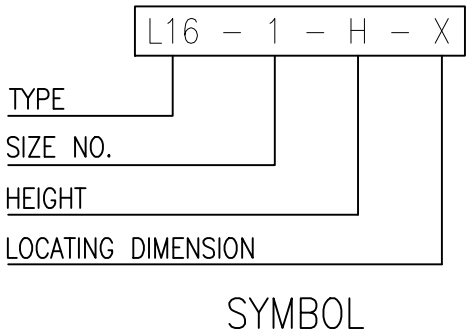
SD-PI-007

SHEET NO.

1 OF 1



NOTE:-
1. DO NOT USE FOR ANCHORING THE PIPE.



SIZE NO.	MAX. LOAD (W) Kg.	M	A	B	C
1	500	ISA 80x80x8	600	150	45
2	800	ISA 100x100x10	700	150	60
3	1500	ISA 130x130x12	800	150	80

0	10.05.17	ISSUED WITH TENDER	US		DK		AD	
REV. NO.	DATE	SUBJECT OF REVISION	PREP		CHKD		APPD	



M/s. VCS QUALITY SERVICES
PVT. LTD.

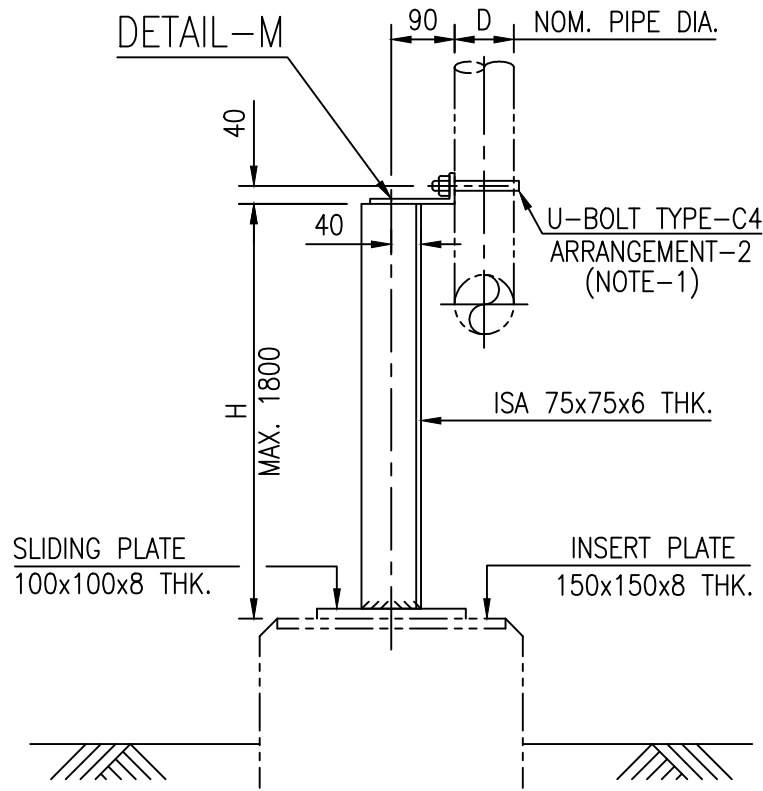
LOW SUPPORT SLIDING AND
FIXED FOR PIPE SIZE 3/4"
THRU 1 1/2" TYPE L-15

DRAWING NO.

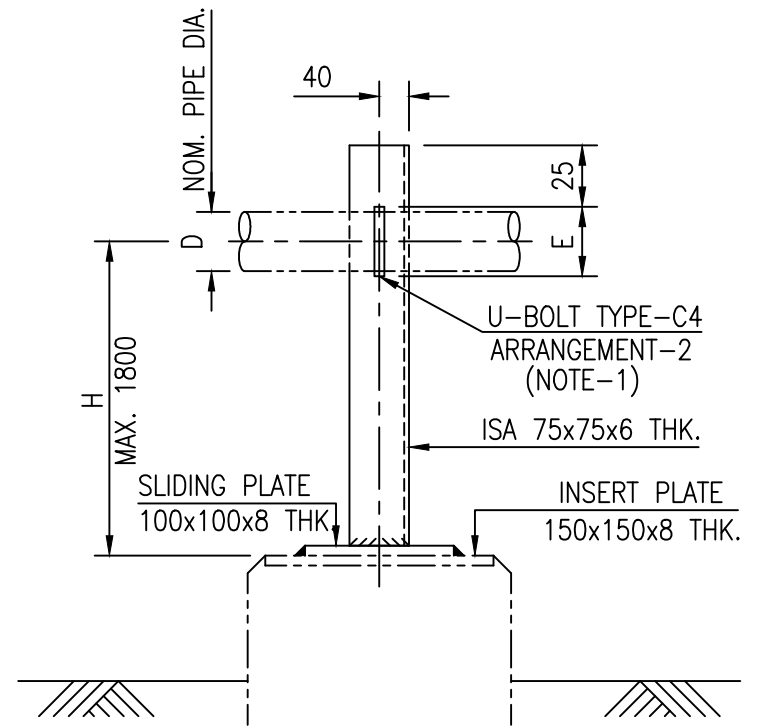
SD-PI-008

SHEET NO.

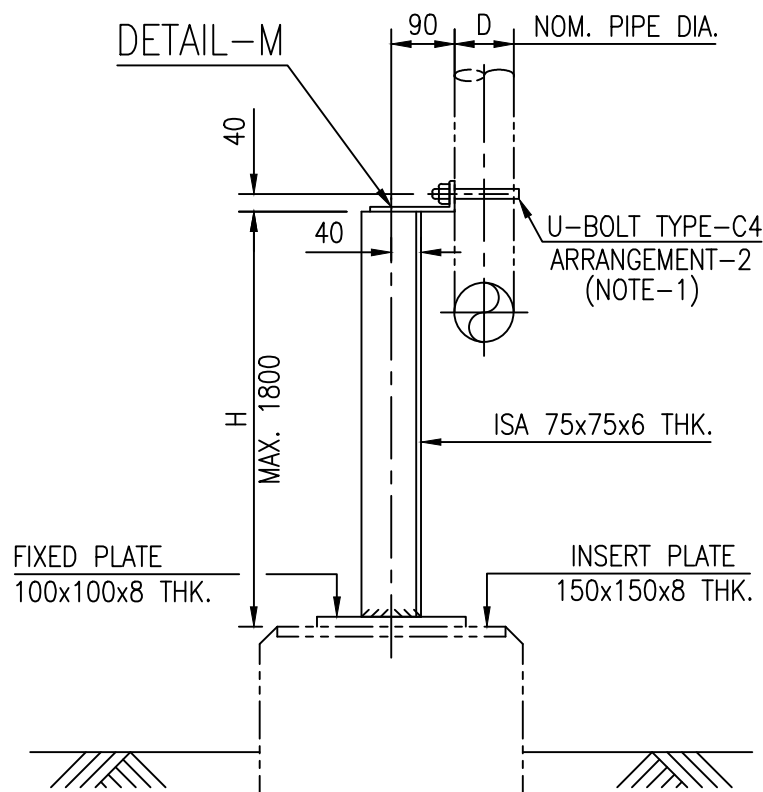
1 OF 1



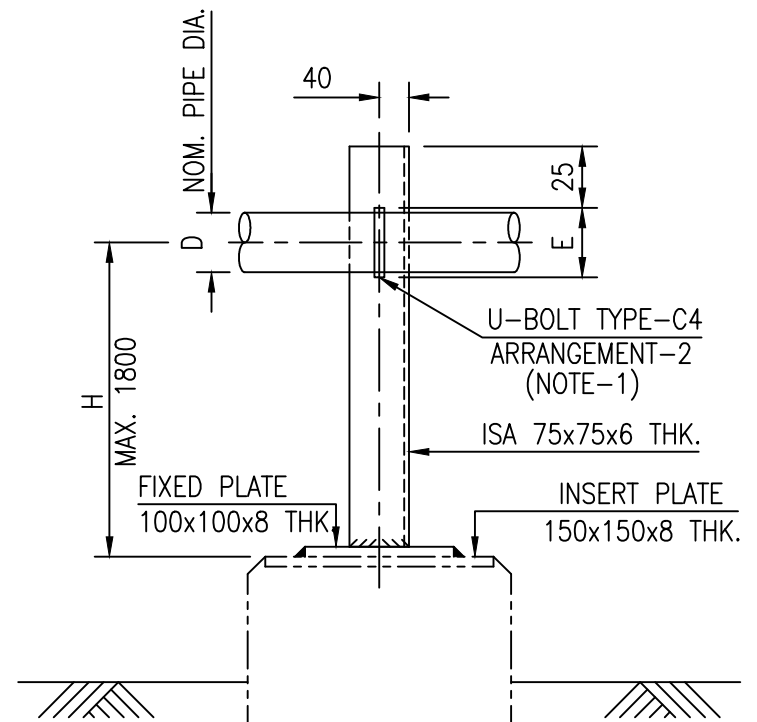
ARRANGEMENT TYPE-1
(SLIDING)



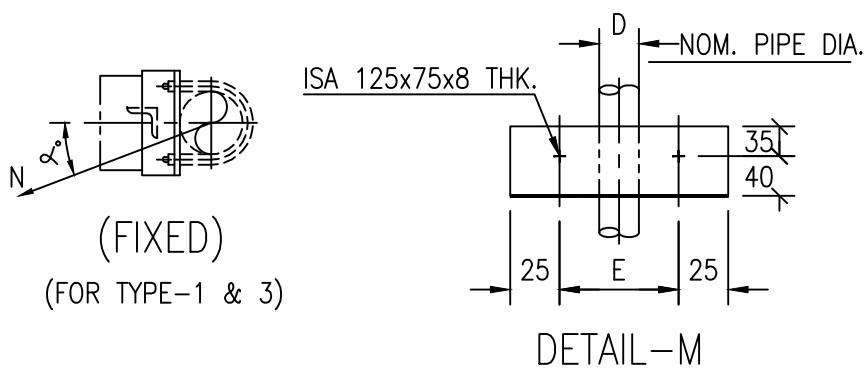
ARRANGEMENT TYPE-2
(SLIDING)



ARRANGEMENT TYPE-3
(FIXED)



ARRANGEMENT TYPE-4
(FIXED)



D	E
3/4"	36
1"	45
1 1/2"	60

$\alpha^\circ =$ (FOR TYPE 1 & 3)

TYPE
ARRANGEMENT TYPE
HEIGHT
NOM. PIPE DIA. (INCH)

L15 - 1 - H - D

SYMBOL

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



M/s. VCS QUALITY SERVICES
PVT. LTD.

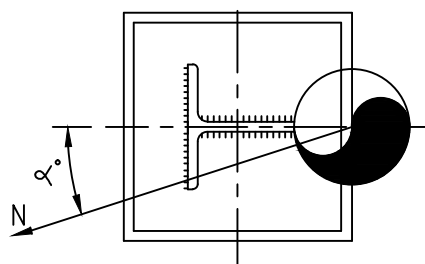
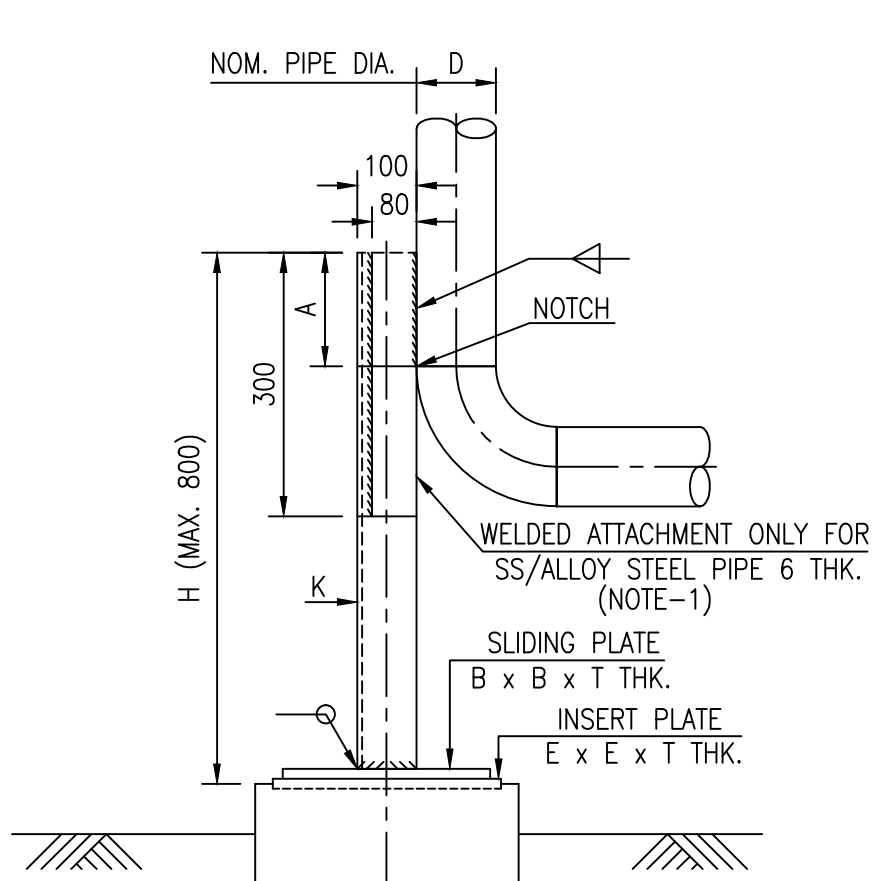
LOW SUPPORT SLIDING FOR
BARE & INSULATED PIPE
SIZE 2" THRU 24" TYPE-L6

DRAWING NO.

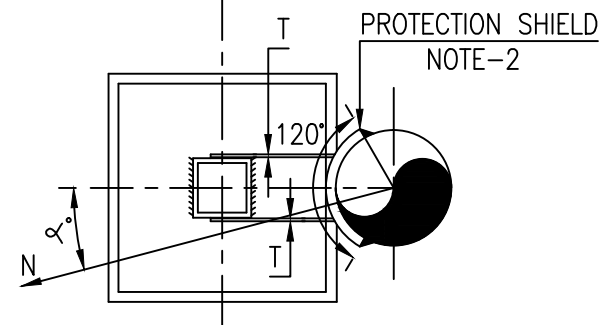
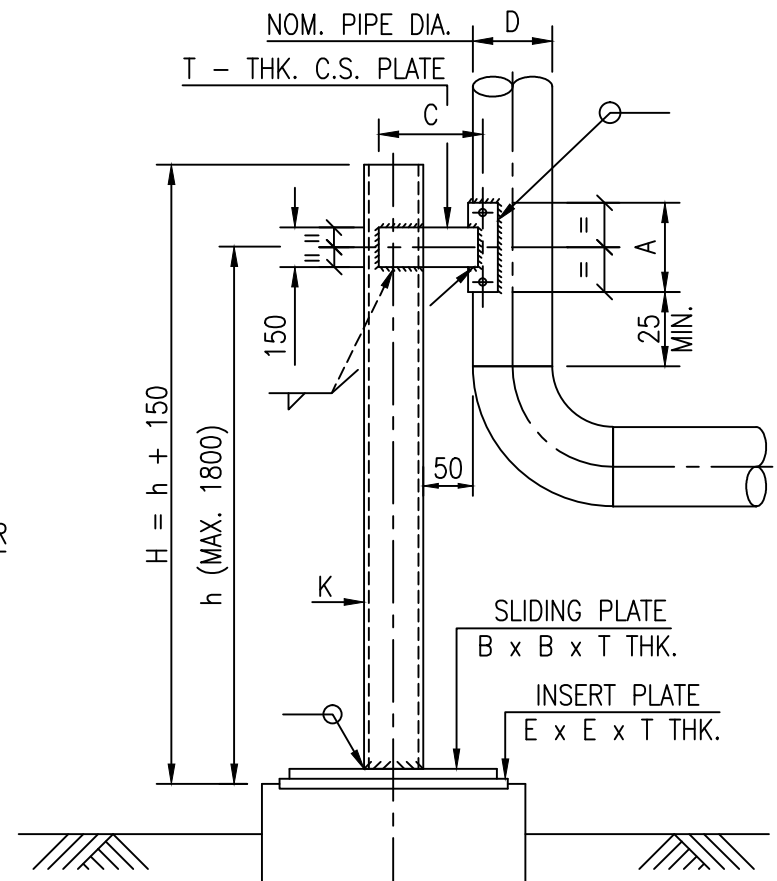
SD-PI-009

SHEET NO.

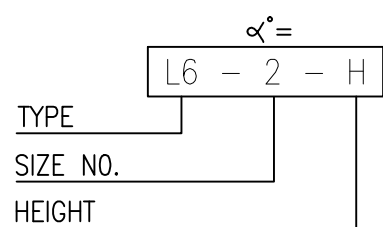
1 OF 1



FOR PIPE SIZES 2" THRU 4"



FOR PIPE SIZES 6" THRU 24"



SYMBOL

NOTES:-

1. MATERIAL FOR WELDED ATTACHMENT SHALL BE EQUIVALENT TO PIPE MATERIAL.
2. PROTECTION SHIELD IS TO BE CUT FROM LINE PIPE.

SIZE NO.	D	K	A	T	C	E	B
1	2" TO 4"	CUT FROM ISMB 200	200	10	-	250	150
2	6" TO 10"	ISMC-125 2 NOS.	200	12	150	300	200
3	12" TO 24"	ISMC-225 2 NOS.	300	12	230	400	300

FOR TEMP. UP TO 400 °C ONLY

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



M/s. VCS QUALITY SERVICES
PVT. LTD.

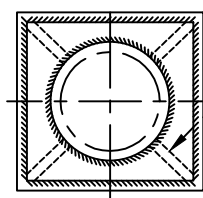
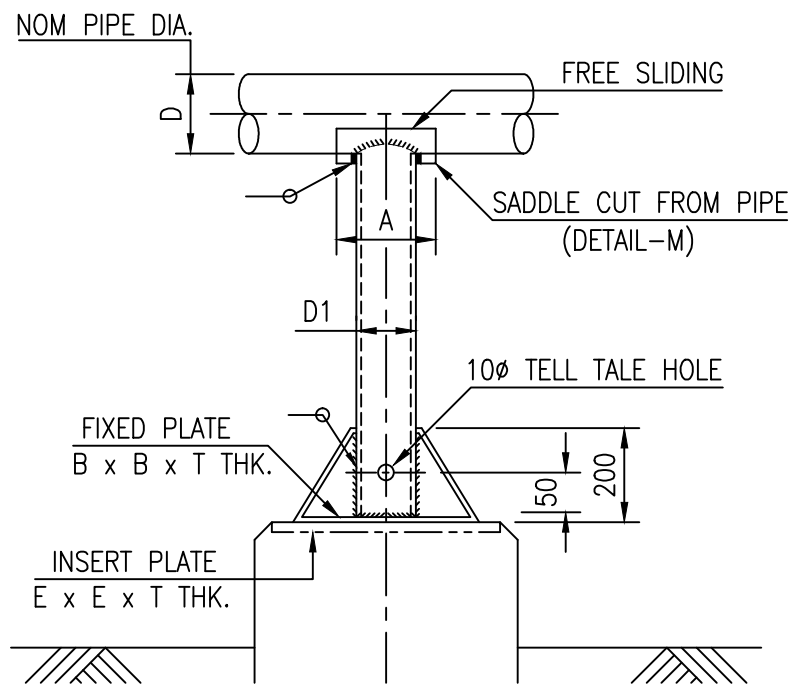
LOW SUPPORT SLIDING FOR BARE
PIPE SIZE 3/4" THRU 36"
TYPE-L5 & L5A

DRAWING NO.

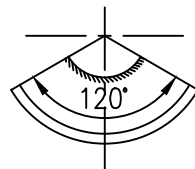
SD-PI-010

SHEET NO.

1 OF 1

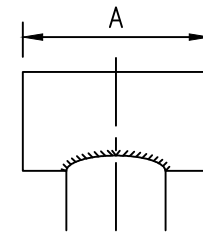
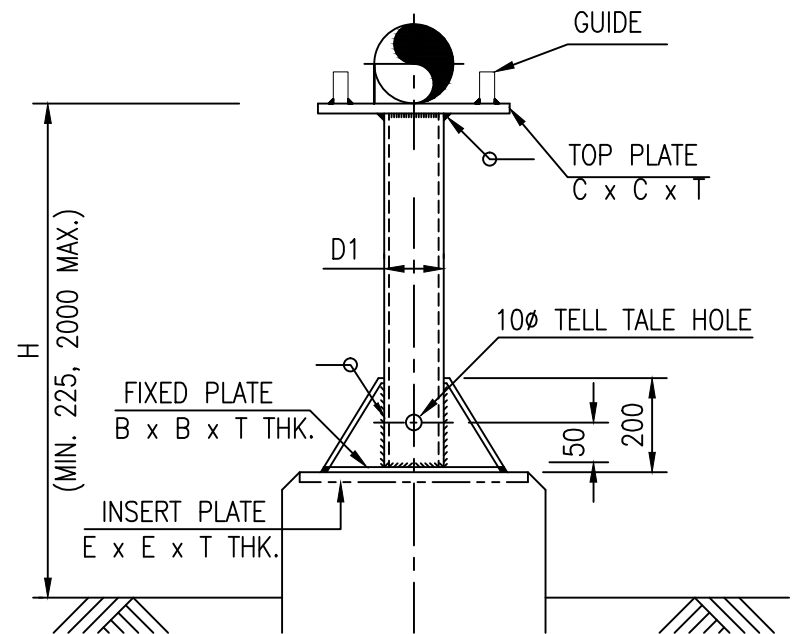


10 THK. PLATE TO BE
WELDED WHEN H EXCEEDS 1000



TYPE
SIZE NO.
HEIGHT

SYMBOL



TYPE
SIZE NO.
HEIGHT

SYMBOL

SIZE NO.	D	A	D1 (NOTE-1)	C	B	E	T
1	3/4"	2" NB x 100 Lg.	2" HEAVY IS :1239	150	150	200	12
	1"			200			
	1.1/2"	3" NB x 100 Lg.					
	2"						
2	3"	6" NB x 150 Lg.	2" HEAVY IS :1239	200	150	200	12
	4"						
3	6"	10" NB x 250 Lg.	3" HEAVY IS :1239	300	200	250	16
	8"						
4	10"	14" NB x 350 Lg.	4" HEAVY IS :1239	350	200	250	16
	12"						
5	14"	18" NB x 350 Lg.	6" HEAVY IS :1239	400	250	300	20
	16"						
6	18"	20" NB x 350 Lg.	8" SCH. 40	400	300	350	20
7	20"	24" NB x 350 Lg.	10" SCH. 40	450	350	400	20
	24"						
8	26"	30" NB x 350 Lg.	12" SCH. 40	550	400	500	20
	30"						
	36"	36" NB x 400 Lg.					

NOTES:-

- IN CASE SIZE AND/OR SCH. OF SUPPORT PIPE (D) LISTED IN THE TABLE IS NOT AVAILABLE, USE NEXT HIGHER SIZE AND/OR NEAREST EQUIVALENT THICKNESS AVAILABLE.
- MATERIAL FOR SUPPORT PIPE & PLATE SHALL BE CARBON STEEL.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



M/s. VCS QUALITY SERVICES
PVT. LTD.

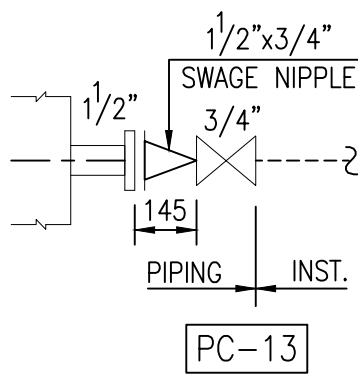
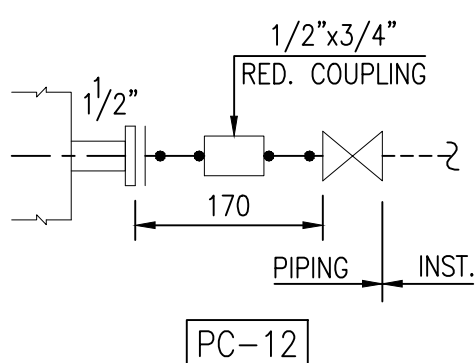
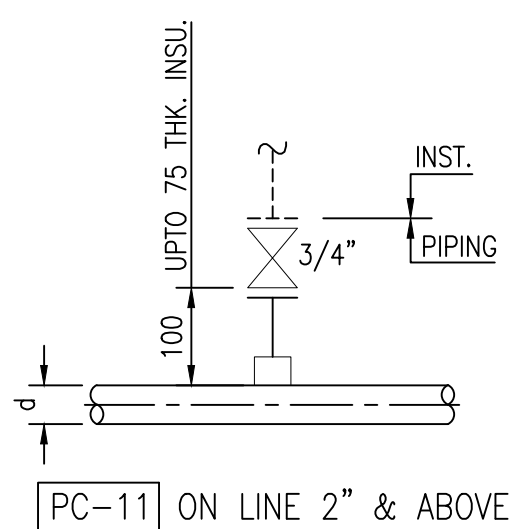
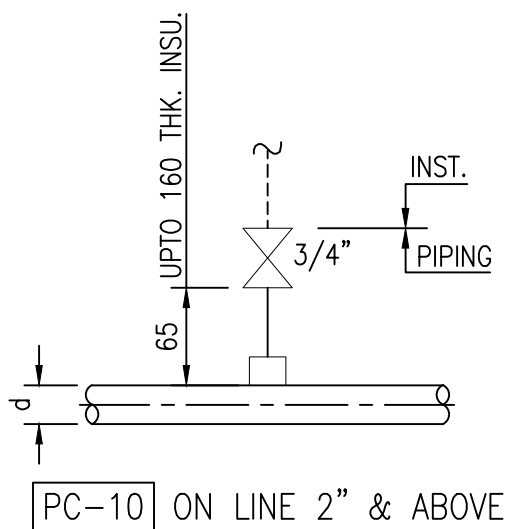
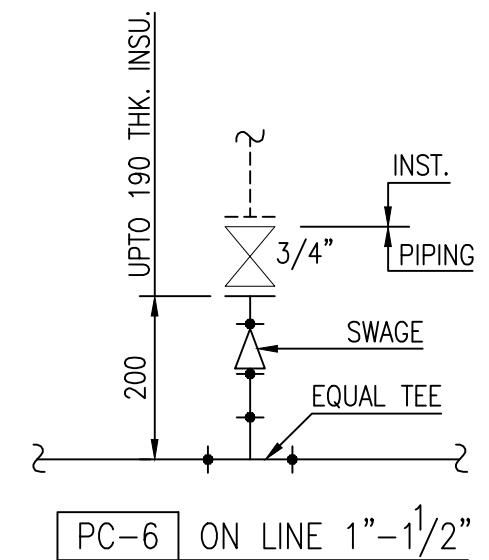
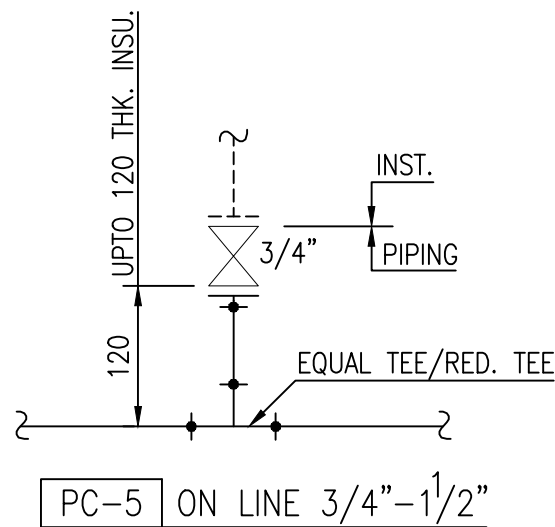
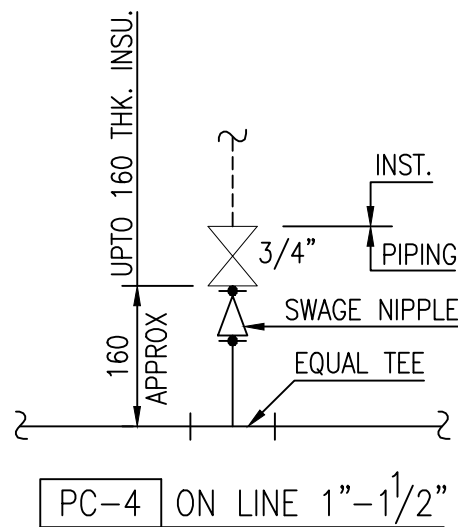
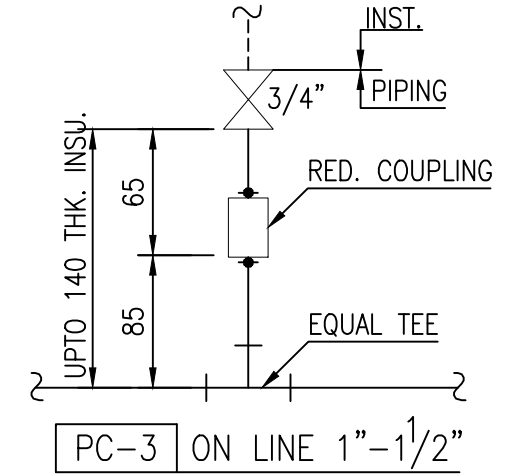
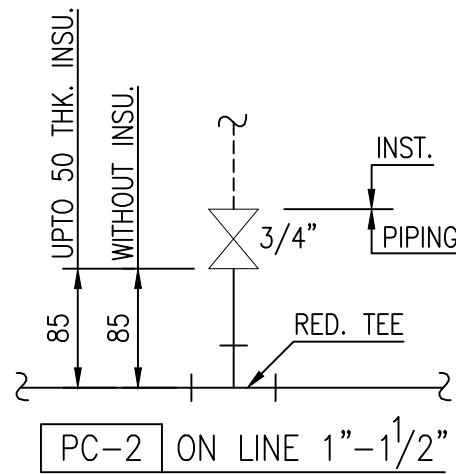
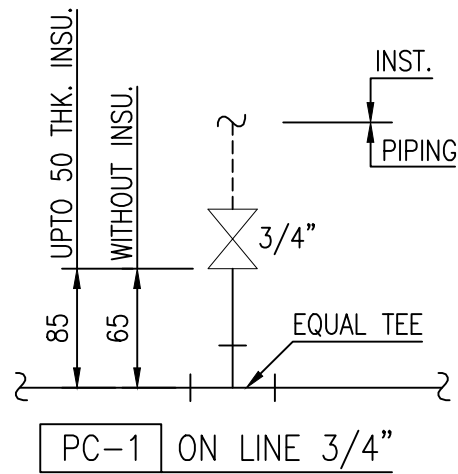
PRESSURE TAPPINGS
(PA, PG, PC, PT, PIC ETC.)

DRAWING NO.

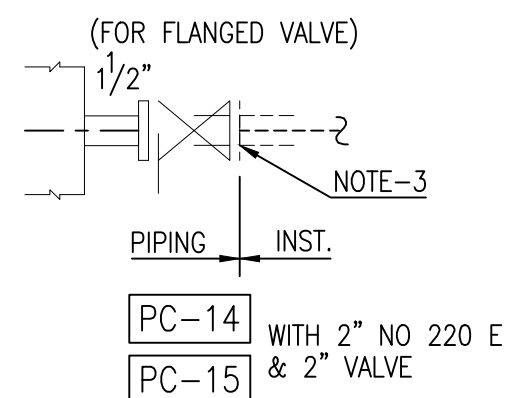
SD-PI-011

SHEET NO.

1 OF 1



ON VESSELS / COLUMNS



NOTES:-

1. THE INDICATED DIMENSIONS ARE MINIMUM WHICH ALSO COVER INSULATION TO THE EXTENT SHOWN ABOVE IN HIGHER THICKNESS OF INSULATION THAN INDICATED, THE DIFFERENCE SHALL BE ADDED IN THE DIMENSIONS SHOWN ABOVE ACCORDINGLY.
2. PRESSURE TAPPING SHALL BE PROVIDED WITH GATE, GLOBE OR PLUG VALVE (FLGD. SW. OR SCR'D) WITH TEE (EQ. OR RED.) HALF COUPLING (.W. OR SCR'D) OR STUB-IN AS PER PIPING SPECIFICATION.
3. IN CASE OF FLGD. VALVES BOLTING & GASKET ON BOTH SIDES OF VALVE SHALL BE IN PIPING SCOPE.
4. IN CASE OF TAPPING PROVIDED OTHER THAN INDICATED IN THIS STD FOR LAYOUT REASONS DETAILED DIMENSIONS WILL BE CALLED FOR OR CARRIED OUT.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



M/s. VCS QUALITY SERVICES
PVT. LTD.

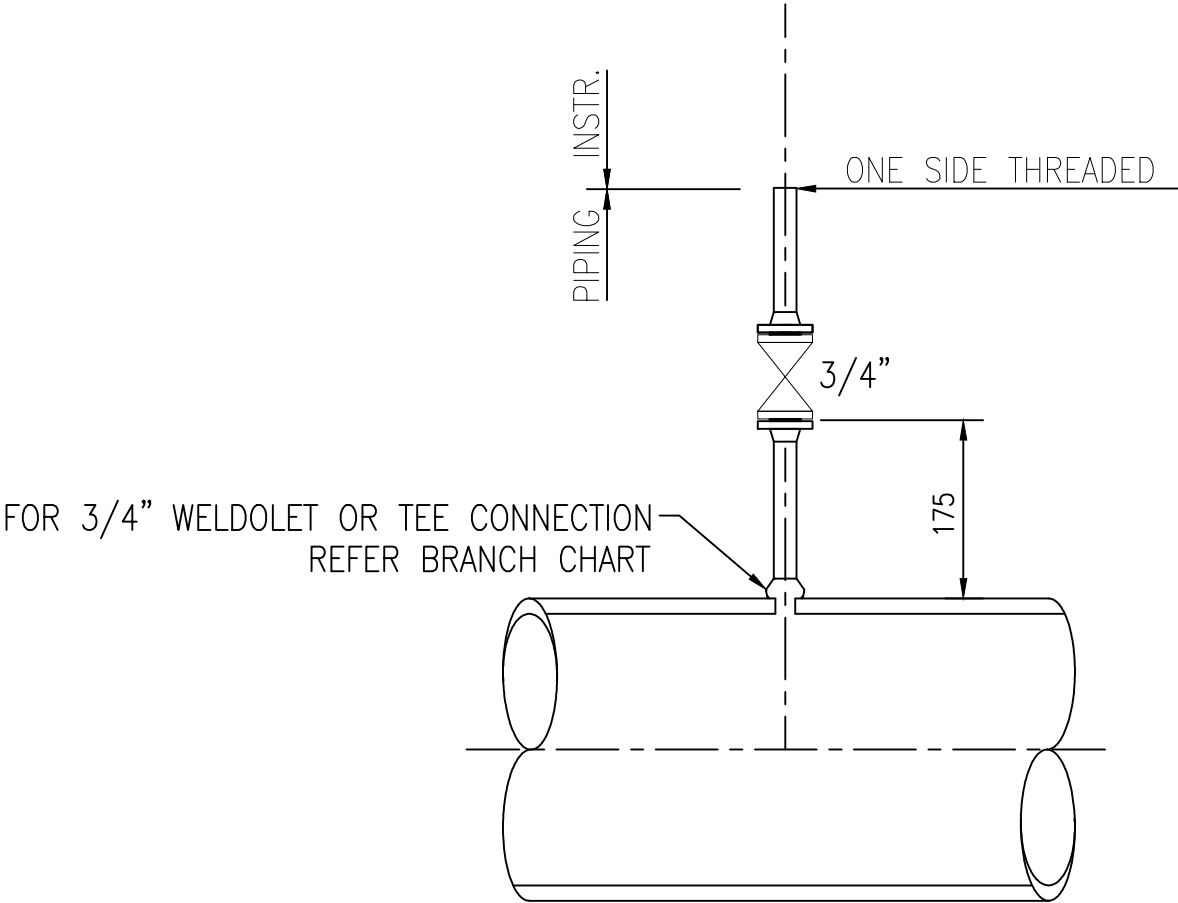
DETAIL OF PRESSURE
CONNECTIONS ABOVE GROUND
PIPE

DRAWING NO.

SD-PI-012

SHEET NO.

1 OF 1



0	10.05.17	ISSUED WITH TENDER	US		DK		AD	
REV. NO.	DATE	SUBJECT OF REVISION	PREP		CHKD		APPD	



M/s. VCS QUALITY SERVICES
PVT. LTD.

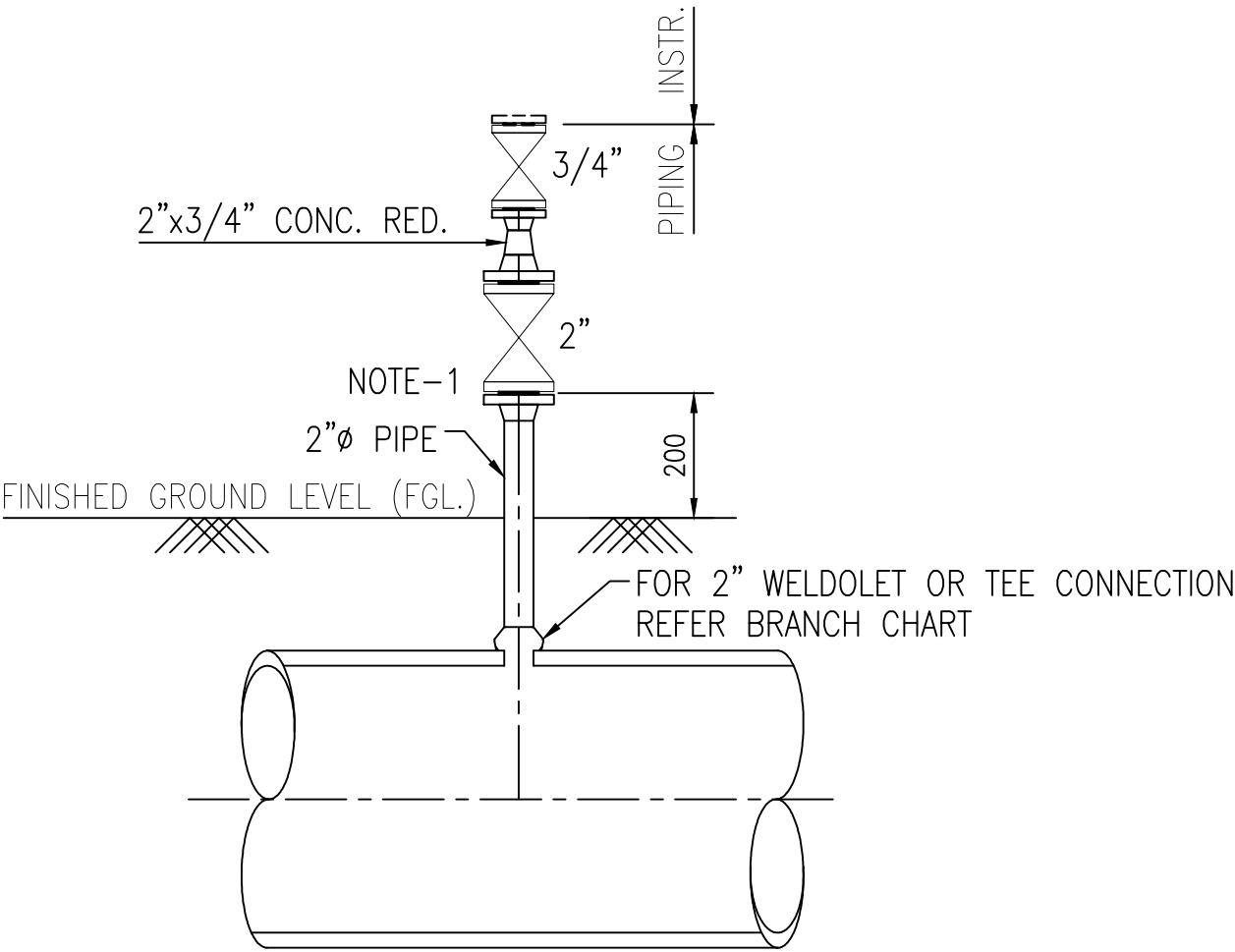
DETAIL OF PRESSURE CONNECTIONS
UNDER GROUND PIPE

DRAWING NO.

SD-PI-013

SHEET NO.

1 OF 1



NOTE:
1 INSULATION GASKET SHALL BE INSTALLED.

0	10.05.17	ISSUED WITH TENDER	US		DK		AD	
REV. NO.	DATE	SUBJECT OF REVISION	PREP		CHKD		APPD	



M/s. VCS QUALITY SERVICES
PVT. LTD.

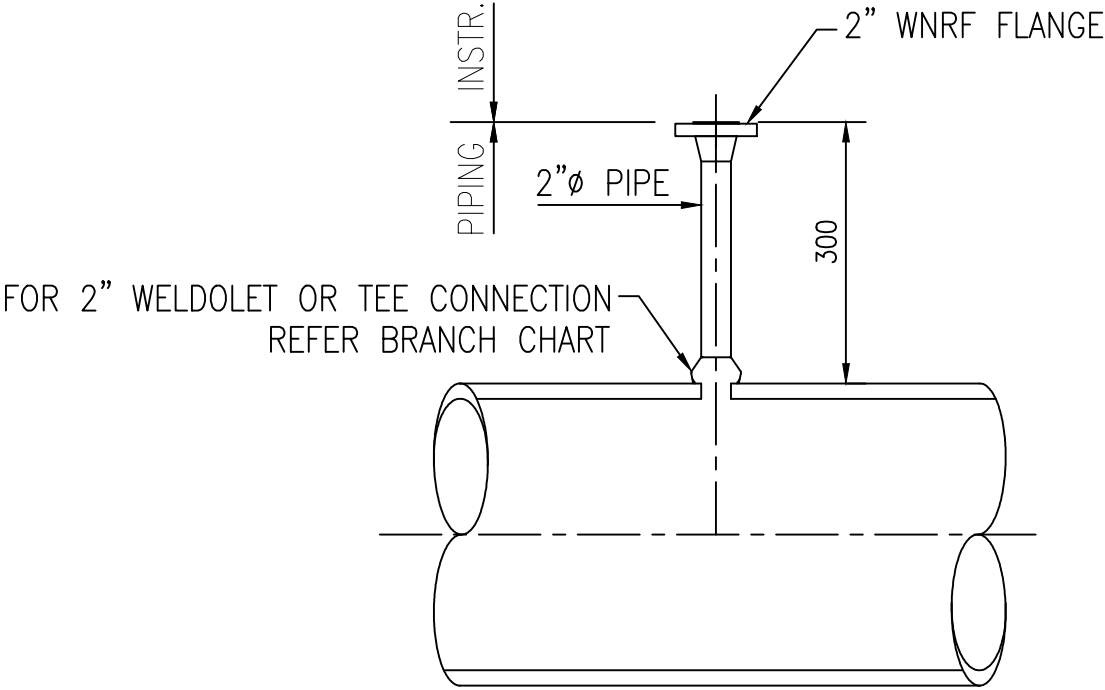
DETAIL OF TEMPERATURE CONNECTIONS
ABOVE GROUND PIPE

DRAWING NO.

SD-PI-014

SHEET NO.

1 OF 1



0	10.05.17	ISSUED WITH TENDER	US		DK		AD	
REV. NO.	DATE	SUBJECT OF REVISION	PREP		CHKD		APPD	



M/s. VCS QUALITY SERVICES
PVT. LTD.

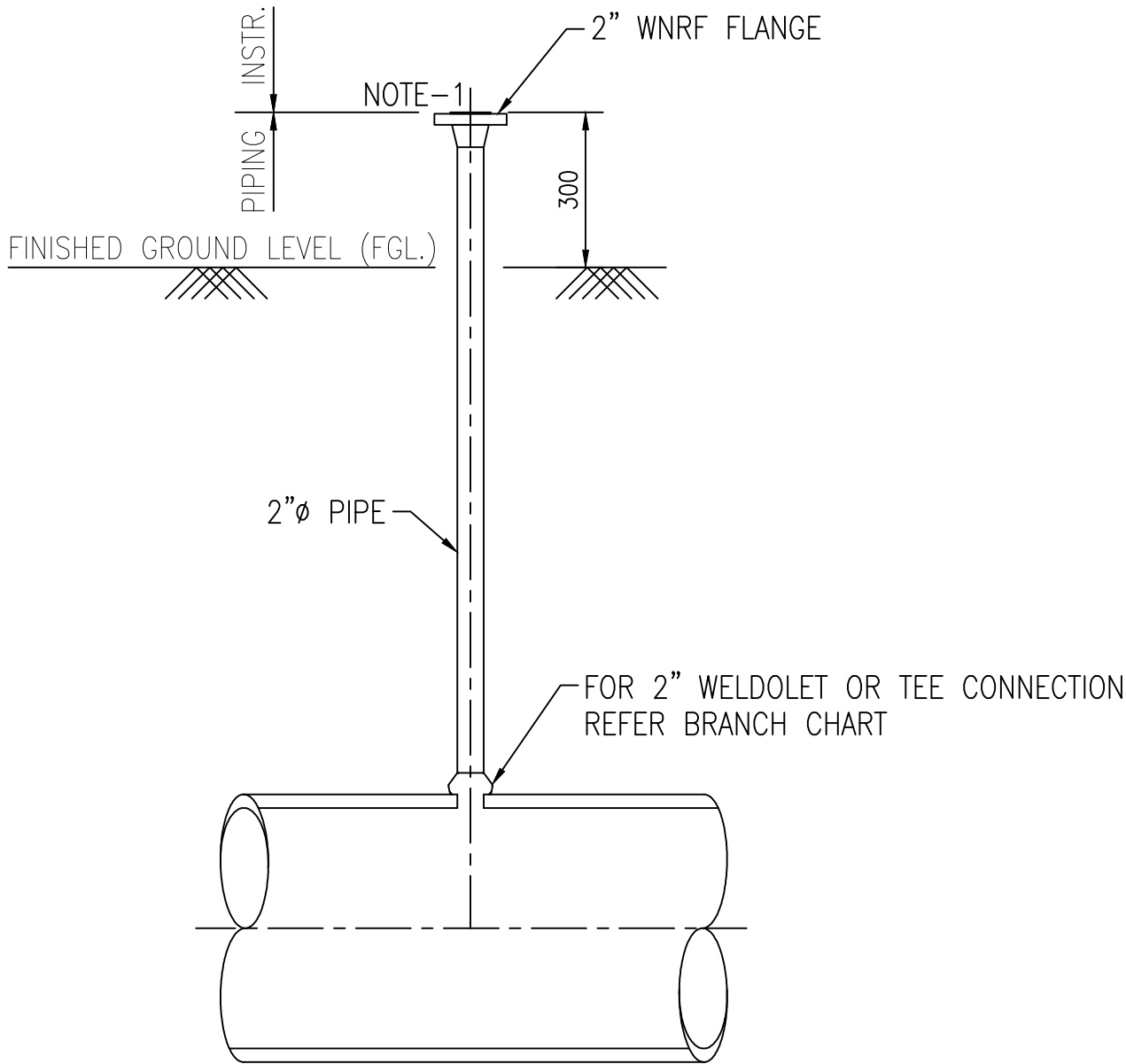
DETAIL OF TEMPERATURE
CONNECTIONS UNDER GROUND
PIPE

DRAWING NO.

SD-PI-015

SHEET NO.

1 OF 1



NOTE:
1 INSULATION GASKET SHALL BE INSTALLED.

0	10.05.17	ISSUED WITH TENDER	US		DK		AD	
REV. NO.	DATE	SUBJECT OF REVISION	PREP		CHKD		APPD	



M/s. VCS QUALITY SERVICES
PVT. LTD.

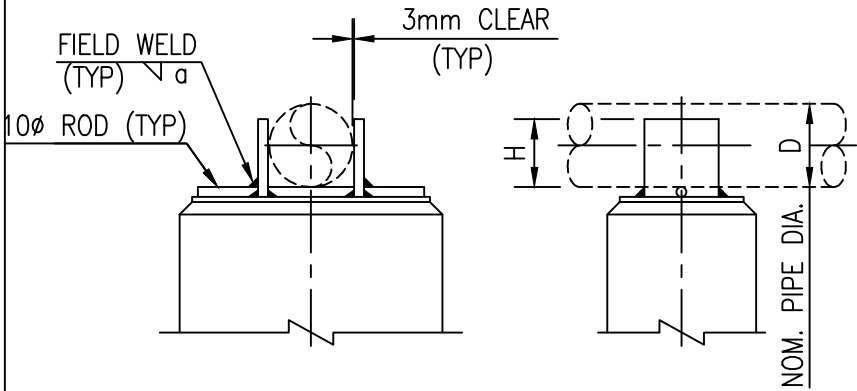
GUIDE SUPPORT FOR BARE PIPE
(SIZE 1/2" TO 24") TYPE G2

DRAWING NO.

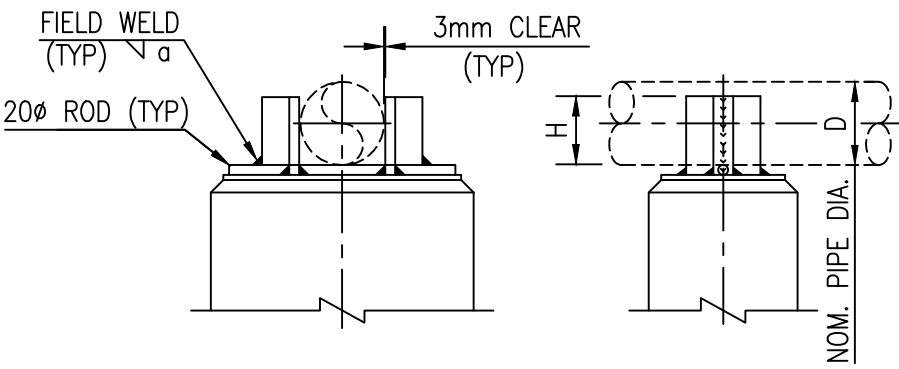
SD-PI-016

SHEET NO.

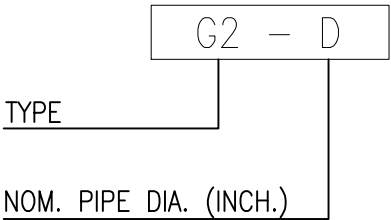
1 OF 1



FOR SIZES UPTO 4"



FOR SIZES 6" THRU 24"



SYMBOL

D	H	a	METERIAL
2" & SMALLER	40	6	FLAT 60 x 10
3" TO 4"	70	6	FLAT 75 x 10
6" TO 8"	130	6	2 NOS. ISA 50 x 50 x 6
10" TO 18"	230	10	2 NOS. ISA 75 x 75 x 10
20" TO 24"	350	10	2 NOS. ISA 90 x 90 x 10

NOTES:-

GUIDE ANGLES SHOULD BE SUITABLY TRIMMED WHEREVER THESE OBSTRUCT ADJOINING GUIDE ANGLES.

0	10.05.17	ISSUED WITH TENDER	US		DK		AD	
REV. NO.	DATE	SUBJECT OF REVISION	PREP		CHKD		APPD	



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PVT. LTD.

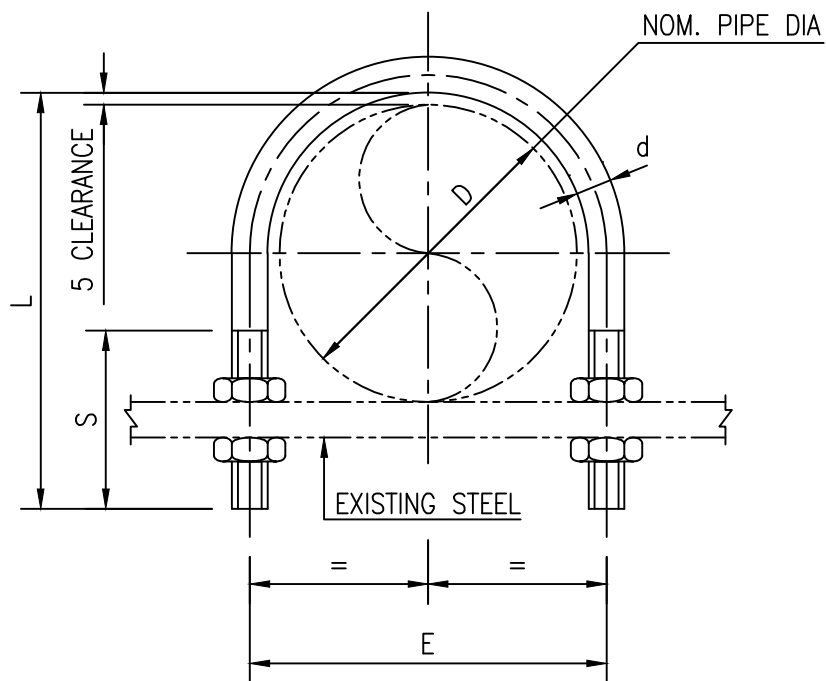
U-BOLT FOR BARE PIPE
(SIZE 1/2" TO 24")

DRAWING NO.

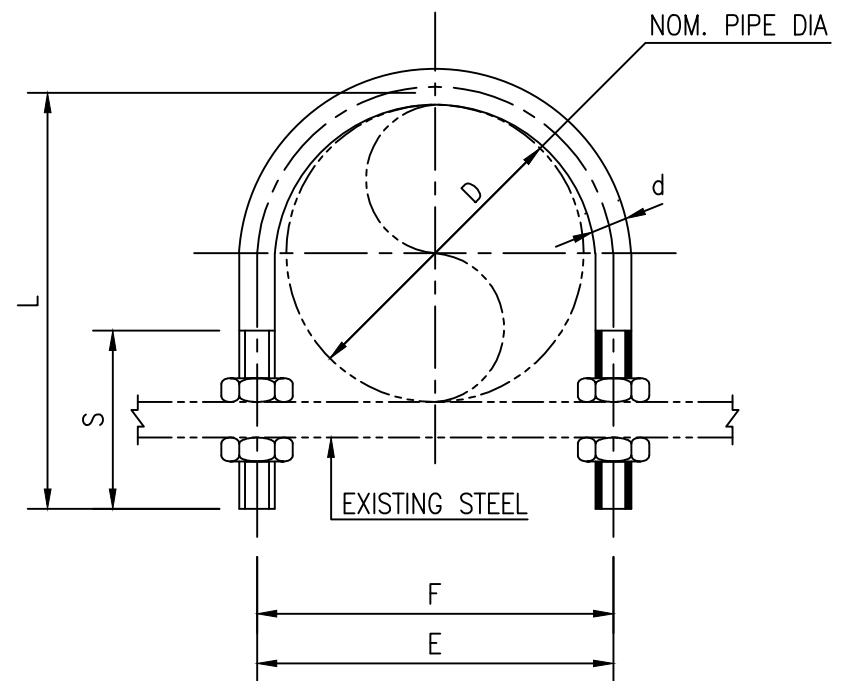
SD-PI-017

SHEET NO.

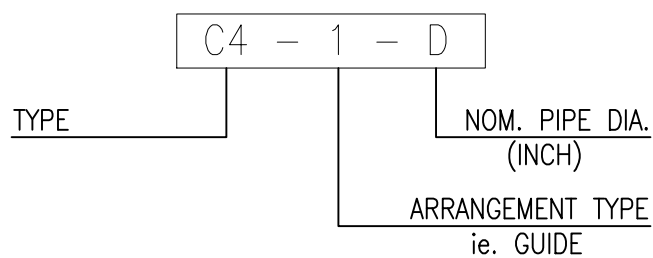
1 OF 1



GUIDE
ARRANGEMENT TYPE-1
(1/2" TO 24")



FIXED
ARRANGEMENT TYPE-2
(1/2" TO 1 1/2")



SYMBOL

D	O.D. (mm)	'U' CLAMP				
		L	E	S	d	F
1/2"	21	65	30	50	6	24
3/4"	27	70	36	50	6	30
1"	33	75	45	55	8	37
1 1/2"	48	90	60	55	8	52
2"	60	105	72	60	8	64
3"	89	145	106	80	12	94
4"	114	170	130	80	12	119
6"	168	240	190	100	16	173
8"	219	290	242	100	16	226
10"	273	345	296	100	16	280
12"	324	420	351	130	20	331
14"	356	450	382	130	20	362
16"	408	500	435	130	20	414
18"	457	565	490	140	24	465
20"	508	620	540	140	24	515
24"	610	720	645	140	24	620

0	10.05.17	ISSUED WITH TENDER	US		DK		AD	
REV. NO.	DATE	SUBJECT OF REVISION	PREP		CHKD		APPD	



M/s. VCS QUALITY SERVICES
PVT. LTD.

VENTS AND DRAINS
(ON LINES 2" AND ABOVE)

DRAWING NO.

SD-PI-018

SHEET NO.

1 OF 1

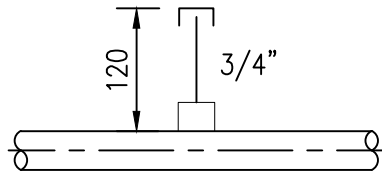
TYPE

VENT

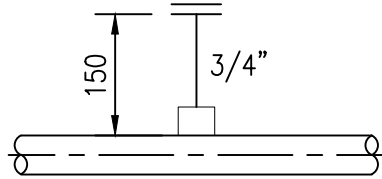
DRAIN

TYPE

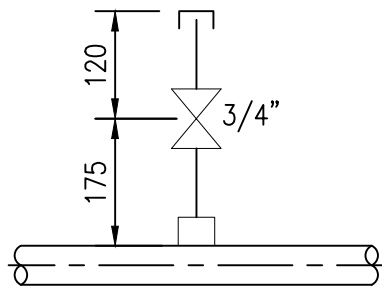
VP1
V1C



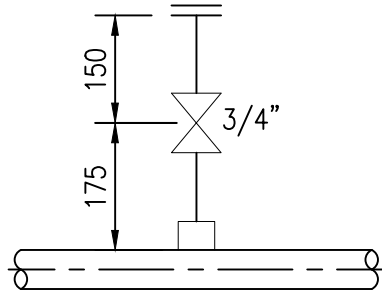
V2F



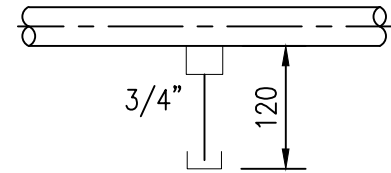
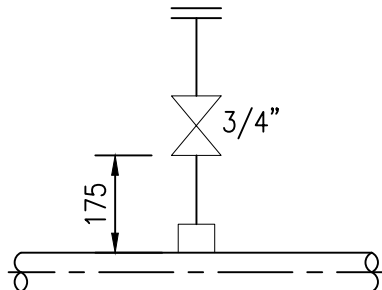
V3
V3C



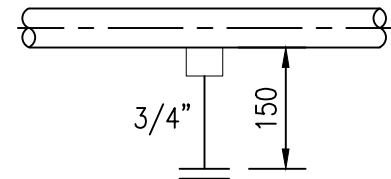
V4F



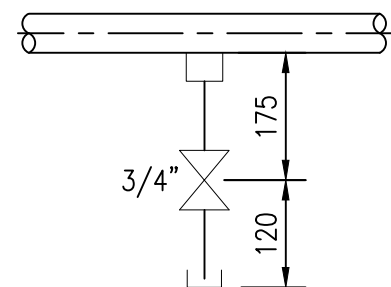
V5F



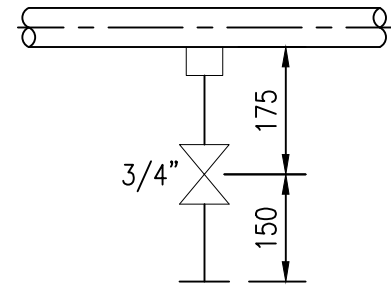
D1
D1C



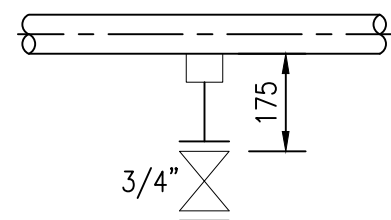
D2F



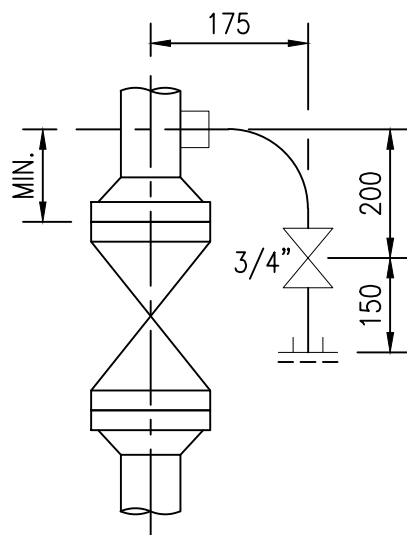
D3
D3C



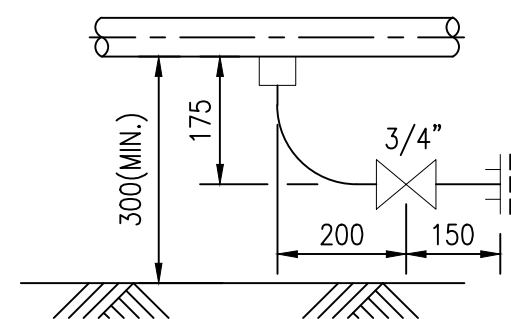
D4F



D5F



DC9
DF9



DC10
DF10

NOTES:—

1. DELETED.
2. VENTS & DRAINS SHALL BE PROVIDED WITH GATE, GLOBE OR PLUG VALVE (FLG'D.) WITH HALF COUPLING. OR STUB IN, WITH CAP OR FLANGE & BLIND FLANGE AS PER PIPING SPECIFICATIONS.
3. DELETED.
4. LEGEND : V = VENT; D = DRAIN; C = CAP; F = FLANGE; P = PLUG.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



M/s. VCS QUALITY SERVICES
PVT. LTD.

VENTS AND DRAINS
(ON LINES 1 1/2" AND BELOW)

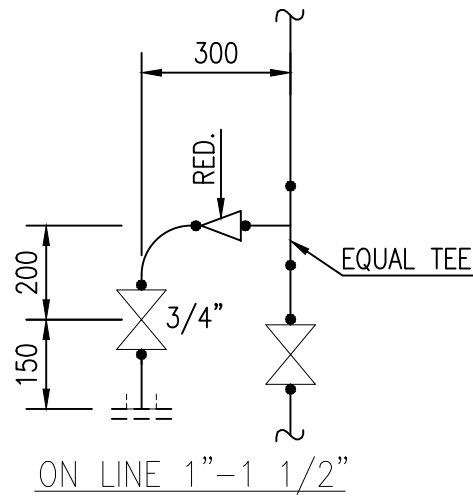
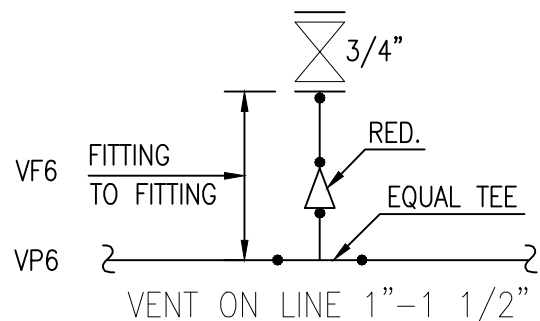
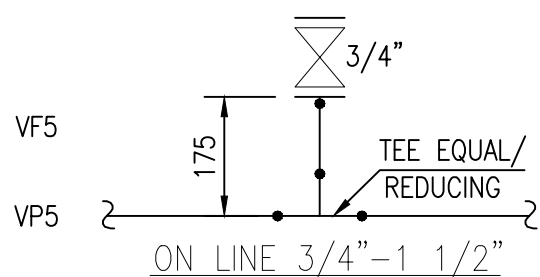
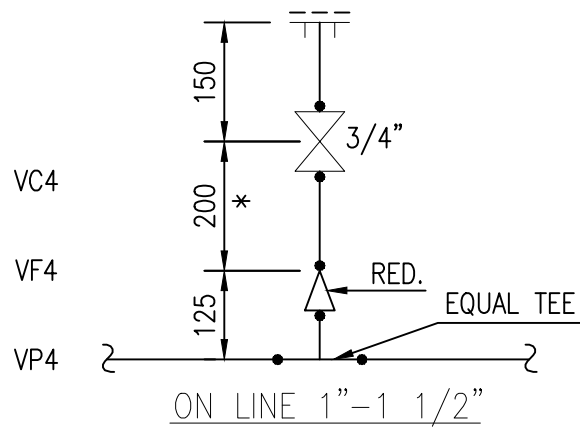
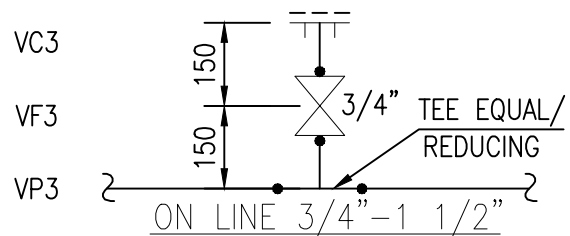
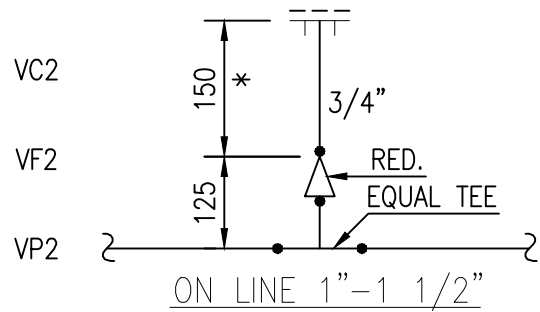
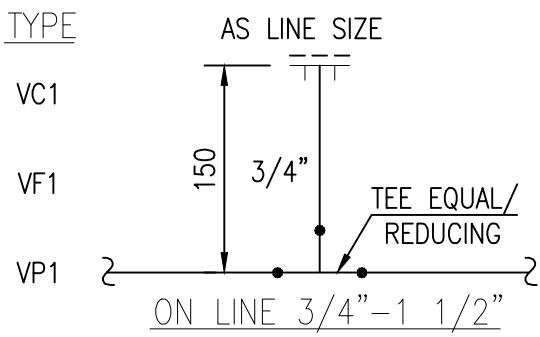
DRAWING NO.

SD-PI-019

SHEET NO.

1 OF 1

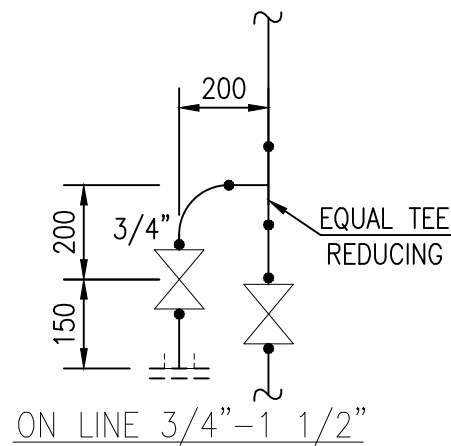
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DC7

DF7

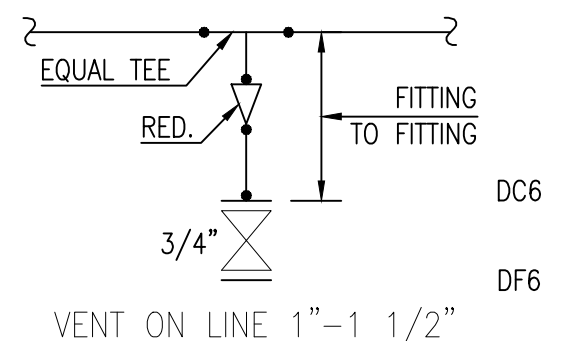
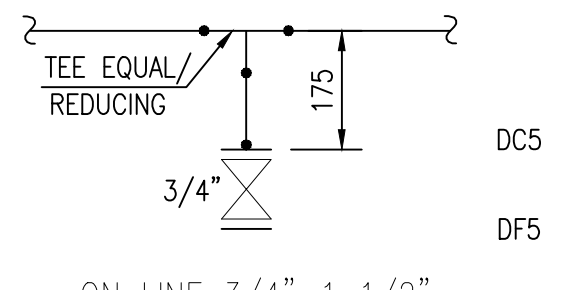
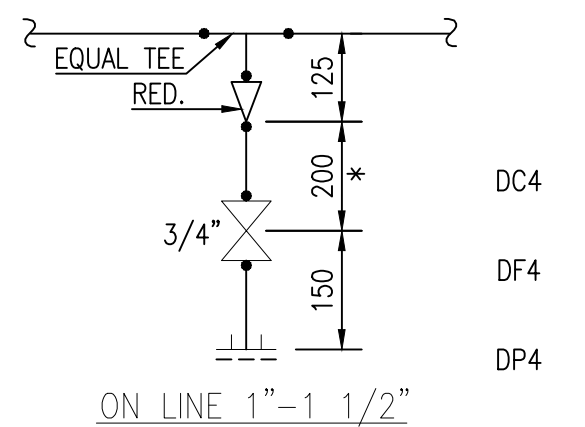
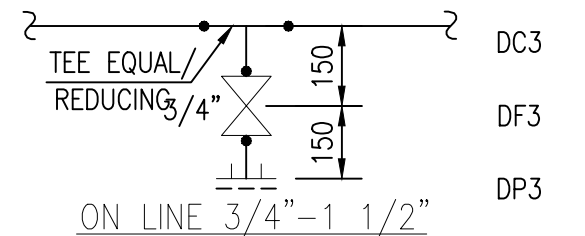
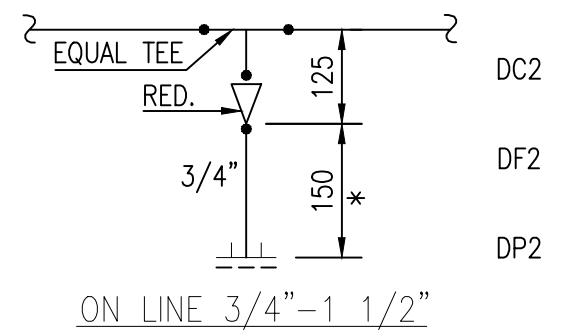
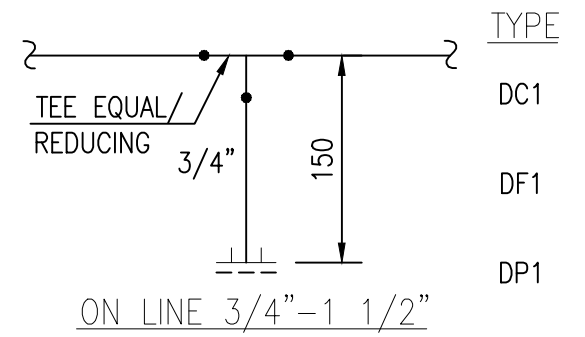
DP7



DC8

DF8

DP8



NOTES:-

- DIMENSIONS ARE VALID FOR 50mm(MAX) INSULATION THICKNESS, INCREASE DIMENSIONS AS REQUIRED, DIMENSIONS MARKED '*' ARE MAXIMUM AND MAY BE REDUCED TO SUIT.
- VENTS & DRAINS SHALL BE PROVIDED WITH GATE, GLOBE OR PLUG VALVE (FLGD.) WITH TEE (EQUAL OR REDUCING), HALF COUPLING OR STUB IN, CAP OR PLUG FLANGE AND BLIND FLANGE AS PER PIPING SPECIFICATION.
LEGEND : V = VENT; D = DRAIN; C = CAP; F = FLANGE; RED. = REDUCER, COUPLING OR SOCKET; P = PLUG.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



M/s. VCS QUALITY SERVICES
PVT. LTD.

SYMBOLS OF PIPING
ELEMENTS ON DRAWINGS

DRAWING NO.

SD-PI-023

SHEET NO.

1 OF 4

DESCRIPTION	FLANGED	SCREWED	WELDED (NOTE-1)	SOCKET WELD
90° ELBOW				
ELBOW (TURNED UP)				
ELBOW (TURNED DOWN)				
MITERED BEND 90°				
MITERED BEND 45°				
45° ELBOW				
45° ELBOW (TURNED UP)				
45° ELBOW (TURNED DOWN)				
TEE EQUAL/UNEQUAL				
TEE (OUTLET UP)				
TEE (OUTLET DOWN)				
CROSS				
CONCENTRIC REDUCER				
ECCENTRIC REDUCER				
DEAD END				
LATERAL				
SIGHT GLASS				
UNION				
HALF COUPLING				
FULL COUPLING				
HOSE COUPLING				

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



M/s. VCS QUALITY SERVICES
PVT. LTD.

SYMBOLS OF PIPING
ELEMENTS ON DRAWINGS

DRAWING NO.

SD-PI-023

SHEET NO.

2 OF 4

DESCRIPTION	FLANGED	SCREWED	WELDED (NOTE-1)	SOCKET WELD
GATE VALVE (PLAN)				
GATE VALVE (ELEVATION)				
GLOBE VALVE (PLAN)				
GLOBE VALVE (ELEVATION)				
ANGLE VALVE (PLAN)				
ANGLE VALVE (ELEVATION)				
CHECK VALVE (PLAN OR ELEVATION)				
ANGLE STOP CHECK VALVE (PLAN)				
ANGLE STOP CHECK VALVE (ELEVATION)				
PLUG VALVE (PLAN)				
PLUG VALVE (ELEVATION)				
BALL VALVE (PLAN)				
BALL VALVE (ELEVATION)				
NEEDLE VALVE (PLAN OR ELEVATION)				
RELIEF VALVE (PLAN)				
RELIEF VALVE (ELEVATION)				
CONTROL VALVE GLOBE TYPE(PLAN)				
CONTROL VALVE GLOBE TYPE(ELEVATION)				
CONTROL VALVE BUTTERFLY TYPE(PLAN)				
CONTROL VALVE BUTTERFLY TYPE(ELEV.)				
SOLENOID OPERATED VALVE(PLAN OR ELEV.)				

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



M/s. VCS QUALITY SERVICES
PVT. LTD.

SYMBOLS OF PIPING
ELEMENTS ON DRAWINGS

DRAWING NO.

SD-PI-023

SHEET NO.

3 OF 4

DESCRIPTION	FLANGED	SCREWED	WELDED (NOTE-1)	SOCKET WELD
BUTTERFLY VALVE (PLAN OR ELEVATION)				
DIAPHRAGM VALVE (PLAN OR ELEVATION)				
3-WAY PLUG VALVE (PLAN OR ELEVATION)				
4-WAY PLUG VALVE (PLAN OR ELEVATION)				
EXPANSION JOINT				
ANGLE CONTROL VALVE				
CHAIN OPERATING VALVE				
GEAR OPERATED VALVE (BEVEL GEAR)PLAN				
GEAR OPERATED VALVE (SPUR GEAR)PLAN				
MOTOR OPERATING VALVE				
STEAM TRAP				
Y-STRAINER				

DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL
SLIP ON FLANGE		STUB - IN (WITH OR WITHOUT RENIF)	
WELDNECK FLANGE			
SCREWED FLANGE		STUB - IN (SADDLE RENIF)	
SOCKET WELD FLANGE			
SPACER		STUB - IN WITH RENIF (IN PLAN)	
SPACER BLIND			
SPECTALE FIG. 8 (BLIND)		INSULATED (LINES 12" AND BELOW)	
SPECTALE FIG. 8 (OPEN)			

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



M/s. VCS QUALITY SERVICES
PVT. LTD.

SYMBOLS OF PIPING
ELEMENTS ON DRAWINGS

DRAWING NO.

SD-PI-023

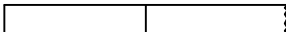
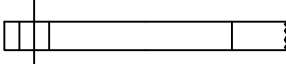
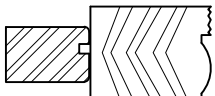
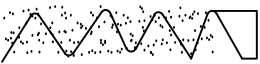
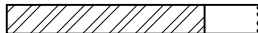
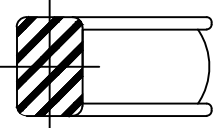
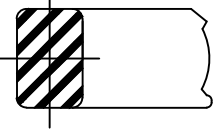
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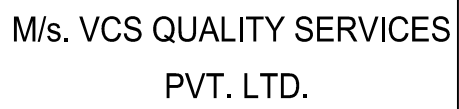
3 OF 4

DESCRIPTION	FLANGED	SCREWED	WELDED (NOTE-1)	SOCKET WELD
BUTTERFLY VALVE (PLAN OR ELEVATION)				
DIAPHRAGM VALVE (PLAN OR ELEVATION)				
3-WAY PLUG VALVE (PLAN OR ELEVATION)				
4-WAY PLUG VALVE (PLAN OR ELEVATION)				
EXPANSION JOINT				
ANGLE CONTROL VALVE				
CHAIN OPERATING VALVE				
GEAR OPERATED VALVE (BEVEL GEAR)PLAN				
GEAR OPERATED VALVE (SPUR GEAR)PLAN				
MOTOR OPERATING VALVE				
STEAM TRAP				
Y-STRAINER				

DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL
SLIP ON FLANGE		STUB - IN (WITH OR WITHOUT RENIF)	
WELDNECK FLANGE			
SCREWED FLANGE		STUB - IN (SADDLE RENIF)	
SOCKET WELD FLANGE			
SPACER		STUB - IN WITH RENIF (IN PLAN)	
SPACER BLIND			
SPECTALE FIG. 8 (BLIND)		INSULATED (LINES 12" AND BELOW)	
SPECTALE FIG. 8 (OPEN)			

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

 M/s. VCS QUALITY SERVICES PVT. LTD.		GASKET THICKNESS		DRAWING NO.					
				SD-PI-024					
				SHEET NO.			1 OF 1		
TYPICAL CROSS SECTION		DESCRIPTION		THICKNESS OF GASKET		COMPRESSED THICKNESS (NOTE -1)			
		FLAT RING FOR RAISED FACE FLANGE		2.0		2.0			
		FULL FACE FOR FLAT FACE FLANGES							
		SPIRAL WOUND METAL FLAT RING GASKET, NON METALLIC FILTER, AND A STEEL SOLID RING TYPE CENTERING DEVICE- FOR RAISED FACE FLANGES.		4.4		3.0			
		FLAT METAL JACKETED GASKET, NON METALLIC FILTER COMPLETELY ENCLOSED WITHIN A FULLY ANNEALED DOUBLE METAL JACKET-FORRAISED FACE FLANGES		3.0		2.0			
		CORRUGATED METAL JACKETED GASKET, NON METALLIC FILTER, COMPLETELY ENCLOSED WITHIN A FULLY ANNEALED DOUBLE METAL CORRUGATED JACKET- FOR RAISED FACE FLANGES.		3.2		1.0			
		CORRUGATED METAL GASKET-FULLY ANNEALED CORRUGATED METAL WITH FILTER MATERIAL CEMENTED TO THE CORRUGATIONS ON BOTH FACES -FOR RAISED FACE FLANGES		3.2		1.0			
		SOLID METAL FLAT RING FOR SMALL TONGUE AND GROOVE FLANGES.		AS SPECIFIED					
		SOLID METAL FLAT RING FOR LARGE TONGUE AND GROOVE FLANGES.		AS SPECIFIED					
		SOLID METAL OCTAGONAL RING FOR R.T.J FLANGES		DIMENSIONS SHALL BE AS PER ASME B 16.20(NOTE-2)					
		SOLID METAL OVAL RING FOR R.T.J FLANGES		DIMENSIONS SHALL BE AS PER ASME B 16.20(NOTE-2)					
		FULLY ANEALED CORRUGATED METAL FOR RAISED FACE FLANGES.		3.2		1.0			
0	10.05.17	ISSUED WITH TENDER		US		DK		AD	
REV. NO.	DATE	SUBJECT OF REVISION		PREP		CHKD		APPD	



1 OF 1



FOR TEMP. UP TO 400 °C ONLY

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REV. NO.	DATE	SUBJECT OF REVISION	PREP		CHKD		APPD	



M/s. VCS QUALITY SERVICES
PVT. LTD.

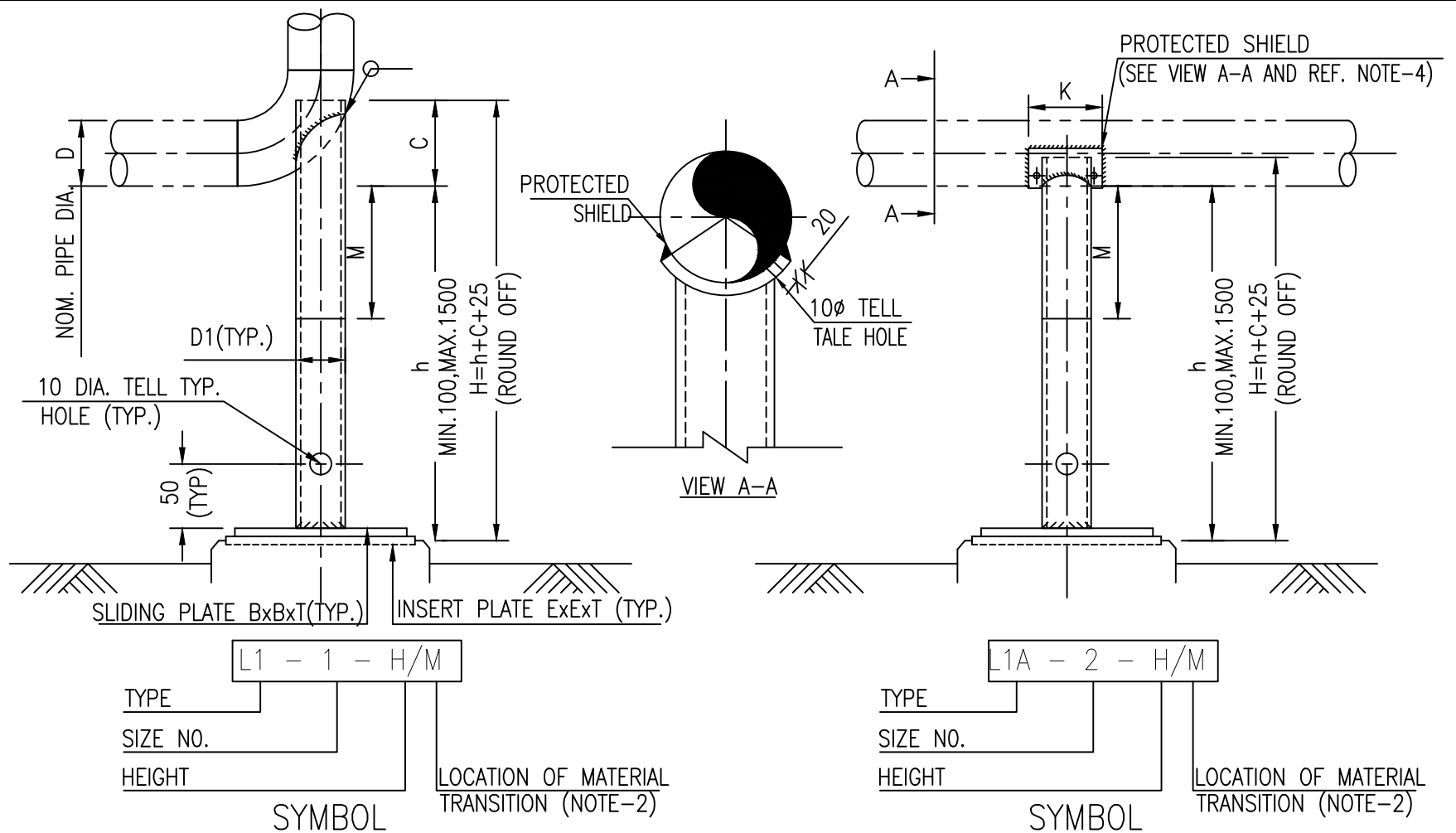
LOW SUPPORT SLIDING FOR BARE
& INSULATED PIPE SIZE 2"
THRU 36" TYPE-L1 AND L1A

DRAWING NO.

SD-PI-026

SHEET NO.

1 OF 1



SIZE NO.	D	D1 (NOTE-3)	B	T	C (NOTE-5)	E	K (NOTE-4)
1	2"	2" S40/10S	150	10	70	250	160
	3"				115		
2	4"	3" S40/10S	200	10	137	300	190
	6"				174		
3	8"	4" S40/10S	200	12	205	300	215
	10"				262		
	12"				287		
4	14"	6" S40/10S	250	12	388	350	270
	16"				418		
5	18"	8" S40/10S	300	12	454	400	320
6	20"	10" S40/10S	350	12	554	450	375
	24"				615		
7	26"	12" S40/10S	400	16	675	500	425
	30"				800		
	36"				950		

NOTES:-

- INSERT AND SLIDING PLATE MATERIAL SHALL BE CARBON STEEL WHERE DESIGN TEMP. IS $>345^{\circ}\text{C}$ WITH $h < 200\text{MM}$, SLIDING PLATE MATERIAL SHALL BE EQUIVALENT TO PIPE MATERIAL.
- DIMENSION "M" LOCATES THE POINT OF MATERIAL TRANSITION ON THE SUPPORT. THE STUB MATERIAL SHALL BE EQUIVALENT TO THAT OF LINE PIPE AND THE LOWER SUPPORT PIPE SHALL BE CARBON STEEL. MINIMUM VALUE OF M SHALL BE "INSULATION THICKNESS+25MM".
A. FOR CARBON STEEL(CS) LINE PIPE, THE ENTIRE SUPPORT PIPE SHALL BE CS, THAT IS $M=0$.
B. FOR ALLOY STEEL(AS) OR STAINLESS STEEL(SS) LINE -PIPE, SUPPORT PIPE SHALL CONSIST OF THE FOLLOWING-
-FOR h LESS THAN OR EQUAL TO 500MM, ENTIRE SUPPORT PIPE MATERIAL SHALL BE EQUIVALENT TO THAT OF LINE PIPE, THAT IS $M=h$.
-FOR h GREATER THAN 500MM, SUPPORT PIPE SHALL BE COMPOSITE WITH $M=\text{INSULATION THK.}+25\text{MM}$ OR 100MM, WHICHEVER IS GREATER.
- IN CASE SIZE AND/OR SCH. OF SUPPORT PIPE (D1) LISTED IN THE TABLE IS NOT AVAILABLE USE NEXT HIGHER SIZE AND/OR NEAREST HIGHER THICKNESS AVAILABLE.
- PROTECTION SHIELD (LENGTH=KMM) CUT FROM LINE-PIPE OR EQUIVALENT PLATE SHALL BE PROVIDED ON HORIZONTAL LINE AS FOLLOWS-
A. FOR 150# AND 300# CLASS PIPEING
CS AND AS LINES - 10" AND ABOVE
SS LINES - 2" AND ABOVE
B. FOR 600# AND HIGHER CLASS PIPING
CS, AS AND SS LINES - 10" AND ABOVE
- DIMENSION "C" IS TO BE MODIFIED IF OTHER THAN 1.5 D RADIUS ELBOWS ARE USED.
- IN CASE CALCULATED h EXCEEDS THE MAX. VALUE, PEDESTAL SHALL BE RAISED ACCORDINGLY.

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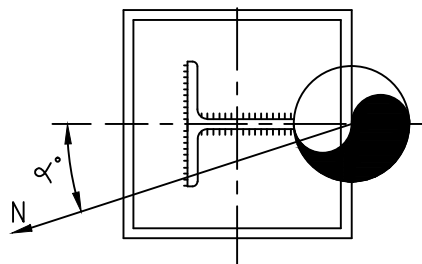
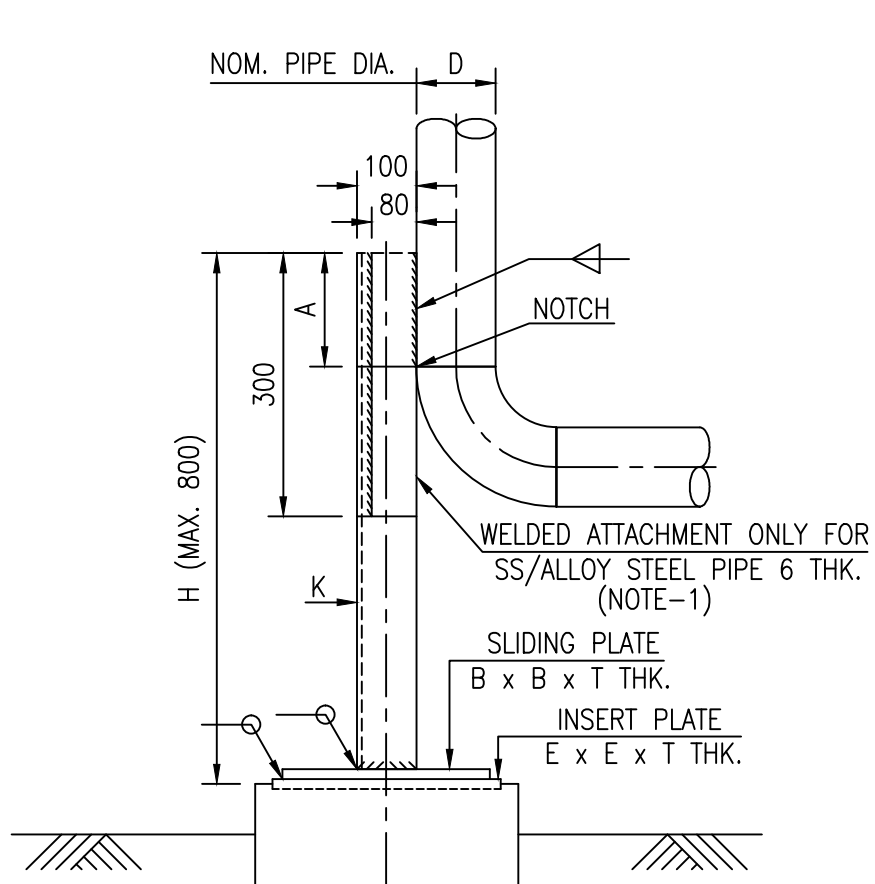
LOW SUPPORT FIXED FOR BARE
& INSULATED PIPE SIZE 2"
THRU 24"TYPE-L6

DRAWING NO.

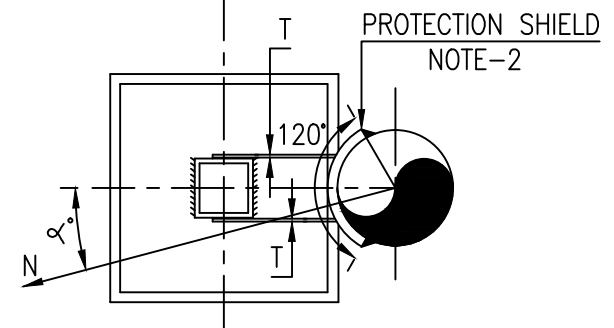
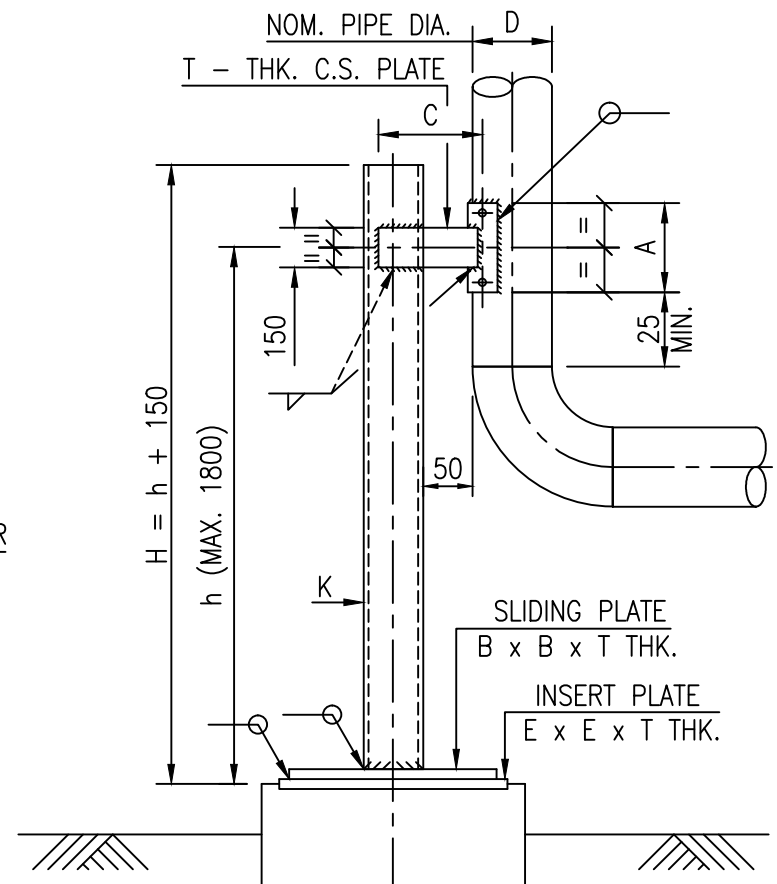
SD-PI-027

SHEET NO.

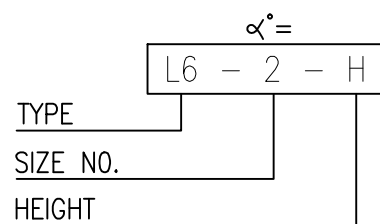
1 OF 1



FOR PIPE SIZES 2" THRU 4"



FOR PIPE SIZES 6" THRU 24"



SYMBOL

NOTES:-

1. MATERIAL FOR WELDED ATTACHMENT SHALL BE EQUIVALENT TO PIPE MATERIAL.
2. PROTECTION SHIELD IS TO BE CUT FROM LINE PIPE.

SIZE NO.	D	K	A	T	C	E	B
1	2" TO 4"	CUT FROM ISMB 200	200	10	-	250	150
2	6" TO 10"	ISMC-125 2 NOS.	200	12	150	300	200
3	12" TO 24"	ISMC-225 2 NOS.	300	12	230	400	300

FOR TEMP. UP TO 400 °C ONLY

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



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PVT. LTD.

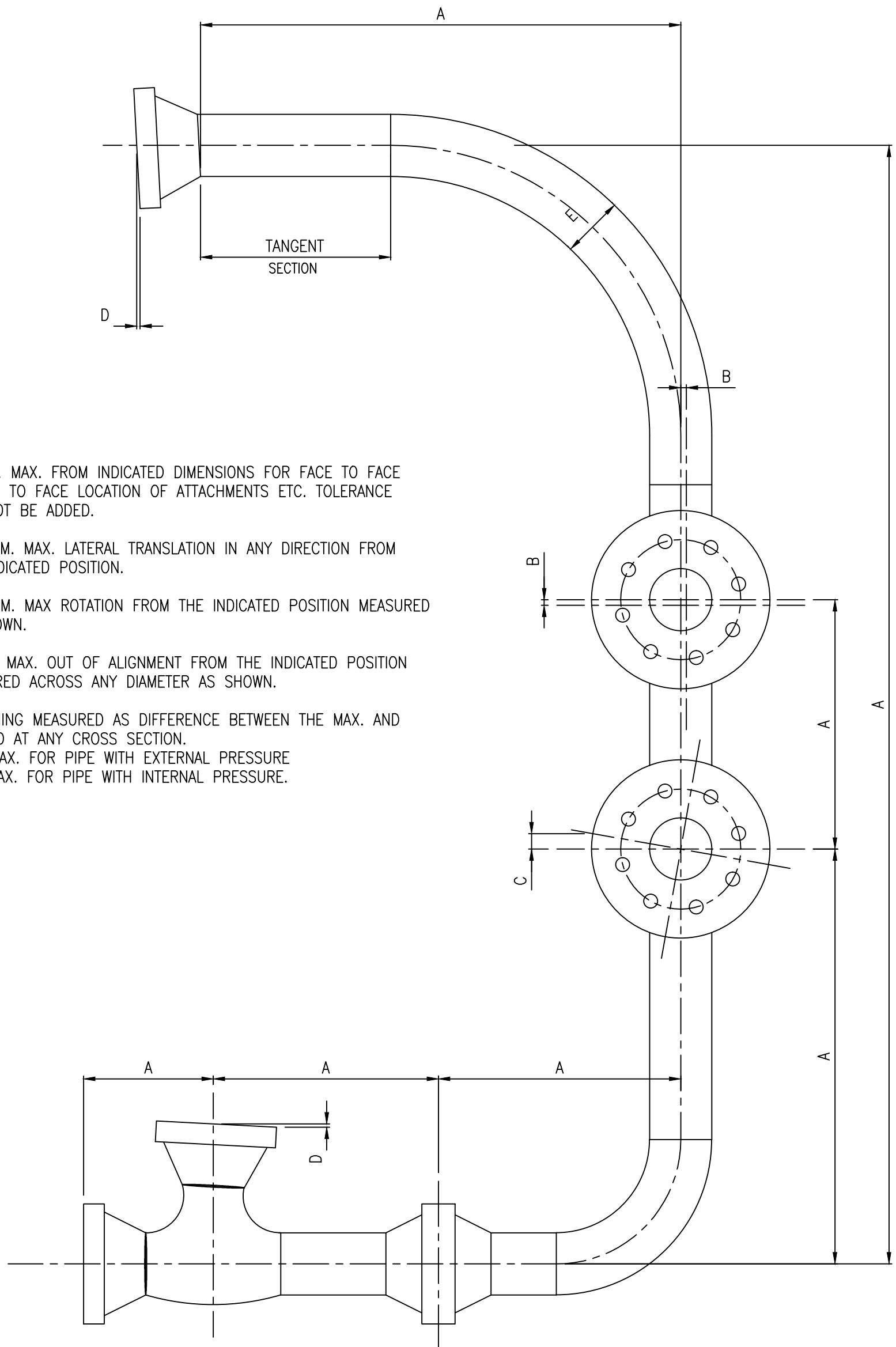
TOLERANCES FOR FABRICATION

DRAWING NO.

SD-PI-028

SHEET NO.

1 OF 1



- A ± 3 MM. MAX. FROM INDICATED DIMENSIONS FOR FACE TO FACE CENTRE TO FACE LOCATION OF ATTACHMENTS ETC. TOLERANCE CAN NOT BE ADDED.
- B ± 1.5 MM. MAX. LATERAL TRANSLATION IN ANY DIRECTION FROM THE INDICATED POSITION.
- C ± 1.5 MM. MAX ROTATION FROM THE INDICATED POSITION MEASURED AS SHOWN.
- D ± 1 MM MAX. OUT OF ALIGNMENT FROM THE INDICATED POSITION MEASURED ACROSS ANY DIAMETER AS SHOWN.
- E FLATTENING MEASURED AS DIFFERENCE BETWEEN THE MAX. AND MIN. OD AT ANY CROSS SECTION.
-3% MAX. FOR PIPE WITH EXTERNAL PRESSURE
8% MAX. FOR PIPE WITH INTERNAL PRESSURE.

0	10.05.17	ISSUED FOR STANDARD	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

 M/s. VCS QUALITY SERVICES PVT. LTD.	ABBREVIATIONS		DRAWING NO.							
			SD-PI-029							
			SHEET NO.		1 OF 1					
M&F MALE & FEMALE MI MALLEABLE IRON MOLY OR MO MOLYBDENUM MR MATERIAL REQUISITION MTO MATERIAL TAKE OFF MS MILD STEEL MSS MANUFACTURER’S STANDARD SOCIETY MH MAN HLOE NPT NATIONAL PIPE THREAD NPSH NET POSITIVE SUCTION HEAD NIP NIPPLE OD OUTSIDE DIAMETER PC.MK PIECE MARK PE PLAIN END PL PLATE PLTF PLATFORM P.S PIPE SUPPORT PSE PLAIN SMALL END PRESS. PRESSURE PSI POUNDS PER SQUARE INCH POE PLAIN ONE END PSIG POUNDS PER SQUARE INCH GAUGE RAD OR R RADIUS RED. REDUCER RF RAISED FACE R/L RANDOM LENGTH REF. REFERENCE RPM REVOLUTIONS PER MINUTE RTJ RING TYPE JOINT SH SPRING HANGER SHT SHEET SCH SCHEDULE SCRD SCREWED S SAMPLE CONNECTION SG SIGHT GLASS SC SAMPLE COOLER SMLS SEAMLESS SO SLIP ON SOL SOCKOLET SP. GR SPECIFIC GRAVITY SR SHORT RADIUS SS STAINLESS STEEL ST STEAM TRAP STN STATION STM STEAM STD STANDARD SW SOCKET WELD SWG SWAGE NIPPLE / STD WIRE GAGE STA STEAM TRAP ASSEMBLY TOG TOP OF GRATING TEMP. TEMPERATURE TOL THREDOLET T&C THREADED & COUPLED THRD THREADED T&G TONGUE & GROOVE TBE THREADED BOTH ENDS TLE THREADED LARGE END TSE THREADED SMALL END TOS TOP OF STEEL TOE THREADED ONE END TYP TYPICAL VC VENT CONNECTION VERT. VERTICAL WP WORKING PRESSURE, WORKING POINT  INVERT LEVEL OF PIPE  BOTTOM LEVEL OF THE PIPE  CENTRELINE ELEVATION OF PIPE WN WELD NECK WT WEIGHT WOL WELDOLET WLD WELD XS EXTRA STRONG XXS DOUBLE EXTRA STRONG										
NOTE: 1. FOR ABBREVIATIONS RELATED TO CIVIL ENGINEERING/UNDERGROUND PIPING WORK, REFER CIVIL ENGINEERING STANDARD.										
0	10.05.17	ISSUED WITH TENDER			US		DK		AD	
REV. NO.	DATE	SUBJECT OF REVISION			PREP		CHKD		APPD	



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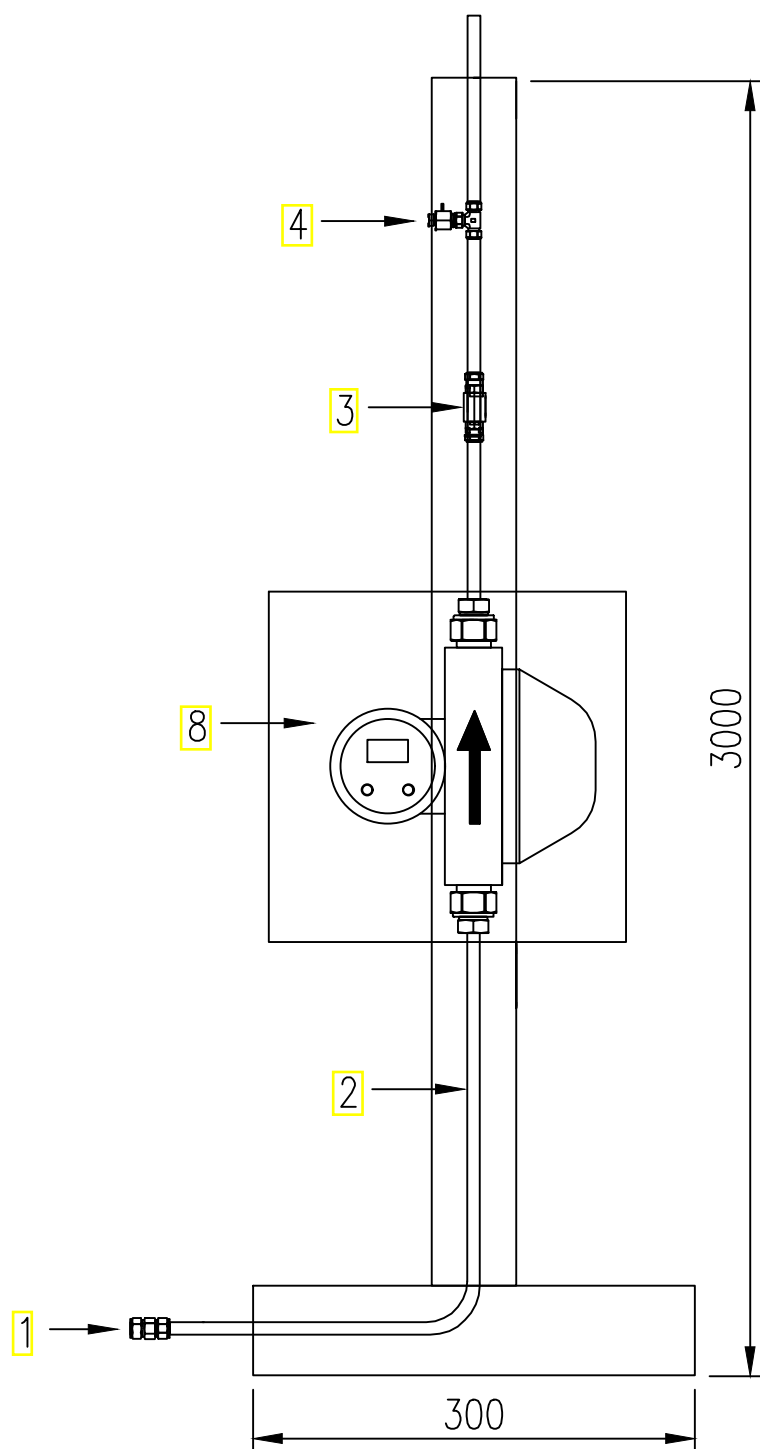
LCV LOADING POST WITH FLOW METER

DRAWING NO.

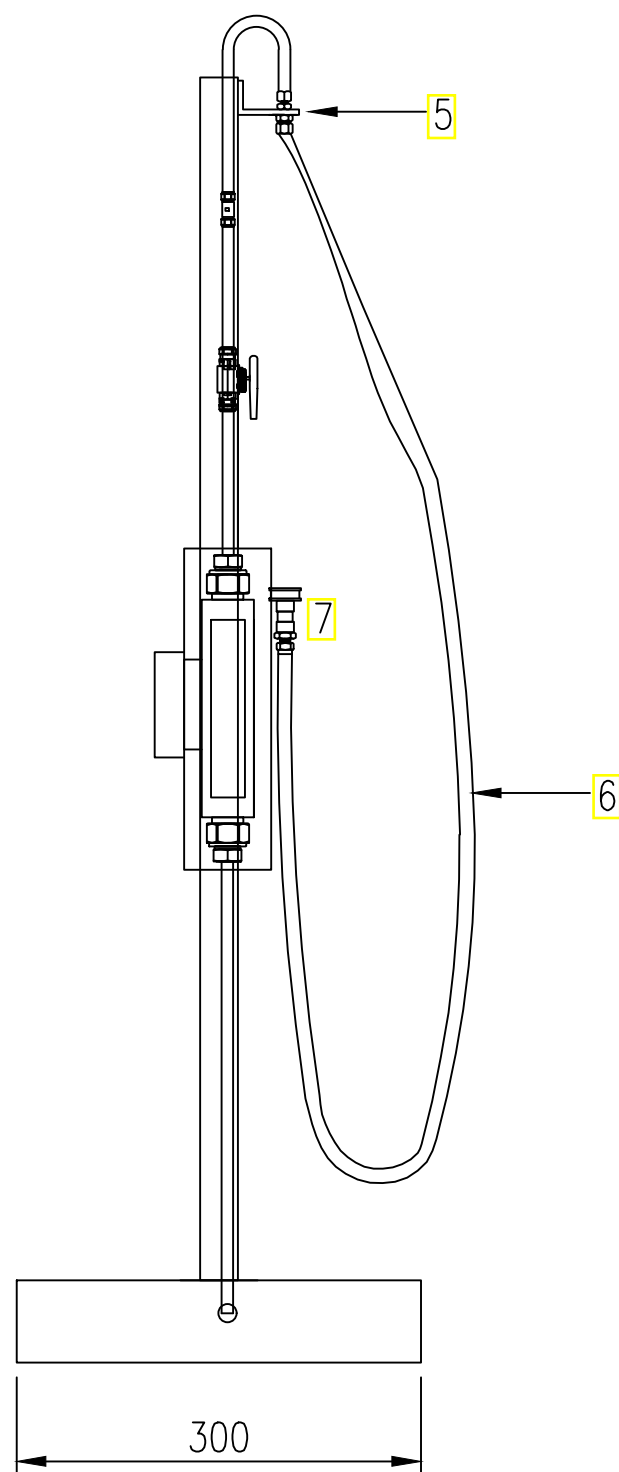
SD-ME-001

SHEET NO.

1 OF 1



FRONT VIEW



SIDE VIEW

S.NO.	PART NAME	MATERIAL	MAKE/MODEL
1	UNION 3/4" OD	SS 316	SWAGELOK/PARKER/ DK LOK
2	TUBE 3/4" OD	A 269/213 TP316	SANDVIK/TUBACEX
3	TWO WAY BALL VALVE 3/4" OD	SS 316	SWAGELOK/PARKER/ DK LOK
4	BLEED VALVE 1/4" NPTM	SS 316	SWAGELOK/PARKER/ DK LOK
5	BULKHEAD UNION 3/4" OD	SS 316	SWAGELOK/PARKER/ DK LOK
6	FILL HOSE 1/2" ID, LENGTH-4Mtr. (SS BRAIDED STAINLESS STEEL)	5000 PSIG	SWAGELOK/TUBACEX/ETON
7	QRC 1/2" NPTF	SS 316	SWAGELOK/PARKER/ DK LOK
8	FLOW METER WITH INTEGRATED DISPLAY (COROLIS TYPE) 0-100 Kg/min.	-	MICRO MOTION / E&H

NOTES :

1. ALL DIMENSIONS IN MM.
2. THIS DWG. IS INDICATIVE ONLY, VENDOR TO FURNISH FINAL DWG. BASED ON ARRANGEMENT FOR CNG FILLING FOR APPROVAL POST ORDER.
3. HOSE SHOULD CONFIRM TO NFPA52/CSA NGV 4.2-2014/CSA12.52-2014.

0	24.09.19	ISSUED FOR REVIEW	DK	RR	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



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
REV	DATE	DESCRIPTION	PREP	CHKD	APPR



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

 Energising Quality	PIPING MATERIAL SPECIFICATION	Document No.	Rev
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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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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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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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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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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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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	T	W	1.5	
		T	T	T	S	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 1SO 15761	BODY-ASTM A 350 GR.LF2,TRIMSTELLIT ED, 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 1SO 15761	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 1SO 17292	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1,TRIM-BODY SEAT-RPTFE	SW, 800, 3000, B-16.11
VLV.BALL	02.000	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:

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
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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Branch Table

																			T	42	BRANCH PIPE (INCH)
																			T	36	
																		T	T	32	
																		T	T	30	
																		T	T	24	
																		T	T	20	
																		T	T	18	
																		T	T	16	
																		T	T	14	
																		T	T	12	
																		T	T	10	BRANCH PIPE (INCH)
																		T	T	8	
																		T	T	6	
																		T	T	4	
																		T	T	3	
																		T	T	2	
																		T	T	1.5	
																		T	T	1	
																		T	T	0.75	
																		T	T	0.50	
0.05	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

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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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CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

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		10
												T	T	T		8
												T	T	T		6
												T	T	T		4
												T	T	T		3
												T	T	T		2
												T	T	T		1.5
												T	T	T		1
												T	T	T		0.75
												T	T	T		0.05
T	T	T	T	S	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)																



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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CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

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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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	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 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, 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 ISO 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, 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	S	S	S	S	S	S	1.5
											T	T		T	S	S	S	S	S	S	S

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CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF NAGALAND GA

	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.BLIN D	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&BLN D	10.000	14.000		ASME- B16.48	ASTM A 350 GR.LF2	600, FF/125AARH
FITTINGS						

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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
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, 600, 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, 600, 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

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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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**CITY GAS DISTRIBUTION PROJECT
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TCP DESIGN BASIS			Total Sheets		7
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HP OIL GAS PRIVATE LIMITED

CITY GAS DISTRIBUTION PROJECT

TEMPORARY CATHODIC PROTECTION DESIGN BASIS

FOR

NAGALAND GEOGRAPHICAL AREA

C1	24.12.2025	ISSUED FOR REVIEW	FJ	AA	AA
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**CITY GAS DISTRIBUTION PROJECT
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CITY GAS DISTRIBUTION PROJECT OF NAGALAND GEOGRAPHICAL AREA

1. GENERAL

This design basis defines the design requirements for this project in addition to the applicable specifications for:-

- Temporary cathodic protection (TCP)
- Sacrificial anode cathodic protection system
- Impressed current cathodic protection system.
- NACE requirements
- OISD requirements and
- PNGRB regulations

In case of conflict the requirements mentioned in the stringent requirements mentioned in this document **or stringent** shall prevail.

2. Temporary Cathodic protection

2.1. Type	<u>Sacrificial Magnesium anode</u>
2.2. Design life	2 Year or till commissioning of PCP whichever is later
2.3. Pipeline coating	Three Layer Polyethylene
2.4. Casing for carrier pipe	HDD is the preferred obstacle crossing method. Bare casing will be used where required.
2.5. Protective current density at 30° C	As per standard specification
2.6. Current drainage and coating resistance measurement survey	Shall be carried out
2.7. Corrosion Survey	Shall be carried out
2.8. Anode material (for sacrificial CP System)	Magnesium (1.55 V)
2.9. Minimum number of anodes (TCP)	At least 1 anode must be provided for each km of pipeline even if calculations show a lower requirement.
2.10. Polarization coupons (Factory manufactured)	Shall be provided at every 10 kms and additional coupons as required as per specification for TCP
2.11. Size of exposed area of coupon	10mm x 10mm
2.12. No. & Location of coupons	To be decided during detail engineering subject to 1.7 above
2.13. No. of magnet devices for operation of magnetic reed switch	As per SOR/SOW
2.14. Electrical resistance probes	Shall be provided. Location to be decided during detail engineering.
2.15. Polarization cell	Solid state type shall be provided at every HT Line Crossings of 66 KV & Above.
2.16. Surge Diverters	Solid state type surge diverter shall be provided at every insulating joint. <i>Lightning impulse current (10/350 μs) (Iimp) 150 kA</i>

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2.17. Additional tests to evaluate the coating defects	Shall be conducted after connecting to PCP system.
2.18. Test Stations	Test stations shall be provided at an average spacing of 1 km along the pipeline ROW
2.19. Test station locations	- At places where TCP anodes are installed - Both sides of cased crossings (Road or railway) - One side of the crossing if it is not cased - All insulating joints - At location of reference cells, surge diverters, polarization coupons, polarization cells, ER Probes - Both sides of canal crossings of width >50 m - Both sides of major river crossings - At EHV/ HV AC/ HV DC overhead line crossings and where these overhead lines are in parallel. - Near DC networks or grounding systems and HV DC grounding systems - Where interference problems are suspected - At crossings of pipelines and other structures - At SV/IP/DT/RT stations - At any other location considered necessary by the owner/consultant.
2.20. Cable type	High conductivity, annealed Tinned copper conductor, 650/1100 volt grade, HMWPE insulated, aluminum backed by Mylar tape/polyester tape shielded, armoured/unarmoured and HMWPE sheathed cables shall be used.
2.21. Cable sizes	- Ref Cell 1x10mm² - Potential measurement 1x6mm² - Polarization coupon 1x6 mm² & 1x10 mm² - Current measurement 1x10mm² - Pipe bonding 25mm² - Cathode connection 35 mm² - Anode Header connection 35 mm² - Surge diverter 25 mm² - Anode connection (HT Crossing) 25 mm² - Anode connection Cased crossing 10 mm² - Anode connection TCP 06 mm²
2.22. Bonding with foreign pipelines	Will be done.

NOTE:

Withing 60 days of lowering each continuous segment of pipe it should be protected at a minimum -850 mV potential by Mg anodes as part of the TCP. Where soil

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resistivity is 150 ohm.M or more, achievement of -850 mV potential level should not be mandatory. However minimum acceptable shift of potential at such locations (where soil resistivity is 150 ohm.M or more) shall be decided by the owner/consultant, on a case to case basis.

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3. Additional requirements:

- a) For protection of the carrier pipe inside casing pipe, if any, zinc ribbon anode shall be used with below mentioned installation method after consultation with PMC/owner:
 - Zinc ribbon anodes to be installed for protection of carrier pipe inside the casing pipe along with Bentonite filling at the annular space between casing and carrier. Discrete Mg anode (quantity as required to achieve - 850mV potential level), shall be connected to casing pipe at the cased crossings in case casing and carrier pipe is shorted (i.e become in mechanical contact with each other) and the short is not cleared after filling of Bentonite.
- b) The pipeline shall be grounded through polarization cell with Zinc galvanic anode/zinc ribbon anode or braided copper mitigator, wherever the pipeline is either crossing or running in parallel with overhead EHV/ HV transmission lines of voltage grade 66 KV and above.
- c) Current measurement test station needs to be installed at all the intermediate CP Station for measurement of the upstream and downstream pipeline current as well as coating resistance.
- d) In case anode ground bed for foreign pipeline is existing within 100m of the proposed pipeline ROW and cause interference to proposed pipeline, CP CONTRACTOR need to relocate the anode bed with the consent of the OWNER of the foreign pipeline without any extra cost to HOGPL.
- e) Necessary measures shall be adopted to mitigate the stray current interference due to crossings of high tension line, electrified railway track, existing pipeline in the close vicinity etc. by providing sacrificial anodes, grounding cells, diodes etc.
- f) Surge diverter across insulation joints shall be solid state type. Unprotected side of Surge diverter shall be grounded with GI Earth Electrode and resistance of Earth electrode should be maintained less than 2 Ohms.

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4. Codes and Standards:

1. NACE SP0169	Control Of External Corrosion On Underground Or Submerged Metallic Piping Systems
2. NACE 10A190	Measurement Techniques Related To Criteria For Cathodic Protection of Underground Or Submerged Steel Piping Systems
3. NACE SP0177-2014	Mitigation Of Alternating Current And Lightning Effects On Metallic Structures And Corrosion Control Systems
4. NACE SP0286-2007	Electrical Isolation Of Cathodically Protected Pipelines
5. NACE Pub 54276	CP Monitoring For Buried Pipelines
6. NACE SP0572	Standard Recommended Practice - Design, Installation, Operation, And Maintenance Of Impressed Current Deep Anode Beds
7. IS 8062:2006	Code Of Practice For Cathodic Protection Of Buried Pipelines/Structure For Transportation Of Oil, Natural Gas And Liquids
8. BS 7361-1:1991	Cathodic Protection. Code Of Practice For Land And Marine Applications
9. VDE 0150	Protection Against Corrosion Due To Stray Currents Of D.C. Installation
10.BIS 7098 Part I	Cross-linked Polyethylene Insulated Thermoplastic Sheathed Cables For Working Voltages Up to And Including 1100 Volts
11.IS 1554-1	PVC Insulated (Heavy Duty) Electric Cables, Part 1: For Working Voltages Up To And Including 1 100 V
12.NACE Standard SP0207	Performing Close-Interval Potential Surveys and DC Surface Potential Gradient Surveys on Buried or Submerged Metallic Pipelines
13.IS 8062	Code of Practice for Cathodic Protection of Buried Pipeline/ Structure for Transportation of Natural Gas, Oil and Liquids
14.IS 1554, Part I	PVC Insulated (Heavy Duty) Electric Cables: For Working Voltages up to and Including 1100V
15.IS/ IEC: 60079	Electrical Apparatus for Explosive Gas Atmosphere
16.IS/ IEC: 60529	Classification of Degree of Protection Provided by Enclosures



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TCP SCOPE OF WORK

TOTAL SHEETS

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CP

SOW

4002

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CITY GAS DISTRIBUTION PROJECT OF NAGALAND GA

TCP SCOPE OF WORK

FOR

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CITY GAS DISTRIBUTION PROJECT OF NAGALAND GEOGRAPHICAL AREA

ABBREVIATION

PNGRB	Petroleum and Natural Gas Regulatory Board
OISD	Oil Industry Safety Directorate
CEA	Central Electricity Authority
SEA	State Electricity Authority
BS	British Standards
ICCP	Impressed Current Cathodic Protection
TCP	Temporary Cathodic Protection
MEDB	Main Electrical Distribution Board
HDD	Horizontal directional drilling
MLV	Main Line valve
CPPSM	Cathodic Protection Power Supply Module
3LPE	3-Layer Polyethylene
NACE	National Association of Corrosion Engineers
ASTM	American Society for Testing and Materials
CIPL	Close Interval Potential Logging
CPTRU	Cathodic Protection Transformer Unit
DCVG	Direct Current Voltage Gradient
IJ	Insulation Joint

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CITY GAS DISTRIBUTION PROJECT OF NAGALAND GEOGRAPHICAL AREA

1.0 SCOPE OF WORK

Corrosion survey, design, detail engineering, fabrication, supply, installation, testing and commissioning of the temporary cathodic protection system using Mg galvanic anodes to protect the external surface of 3LPE coated pipeline in Nagaland GA against corrosion for design life of minimum 2 years.

GA	Dia(inch)	Length(in KM)
NAGALAND GA	12	1.50
	8	10.22
	6"	21.45

Maintaining and keeping of PSP value as specified and monitoring at monthly basis of PSP voltage & AC voltage of the temporary cathodic protection system till the handover of the pipeline to the owner as per Annexure-A. All work shall be carried out conforming to the Scope of work, Design Basis, Data Sheets, national & international standard & as per standard specification No.- VCS-SS-EL-4018A for temporary Cathodic Protection system. Scope shall also include but not limited to the following for completion of jobs:-

- (i) Measurement of soil resistivity along the ROW (At 1000mtr. Interval) & collection of soil & water samples along ROW at depth of 1M, 2M & 3M at every 10km interval (Min 03 sample at each location) for its chemical & microbial analysis as per specification for corrosion survey **VCS-SS-EL-4017 & NACE Standard TM0106-2006** for detection of SRB, ARB, TDS, pH, Rx, Moisture & total dissolved H₂S etc.

Collection of additional data elements along the ROW of pipeline related to AC, DC interference including details of all like foreign pipeline, overhead power transmission lines crossings & parallelism, power cables, river crossing, road crossing locations, railway traction (electrified/non-electrified), Substations (HVAC/HVDC), existing CP facilities (such as transformer rectifiers, anode ground beds, test facilities etc.) along with GPS coordinates. Site survey report submitted in design document shall have all these details included.

- (ii) Design, Detailed Engineering, Preparation of Design Document, Preparation of Test station schedule & Bill of Material as per the corrosion survey & Chemical analysis of Soil/Water samples for Temporary Cathodic Protection system. Catalogues, vendor drawings, installation procedures, operation and maintenance manuals etc. for all equipment/materials shall be the part of

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design document.

- (iii) Total number of anode shall be calculated as per total anode weight requirement & total protection current required. Localized soil resistivity at 1 Mtr. depth shall be considered for calculation of number of Anodes. However, minimum one anode shall be installed at every 1 KM with test station.
- (iv) Supply, installation, testing & commissioning of Mg (7.6 Kg) galvanic anodes with backfill as per the standard specification- **VCS-SS-EL-4018A**. The weight of the Mg Anode & the total nos. of anodes shall be calculated as per the corrosion survey, soil chemical analysis, total weight and current requirement of the pipeline section.
- (v) Supply, Installation, Testing & commissioning of Test stations (Big Size & Normal Size) weatherproof (IP-55) including cement concrete foundation as per specification & enclosed drawings. Selection of TLP size will be as per the nos. of cables terminating at the station. TLP shall be sealed at both ends by means of foam sealing/solid sealing. Termination plate inside the TLP should have high insulation level (FRP or higher grade) to avoid drainage of CP current due to insulation leakage. All the test-stations and junction boxes shall be provided with shrouded Allen screws to avoid vandalism. Connection scheme shall be permanently fixed inside the TLP.
- (vi) Cable laying and Cable to pipe connection by Thermit welding for 35 mm², 25 mm², 10 mm², 6 mm² copper cable including excavation and exposing piping, recoating with epoxy, testing etc. Colour code identification for the various CP System cables used in the system shall be included in design document.
- (vii) Contractor to note that the exact cable routing and exact cable quantities shall be decided at site based on actual site conditions. Contractor shall ensure that there is no surplus or shortage of cables at site and procure cables accordingly.
- (viii) GI Earthing of aboveground cathodically unprotected pipeline at all locations. The earth electrode shall be per IS 3043. Earth electrode resistance shall be limited to 2Ω max.
- (ix) Supply, installation, testing & commissioning of one set of Explosion proof type spark gap arrester (10/350μS rating shall be 150 kA) across each insulating joint as per P&ID/specification. Surge diverter cable needs to be terminated without any joints across the IJ.
- (x) For CP at cased crossings, **Bare Casing shall be considered** as far as

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possible. At cased crossing, if the casing pipe is coated then it shall be protected additionally by (Independent from carrier pipe protection system) sacrificial Zn anodes installation. Carrier pipeline at cased crossings shall be protected by providing Sacrificial Ribbon anodes. The TCP contractor shall check and confirm the isolation between carrier pipe and casing after installation and before welding the section with mainline. Any re-work requires for establishing isolation shall be in the scope of pipeline Contractor without any extra time and cost to OWNER.

- (xi) Supply, installation, testing & commissioning of solid state polarization cells and Grounding through zinc anodes at HT line crossings/ running parallel (66 KV and above). Rating of polarization cell shall be 3.7 KA @ 30 Cycle & number of 20 kg net weight zinc anode shall not be less than two. The resistance of grounding shall be limited to 2Ω max.

If any proposed additional line of voltage rating 66kV & above is envisaged during construction, the same shall also be considered in the design document. Contractor shall supply polarization cell along with necessary grounding system for the same.

If it is observed during the monthly monitoring that the source of the AC interference is due to the power lines less than 66kV, Contractor shall provide grounding of the pipeline through SSD to mitigate AC interference on the pipeline.

- (xii) Supply, installation, testing & commissioning of external electrical resistance Probe along the pipeline at marshy/vulnerable locations to monitor the external corrosion activity on the pipeline. Location of external ER probe shall be decided during detail engineering.

- (xiii) Supply, installation, testing & commissioning of Polarization coupons having total exposed area of 10mm x 10mm on one side. The coupon shall be installed along the pipeline at additional vulnerable locations (River crossings, Marshy locations, Interference prone area, stray current source locations, foreign pipeline crossings/parallel). Location of external Polarization coupons & magnetic reed switch shall be decided during detail engineering in consultation with HOGPL/VCS.

Exposed side of polarization coupon shall be opposite to pipe & polarization coupon shall not be installed between TLP & Pipeline.

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The works related to collection of approximately 2-5 m of pipeline material (In pieces of 300 to 1000 mm length) for fabrication of polarization coupons is in the scope of the Contractor and shall be supplied by the Owner.

- (xiv) Bonding in between pipelines running parallel or crossing as required including taking of permission from the owner of the foreign pipeline (Permission shall be taken by the Pipeline Owner and any fee required for the same shall be paid by the Owner, however contractor shall assist in all respect to get such permissions from foreign pipeline owner).
- (xv) PSP Monitoring on monthly basis of the TCP system till commissioning of the permanent cathodic protection system including the coupon OFF PSP. Till the construction of the pipeline is in progress and or till handover of the pipeline system to the owner.
- (xvi) All civil/ structural & other miscellaneous works related to TCP system including supply of bricks, cement etc. required for completion of the system.
- (xvii) Coating Integrity test of HDD section of the pipeline shall be conducted immediately after the completion of the HDD of each HDD section by separate temporary power source and anode bed. Bidder shall submit the procedure as per the NACE requirements for approval along with the design document.
- (xviii) Temporary CP system shall be installed immediately of the any lowered section but not later than 15 days from the time of lowering of pipeline segments. To achieve this the TCP design document must be submitted and approved before the construction of the pipeline begins.
- (xix) All civil work related to the CP works like Preparation of buried cable trenches, excavation, back filling, compacting, providing of brick protection by second-class bricks, spreading of fine river sand including supply of bricks, cements steel etc. The job includes repairing of all civil works damaged during installation of electrical and other facilities.
- (xx) The scope of work under this contract shall be inclusive of breaking of walls and floors, and chipping of concrete foundations necessary for the installation of equipment, materials. Minor modifications wherever required to be done in the owner free supplied equipment or devices to enable cable entry, termination, etc.
- (xxi) Supply and installation of all other accessories not specifically mentioned herein but necessary for completion of job.

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(xxii) Co-ordination with other Contractors/Pipeline contractor.

2.0 SCOPE OF SUPPLY

2.1 **Owner's scope of Supply: NIL**

2.2 **Bidder's scope of Supply:**

Supply, testing, Packing, Forwarding, Delivery, Installation and commissioning of all items required to accomplish all jobs/activities listed under clause "scope of work" are included in the scope of the contractor. **No equipment will be free issued by the owner.**

(i) All commissioning & start up spares are in bidder's scope (Included in this package). Any commissioning & startup spare consumed during the startup & commissioning is included in the supply of this package, for which no extra payment is made.

(ii) All The necessary permissions required for the bonding, interference mitigation (from SEB's, water works departments/ boards, railways & other pipeline owners) are in the scope of contractor and shall be obtained before taking mitigation measures.

3.0 INSPECTION AND TESTING

All the equipment supplied by the contractor shall be inspected by the approved inspection agency (TPI) at the manufacturer's works prior to dispatch. Contractor shall furnish necessary certificates, test reports etc. for Review /Approval to Owner/ Inspection agency. Contractor to get DCN prior to supply of equipment/ material from VCS. The TPI shall be from approved TPI list attached with the tender. TPI shall be arranged by the CP contractor for the testing of the material/equipment at the vendor works.

The issue of DCN for any equipment or component thereof does not absolve the contractor from his contractual obligations towards subsequent satisfactory performance of the equipment at site. If any equipment be found defective, in whole or part thereof after receipt at site or during erection/commissioning and testing, the same shall be Rectified/Changed by contractor free of cost.

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4.0 TESTING & COMMISSIONING

The successful tenderer shall provide adequate supervisory/ skilled personnel and all tools and tackles, testing equipment and instruments required for complete checking of installations and testing and commissioning of all equipment and accessories. The testing and commissioning of all equipment is in the scope of bidder & shall be carried out in accordance with the latest edition of relevant Indian / International Standard and NACE standards.

Any defects noticed during the testing and commissioning relating to the equipment supplied and work carried out by the Contractor, will be rectified by the contractor at his own cost. Any work not conforming to the execution drawings, specifications or codes shall be rejected forthwith and the contractor shall carry out the rectification at his own cost.

5.0 DRAWINGS, STANDARD SPECIFICATION AND INSTALLATION STANDARDS

5.1 The equipment/ materials to be supplied and their installation by the contractor shall conform to the requirements of the applicable standard specifications. Also of various material/ equipment shall also conform to the standard specification.

Construction shall be as per drawings/ specifications issued/ approved by the Owner/ Consultant during the course of execution of work.

A)	SPECIFICATION	
	Specification for TCP system	VCS-SS-EL-4018A
	Specification for Corrosion Survey	VCS-SS-EL-4017
B)	DATASHEETS & QAP	
	Quality Assurance Plan	VCS/QAP/TCP/001
C)	STANDARD DRAWINGS	
1.0	Prepacked Zinc Anode	VCS-STD-EL-4511
2.0	Prepacked Mg Anode	VCS-STD-EL-4510
3.0	Details of Test Station for TCP	VCS-STD-EL-4510
4.0	Test Station Connection Schemes	VCS-STD-EL-4514
5.0	Galvanic Anode Installation	VCS-STD-EL-4502
6.0	Zinc Ribbon Anode for Cased Crossings with Coated Casings	VCS-STD-EL-4506
7.0	Pipeline Grounding Through Polarisation Cell and Galvanic Anodes	VCS-STD-EL-4507
8.0	Details of Zinc Grounding Cell	VCS-STD-EL-4508

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OF
NAGALAND GEOGRAPHICAL AREA**

9.0	Permanent Copper – Copper Sulphate Reference Cell & Installation Details	VCS-STD-EL-4509
10.0	Details of thermit weld for cable to pipe joint	VCS-STD-EL-4504

Note:

Pipeline Schematic Route Diagram attached with tender is indicative of the nature of work and issued for tendering purposes only. The bidders, however, shall visit the site before bidding for proper information of site conditions.

6.0 In case of an irreconcilable conflict between Indian or other applicable standards, general conditions of contract, special conditions of contract, specifications, drawings or schedule of rates, the following shall prevail to the extent of such irreconcilable conflict in order of precedence:

1. Contract Agreement
2. Detailed Letter of Acceptance along with Statement of Agreed Variations.
3. Fax / Letter of Intent / Fax of Acceptance.
4. Schedule of Rates as enclosures to Letter of Acceptance.
5. Job / Particular Specifications.
6. Drawings
7. Technical / Material Specifications.
8. Special Conditions of Contract.
9. Instruction to Bidders
10. General Conditions of Contract.
11. Indian Standards
12. Other applicable Standards

- 6.1 It will be the contractor's responsibility to bring to the notice of engineer-in-charge any irreconcilable conflict in the contract documents before starting the work (s) or making the supply with reference which the conflict exists.
- 6.2 In the absence of any specifications covering any material, design of work (s) the same shall be performed / supplies / executed in accordance with standard engineering practice as per the instructions / directions of the engineer-in-charge, which will be binding on the contractor.
- 6.3 In case of any conflict in technical requirements among PJS, TS, SCC, SOR etc. of tender document and international / national codes / standards, more stringent requirement shall govern or as per the decision of EIC.

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CITY GAS DISTRIBUTION PROJECT OF NAGALAND GEOGRAPHICAL AREA

Annexure-A

Format for TCP system Commissioning

Sr. No	TS No	Chainage	TS Type	Natural PSP	Instant PSP	Polarised PSP (24 Hrs.)	Anode Voltage (V)	Anode Current (mA)	AC Voltage (V)	Other Readings (If Any)	Remarks

Format for Monthly Monitoring Report of TCP system

Sr. No	TS No	Chainage	TS Type	PSP (-) Voltage			Anode Voltage (V)	Anode current (mA)	AC Voltage (mV)	Other Readings (If Any)	Remarks
				Carrier		Casing (If Protected)					
				Without Bonding	Bonding						

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ENERGISING QUALITY

VCS QUALITY SERVICES PVT. LTD.

**STANDARD SPECIFICATION
FOR
SACRIFICIAL ANODE CATHODIC PROTECTION SYSTEM FOR
PIPELINES**

VCS – SS – EL – 018A

						
00	06.11.2017	ISSUED AS STANDARD	MG	RD	AD	SK
Rev. No	Date	Purpose	Prepared By	Checked By	Approved By	Approved By



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ANNEXURE-I : TCP MATERIALS DATASHEET



ABBREVIATION

LPE	Three Layer Polyethylene
AC	Alternating Current
Ag / AgCl	Silver / Silver chloride reference electrode
CSE/Cu/CuSO ₄	Copper Sulphate Electrode
DC	Direct Current
HDD	Horizontal Directional Drilling
HT	High Tension Line
ICCP	Impressed current Cathodic Protection
MIJ	Monolithic Insulation Joint
PCP	Permanent Cathodic Protection
PSP	Pipe to Soil Potential
ROU	Right of Use
ROW	Right of Way
SV Station	Sectionalized Valve Station
TCP	Temporary Cathodic Protection
TLP	Test Lead Point



1.0 SCOPE

This specification defines the requirements of design, engineering, installation, testing and commissioning of sacrificial anode cathodic protection system (SACP) for external surface of city gas distribution buried 3LPE coated pipelines with associated high build liquid epoxy valves/fitting. The SACP system shall be used for protecting city gas distribution pipelines during the TCP construction phase.

This specification defines the basic guidelines to develop a suitable sacrificial cathodic protection system for city gas distribution pipelines.

All data required in this regard shall be taken into consideration to develop an acceptable design and for proper engineering of the system.

Compliance with this specification and/or approval of any of the contractor's documents shall in no case relieve the contractor of his contractual obligations.

2.0 LATEST CODES & STANDARDS

ISO 15589-1: 2015	Petroleum and natural gas industries-CP of pipe line transportation systems- on land pipelines
NACE SP-0169-2013	Recommended practice control of external corrosion on underground or submerged metallic piping system
IS 8062 part-2: 2006	Code of Practice for Cathodic Protection of Steel Structures, Part II: Underground Pipelines
OISD-RP-226- 2013	Natural gas transmission pipelines and city gas distribution networks
NACE SP-0286-2007	Recommended Practice- the electrical isolation of cathodically protected pipe lines
NACE SP-0200-2014	Cathodic Protection for metallic cased crossings
BS EN 50162:2004	Protection against corrosion by stray current from direct current systems
BS EN 15280:2013	Evaluation of AC corrosion likelihood of buried pipelines applicable to cathodically protected pipelines
NACE SP-0177-2014	Recommended Practice- Mitigation of AC and lighting effects on metallic structures and corrosion control systems
NACE-SP-21424-2018	Alternating Current Corrosion on Cathodically Protected Pipelines: Risk Assessment, Mitigation, and Monitoring
NACE SP0104-2014	The Use of Coupons for Cathodic Protection Monitoring Applications
NACE TM0497-2012	Measurement techniques related to criteria for cathodic protection on submerged metallic piping system
ASTM G57-2012	Field measurement of soil resistivity using Wenner four pin electrode method
ASTM B418-2016	Cast and Wrought Galvanic Zinc Anodes
ASTM B843-2018	Magnesium Alloy anodes for cathodic protection
API 1102	Recommended practice for Steel Pipelines Crossing Railroads and Highways
IS 1554 PART-1	PVC Insulated heavy duty cables
IS 3043: 2007	Code of practice for Earthing
ISO 13847:2013	Petroleum and natural gas industries — Pipeline transportation systems — Welding of pipelines



OISD RP-113-2013	Classification of area for electrical installations at hydrocarbon processing and handling facilities
OISD-RP-188-2019	Corrosion monitoring of offshore and onshore pipelines
PNGRB-G.S.R. Infra/ T4S/ P&PPPL/01 /2014	Technical Standards and Specifications including Safety Standards for Petroleum and Petroleum Products Pipelines
PESO Petroleum rules 2002	CHAPTER III: PART V- Transport by Pipelines

The equipment shall also confirm to the provisions of Indian Electricity rules and other statutory regulations currently in force in the country.

In case of any contradiction between various referred standards/ specifications /data sheet and statutory regulations the following order of priority shall govern:

- a. Statutory regulations
- b. Material datasheet
- c. Particular specification (if applicable)
- d. This specification (standard specification)
- e. Codes and standards

3.0 DESIGN

The design and engineering of the SACP system shall be carried out by the contractor as per procedures and design parameters specified below:

3.1 SYSTEM IMPLEMENTATION

- a. Corrosion survey of the ROW as per VCS tender specification
- b. Design basis of SACP system
- c. Design and engineering package of SACP (Including calculation for SACP system)
- d. Field testing and commissioning procedure
- e. As built documentation

3.2 CORROSION SURVEY

- 3.2.1 The details of corrosion survey including soil resistivity data along ROW and other data required for CP design if available with the Owner shall be included as part of project specification. However, verification of its veracity and adequacy shall be the entire responsibility of the contractor. Contractor shall also carry out soil resistivity survey at sacrificial anode ground bed locations for proper design of ground. Wenner's 4-pin method or approved equal shall be used for such measurements. Survey instruments shall have maximum AC and DC ground current rejection feature.

Soil/water samples shall be collected along the ROU for analysis. Samples shall be collected on an average at one location for every 05 km along ROU with minimum at two locations. Exact locations shall be decided at site depending on the type of soil, soil resistivity and in consultation with OWNER or his representative. At each location the soil samples shall be collected at 1 M, 2 M depth and at expected depth of pipeline if it is more than 2 m at the location.



- 3.2.2 Care shall be taken to ensure that the resistivity observations are not influenced by the presence of foreign pipelines/structures, and earth currents in the vicinity of HT lines and installations using earth return in their power system etc.

3.3 ADDITIONAL DATA TO BE COLLECTED

The following data shall be collected to generate design data for evaluation of interaction/interference possibilities due to presence of other services in ROW/in vicinity. Owner shall provide assistance for liaison work to the extent possible.

- Route and types of foreign service/pipeline in and around or crossing the right of way (including those existing and those which are likely to come up during contract execution)
- Diameter, wall thickness, pressure, soil-cover, and type of external coating, type of cathodic protection system provided, if any and year of laying/commissioning in case of foreign pipelines.
- Details of the existing cathodic protection systems protecting the services i.e., type of protection, location, rating of anode beds, test station locations and their connection schemes. Present output current and voltage readings of the CP power supply units.
- Remedial measures existing on foreign pipelines/services to prevent interaction.
- Graphical representation of existing structure/ pipe to soil potential records.
- Possibility of integration/isolation of CP systems, which may involve negotiations with owners of other services
- Information on existing and proposed DC/AC power sources and systems using earth return path such as HVDC substations/ earthing stations, fabrication yards with electric welding etc. in the vicinity of the entire pipeline route.
- Crossing and parallel running of electrified and non-electrified traction (along with information regarding operating voltage; AC/DC type etc.) as well as abandoned tracks near ROW having electrical continuity with the tracks in use.
- Crossing or parallel running of any existing or proposed 11 kV and above AC/DC overhead power lines along with details of voltage, AC/DC type etc.
- Voltage rating phases sheathing details of underground power cables running along ROW or in its vicinity.
- Any other relevant information that may be needed in designing and implementing proper protection.
- Contractor shall conduct necessary potential gradient surveys for any existing anode ground beds that may interfere with the CP system of the pipelines covered under this project.

3.4 REPORT

- On completion of all field work, a report incorporating all the results generated from surveys and details of additional data, collected shall be prepared.



- The report shall also contain detailed interpretation of:
 - Survey results and resistivity data
 - List of Foreign pipeline crossings and other DC interference prone areas
 - List of HT line ($\geq 66\text{kV}$) crossings and other AC interference prone areas
 - Various drawings prepared in connection with the above work.
 - Soil resistivity values plotted on semi-log graph sheets.

3.5 CATHODIC PROTECTION DESIGN PARAMETERS

Unless otherwise specified, following parameters shall be used for design of cathodic protection system.

Where the cathodic protection system is specified for temporary protection, those parts of sacrificial anode cathodic protection system, which will be integrated, with the permanent CP system shall be designed based on permanent CP parameters.

3.5.1 DESIGN LIFE

- TCP shall be designed for 2 years

3.5.2 PROTECTION CURRENT DENSITY

Pipelines directly buried and having three-layer polyethylene (3LPE) coating

Pipeline surrounding	Temporary CP ($\mu\text{ A/m}^2$)
Soil resistivity more than 100 ohm-m	10
Soil resistivity 10 ohm-m to 100 ohm-m	25
Soil resistivity less than 10 ohm-m	50

Pipelines laid through HDD and having three-layer polyethylene (3LPE) coating

Pipeline surrounding	Temporary CP ($\mu\text{ A/m}^2$)
Soil resistivity for HDD	50

Note:

- I. Safety factor for current density: 1.3
- II. Anode utilization factor: 0.85
- III. Pipeline Natural Potential: (-) 0.45 V w.r.t CSE
- IV. Steel Resistivity: 2.2×10^{-7} ohm-M

The above current density values for temporary CP system are applicable for CP system design life.



Actual current density to be adopted shall be decided based upon soil and other environmental conditions, current drainage survey data (where included in Contractor's scope) at HDD locations, proximity of foreign pipe lines/structures and other interference areas affecting the installation. Where considered necessary for satisfactory protection of pipeline the current density shall be suitably increased by contractor.

The pipe protection current density indicated as above shall be applicable where the temperature of the fluid transported by the pipeline/ the surface temperature of the buried portion of the pipeline does not exceed 30° C, the protection current density shall be increased suitably in consultation with the Owner/Company.

3.5.3 CATHODIC PROTECTION DESIGN CRITERIA

Cathodic protection system shall be designed to meet the following criteria:

The pipe to soil potential measurements shall be between (-) 0.95 V (ON) and (-) 1.5 V (ON) for polyethylene coated pipe lines with respect to a copper/copper sulphate reference electrode.

At locations of polarization coupons, the coupon to soil potential measurement shall be between -0.850 V (Instant OFF) to -1.18 V (Instant OFF) with respect to stable permanent copper / copper sulfate reference electrode installed close to the coupon.

A positive potential swing of 50 milli volts or more shall be considered sufficient to indicate the presence of an interaction/interference situation requiring investigation and incorporation of mitigation measures by the Contractor.

4.0 MATERIAL

The system shall include the following major equipment/sub-systems unless otherwise specified in project specifications.

- a. Sacrificial anodes (Magnesium/Zinc, as per soil resistivity)
- b. Sacrificial (Mg) anodes only at coated cased crossings
- c. Sacrificial (Mg) anodes at HDD locations
- d. Test stations
- e. Surge diverter at MIJ and zinc grounding anode at unprotected side of MIJ
- f. DC decoupling device with earthing system
- g. Interconnecting cables
- h. Cables to pipe connections
- i. Polarization coupons for measurement of "Instant OFF" potentials with permanent reference cell

All equipment shall be new and procured from approved manufacturers. Equipment offered shall be field proven. Equipment requiring specialized maintenance or operation shall be avoided as far as possible. Prototype equipment shall not be accepted.



Equipment shall conform to the relevant specifications enclosed with the tender document. All equipment including test stations shall be located in safe non-hazardous areas.

Where it is essential to install the equipment in hazardous area, such equipment shall be flame-proof type and shall meet the requirement of IS: 2148 or equivalent international Standard and shall be suitable for gas group IIB, temperature class T3 (200°C). Indigenous equipment shall be certified by CMRI or any other recognized testing body and shall be approved by the concerned statutory authority. All flameproof equipment shall carry the BIS license marking as per the requirement of statutory authorities. All imported equipment for hazardous area may be tested and certified by an independent certifying agency of country of equipment origin and shall be approved by the concerned statutory authority in India.

4.1 SACRIFICIAL ANODE GROUND BEDS

- 4.1.1 Along ROW where soil resistivity predominantly remains low, ranges from 0-10 ohm-m and pH value is within 9, zinc anodes shall be provided. Anodes of type I as per ASTM-B 418 standard shall be used for seawater, brackish water or saline electrolyte application and anode of type II as per ASTM-B 418 standard shall be used for fresh water, back fill and soil applications.
- 4.1.2 Along ROW where soil resistivity is predominantly in the range of 10 ohm-m to 30 ohm-m, low potential (1.55V) magnesium anodes, as per ASTM-B 843 shall be provided.
- 4.1.3 Along ROW where soil resistivity is predominantly in the range of 30 ohm-m to 50 ohm-m high potential (1.75V) magnesium anodes, as per ASTM-B 843 shall be provided.
- 4.1.4 At high resistivity area where resistivity is of the order of 50 ohm-m and above magnesium ribbon anodes may be provided.
- 4.1.5 In case the soil resistivity varies from 5 ohm-m to 50 ohm-m, then low potential (-1.55V_{CSE}) magnesium anode shall be used for the entire length of the pipeline.
- 4.1.6 Average separation distance between each consecutive sacrificial anode location along the pipeline route for temporary cathodic protection shall be 1 km.
- 4.1.7 The minimum weight of the sacrificial anode for temporary cathodic protection for design life of 2 years shall be min. 2.5kg net pre-packed or whichever is higher, as per detailed design calculations.
- 4.1.8 Suitability of the selected sacrificial anodes for the soil conditions with particular attention to carbonates, bicarbonates, phosphates and nitrates, shall be checked for proper operation by the Contractor.
- 4.1.9 The anodes shall be laid in proper type of back fill consisting of a 20 % bentonite, 75 % gypsum and 5 % of sodium sulfate to improve the local conductivity around the anodes, such that the effect of soil is minimum on the anode effectiveness and life.
- 4.1.10 The leads of all the anodes shall be brought up to the test station and shall be terminated individually.



- 4.1.11 The number of anodes at each ground bed shall be sufficient for providing the specified pipe protection current density taking into consideration the ground bed resistance, cable resistance, etc. The number of anodes for ground bed, spacing of ground beds based on the applicable soil resistivity, size of pipeline, type of coating for the pipeline shall be chosen from the table after necessary verification by the CP contractor.
- 4.1.12 Any deficiency in the protection system if noticed during commissioning or during monitoring shall be corrected by the CP contractor by suitably augmenting the system with additional anodes without any cost / schedule implications.
- 4.1.13 For the portion of the pipeline for which the CP system has been specified based on the permanent CP system parameters – cased crossing, HDD, HT line locations, the contractor shall ascertain the requirement of the cathodic protection current density indicated above, and the anodes installed at these locations, shall be suitable for PCP system design life.

4.2 TEST STATIONS

- 4.2.1 Test stations shall be provided along the pipeline ROW for monitoring the performance of the cathodic protection system at the following locations. Test stations shall be provided at additional locations, if required, so that distance between any two adjacent test stations does not exceed 1000 meters in inhabited areas and 2000 meters in uninhabited areas like forest/deserts.
- At the location of anode ground beds
 - At one sides of metallised road crossings
 - At all insulating joints
 - At tap-off station
 - At HT ($\geq 66\text{kV}$) AC/DC overhead line crossings and location of HT line parallelism within 50M of the pipeline.
 - At vulnerable location with drastic change in soil resistivity.
 - At both sides of major river crossings and HDD.
 - At location of DC decoupler
 - In the vicinity of DC networks or grounding system where interference problems are suspected.
 - At crossings of other pipelines/structures.
 - At both sides of cased crossings.
 - At any other locations considered vulnerable/locations where AC/DC interference is expected
 - At railway line crossings and at selected location along railway lines running parallel to the pipeline.
 - At the location of Sectionalizing Valve (SV) Station.
 - At any other locations considered necessary by owner/owner's representative



4.2.2 The types of TLP to be used shall be as follow:

- i. Type A- Potential measurement
- ii. Type B- Current measurement
- iii. Type C- At the locations of cased crossing- Bare casing
- iv. Type D- At the locations of cased crossing – coated casing
- v. Type E- At locations of foreign pipeline crossings
- vi. Type F- At MIJ locations
- vii. Type H- At HV locations and SV stations
- viii. Type A+HDD- At HDD crossing locations
- ix. Type A + PC- At locations of polarization coupon installations

4.2.3 Test stations used for sacrificial anodes shall have shunt for measurement of anode current, provision for resistance insertion to limit the anode current output and anode disconnecting link.

4.2.4 Test stations for bonding shall be provided with shunt and resistor as a means to monitor and control current flow between the pipeline and foreign pipelines or structures that may exist in common ROW-

4.2.5 Test station with current measuring facility shall be provided at interference prone areas, on both sides of major river crossings, HDD locations, near marshy areas and minimum one for every 10 km max. along the pipeline.

4.2.6 The test stations shall be installed with the face of the test station facing the pipeline. The nameplate of test stations shall carry the following minimum information

- a. Chainage in km.
- b. Test station connection scheme
- c. Distance from pipeline in meters.
- d. Direction of product flow.

4.2.7 Terminals and different schemes of wiring shall be provided as per the test station connection scheme. Minimum twenty percent spare terminals shall be provided in each test.

4.2.8 Minimum two cables shall be provided from the pipeline at any test station

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

4.3 SURGE DIVERTER & GROUNDING OF PIPELINE AT UNPROTECTED SIDE OF MIJ

Explosion proof type spark gap surge diverter shall be connected across each monolithic insulating joint (MIJ) to protect it from high voltage surges.

The surge diverter shall be rated for discharging lightning current (10/350 μ s) & AC fault currents picked by the pipeline across the MIJ without causing excessive voltage build up which would damage the MIJ or cause an electric arc or flashover across the MIJ.



Surge diverters shall be directly mounted on MIJ to prevent the breakdown of MIJ which is 5 kV. The length of the surge diverter leads connecting across the MIJ shall be suitable to connect to the MIJ cleats without any joint/copper clamp.

The above ground portion of the pipeline at the unprotected side of the MIJ shall be grounded by GI plant earthing or zinc anodes of 20 kg net weight.

4.4 GROUNDING OF PIPELINE

4.4.1 AT LOCATION OF HT TRANSMISSION LINE CROSSING (≥ 66 kV)

In TCP scope at all HT crossings (66 kV and above), H-Type TLP's shall be provided, for grounding 3LPE coated pipeline through a suitably rated DC decoupler and suitably designed grounding system.

- a) DC Decoupler:** The DC Decoupler through which the pipeline shall be grounded shall be solid state type and shall be capable of blocking DC voltages ± 2 V and provide an effective and continuous conductive path to suitably design the grounding system for AC induced voltages, lightning currents, surge currents and AC fault currents.
- b) Grounding System:** The grounding system resistance shall be less than 5 ohms to meet the following requirement of AC interference mitigation:
- AC induced voltage: < 15 V RMS AC
 - AC current density: a) < 30 A/m², if DC current density exceeds 1 A/m²
b) < 100 A/m², if DC current density is less than 1 A/m²

The AC-DC current density to be measured at coupon locations and the current densities mentioned above will be time weighted average of 24 hrs.

To achieve required grounding resistance, following type of grounding system shall be designed and installed:

Soil resistivity Range (in ohm-cm)	Type of Grounding System
< 2500 ohm-cm	Minimum two (2) nos. of zinc grounding anodes, in a chemical backfill. Each zinc grounding cell shall have net weight of 20kg.
> 2500 ohm-cm	- Zinc ribbon anode of minimum dimension 12/14 mm, with trench backfilled with chemical backfill. - Copper conductor of size 16 mm ² , with factory pre-packed adequate backfill.

Note: The length of zinc ribbon anode/copper conductor shall be decided by the contractor after having performed grounding calculations.

4.4.2 AT LOCATION OF HT TRANSMISSION LINE RUNNING PARALLEL

Where transmission lines run parallel within 50 M of either side of the pipeline, the pipeline shall be grounded at a maximum interval of 1 km, at suitable locations, where AC induced voltages are the highest. The grounding shall be done through DC decoupler using grounding system to meet the AC interference criteria as specified above under Clause 4.6.1



4.5 CP AT CASED CROSSING

- 4.5.1 Casing should be avoided as far as possible. If cased crossing is unavoidable, bare casing to be provided, with selecting higher thickness allowance as per API 1102
- 4.5.2 No sacrificial anodes (ribbon anodes) shall be used inside casing & carrier annular space.

4.6 REFERENCE CELL ACCESS POINTS

- 4.6.1 Reference cell access points shall be provided at all test station locations, at insulating joint locations, where the ground is paved, for measurement of pipe to soil potentials. A perforated 2" PVC pipe of 1.5- 2-meter length so as to reach the pipeline depth filled with native soil and buried at the location shall be provided for the purpose. The length of the PVC pipe shall be adequate to reach the native soil below the paving.

4.7 CABLES

- 4.7.1 Cables shall be with annealed high conductivity stranded copper conductor, PVC insulated, 650/1100V grade, PVC sheathed conforming to IS: 1554 Part -I. The size of the copper conductor shall be:
- For anode tail cable to test station: 10 mm² unarmored
 - From test station to pipeline: 10 mm² armored
 - For bonding, DC decoupler, grounding anodes and surge diverter: 25 mm² armored
 - For reference cells and pipeline potential measurements: 6 mm² armored

CABLE LAYING

Cables shall be laid in accordance with the layout drawings to be prepared by the Contractor. No straight through joint shall be permitted. Cable route shall be carefully measured and cables cut to required length. Minimum half meter cable slack shall be provided near anodes, pipeline and test stations to account for any settling

All cables inside station/plant area shall be laid at a depth of 0.75 M Cables outside station/plant area shall be laid at a depth of minimum 1.5 M Cables shall be laid in sand under brick cover and backfilled with normal soil. For cables laid outside the station/plant area, polyethylene warning mats shall be placed at a depth of 0.9 m. from the finished grade to mark the route

PVC pipes of proper size shall be provided for all underground cables for road crossings

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

4.8 POLARIZATION COUPON

- 4.8.1 Coupon shall have one side exposed area of 1 cm². The coupon shall be made from the material of the pipeline. Minimum one polarization coupon shall be installed every



5 kms for measurement of "Instant OFF" or polarized potential of the 3LPE coated buried pipeline, which otherwise cannot be measured in a TCP based cathodic protection system.

- 4.8.2 The location of polarization coupon TLP shall preferably be between two Types-A TLP's to check the mid-point pipeline polarization.
- 4.8.3 Cable connection of 10mm² and 6mm² shall be provided to the coupon for connecting it to the pipeline for cathodic protection and potential protection measurements respectively.
- 4.8.4 Polarization coupon TLP will not have any sacrificial anode connected.
- 4.8.5 Polarization coupon shall be provided with a permanent copper / copper sulfate reference electrode installed close to the polarization coupon.
- 4.8.6 Connection of coupon to pipeline shall be through a vacuum sealed magnetic reed switch housed inside the test station. The magnetic reed switch shall be rated to carry and break minimum 10 mA at 50 V DC.
- 4.8.7 Coupons shall be installed at bottom 1/3rd portion of the pipeline and 250 mm away from the pipe surface.
- 4.8.8 The bare area of coupon shall be placed opposite to the pipeline.
- 4.8.9 The permanent reference electrode shall be placed 150 mm from the pipeline.
- 4.8.10 Coupons shall be provided as per the requirement of NACE SP104:2014
- 4.8.11 Selection of other locations of Polarization coupons shall be decided by PMC / Engineer-In-Charge

4.9 PERMANENT REFERENCE CELLS

- 4.9.1 High purity copper-copper sulphate reference cells with proven high reliability shall be provided for stable coupon to soil potential measurement at the locations of polarization coupons.
- 4.9.2 The reference cells shall be of silver/silver chloride type in place of copper/copper sulphate cells, at marshy area locations, where water table is high and chloride ion concentration is more than 300 ppm for marshy area in saline soils high purity zinc may be considered as an alternative to silver/silver chloride.
- 4.9.3 The life of reference cells shall be minimum 10 years under burial-conditions.
- 4.9.4 The test station connection scheme inside the test station shall clearly indicate the type of reference cell (Cu CuSO₄ /Ag AgCl).

4.10 CABLE TO PIPE CONNECTIONS

- 4.10.1 All cable connections to the new pipeline shall be made by an approved exothermic process or by pin brazing. However, cable connection to charged pipelines shall be made by pin brazing. Exothermic welding shall be adopted for water pipelines. The resistance of the cable to pipe at the connection point shall not exceed 0.1 ohm.



Coating shall be repaired after connection of cable conductor to pipeline. The coating repair material shall be compatible with the original coating and shall prevent ingress of water along the cable, surface and at the interface of coating repair with the original pipe coating

5.0 INSPECTION, TESTING AND COMMISSIONING

5.1 SYSTEM TESTING AT SITE

- 5.1.1 Field tests as per the reviewed field testing and commissioning procedures prepared by the Contractor shall be carried out on the equipment/systems before these are put into service. Acceptance of the complete installation shall be contingent upon inspection and test results
- 5.1.2 Before the CP system facilities are put into operation, necessary tests shall be carried out to establish that all equipment, devices, wiring and connection have been correctly installed, connected and are in good working condition as required for the intended operation. Owner/Owner's representative may witness all tests. Intimation shall be given at least one week before commencing the tests.
- 5.1.3 All tools, equipment and instruments required for testing shall be provided by Contractor. Generally, the following minimum tests must be carried out and recorded.

a. Cables

- i. Cable No.
- ii. Voltage grade
- iii. Conductor cross section
- iv. Continuity check
- v. Voltage test
- vi. Insulation resistance values between each core & earth, between cores. All cables shall be tested by 500 V megger

b. Insulating Joint

- i. Location
- ii. Pipe to soil potential of both protected and non-protected sides of the insulating joint before and after energization of CP system

c. Surge Diverter

- i. Location/Identification number rating
- ii. Type
- iii. Explosion proof enclosure check for healthiness
- iv. Check for proper connection

d. DC Decoupler

- i. Location/Identification number
- ii. Ratings
- iii. Check for wiring



- iv. Details of grounding provided

e. Sacrificial Anode

- I. Location
- II. Type
- III. Open circuit potential

f. Permanent Reference Cell

- I. Location
- II. Type of cell
- III. Potential reading
- IV. Installed on near coupon location
- V. Distance and depth from pipeline

g. Grounding Anodes

- I. Location
- II. Type of anode
- III. Potential reading
- IV. Grounding Resistance

h. Coupon

- I. Location
- II. Exposed area of coupon
- III. Potential reading
- IV. Distance and depth from pipeline
- V. Distance of permanent reference electrode from coupon

5.2 COMMISSIONING

- 5.2.1 Natural potential of pipe to soil for the complete pipeline and casing pipeline at the locations of cased crossings shall be measured at all the test station locations, recorded prior to connecting anodes to pipe line and casing pipeline respectively.
- 5.2.2 The anode shall be connected to pipeline in the test station and the pipe to soil potential observation shall be made after allowing 48 to 72 hours for polarization.
- 5.2.3 The current output of each anode at temporary CP anode ground bed shall also be measured. In case the anode output current exceeds the rated capacity, it shall be controlled by insertion of resistance element in the anode circuit inside test station and the pipe to soil potential shall be rechecked for adequacy of protection.
- 5.2.4 At locations of polarization coupon, the coupon 'Instant OFF' potential shall be measured by switching off the reed switch.
- 5.2.5 Additional anodes shall be provided where required to achieve desired level of protection and to keep the anode output current within the rated value. In case pipe to soil potential exceeds the specified value, suitable resistance shall be inserted in the anode circuit to limit the potential.



- 5.2.6 The PSP of casing and carrier pipe shall be recorded and in case the difference in the ON PSP of casing (with anodes disconnected) and carrier pipe is less than 200 mV, the same shall be reported to the Owner/Owner's representative.
- 5.2.7 AC induced voltage measurements shall also be made on the pipeline at all TLP locations to find out continuous induction of voltage.
- 5.2.8 Potential on the protected and unprotected side of the MIJ to be recorded to confirm the integrity of MIJ.
- 5.2.9 At foreign pipeline locations, potential of both the pipelines- owners and foreign shall be recorded and the locations of foreign pipeline anode bed have to be identified to avoid any anodic interference in future. At locations of foreign pipeline crossing Zinc anodes- 20 kg can also be installed as a mitigation measure shall be sized for the design life specified for permanent CP.
- 5.2.10 Resistance of the grounding anode shall be recorded at MIJ (unprotected side) and HT line crossing (location shall be recorded it should be less than 5 ohm or as per design requirement).
- 5.2.11 After connecting all the anode ground beds to pipe line, measurement of pipe to soil potentials shall be taken at each test station to ensure conformity to protection criteria.
- 5.2.12 In case of insufficient protection as per the CP design criteria on any portion of the pipeline/ casing pipeline (at cased crossings where casing is cathodically protected) Contractor shall carry out necessary additions/modifications to the provided protection in consultation with the Owner/Owner's representative.

6.0 SYSTEM MONITORING

- 6.1** Where the CP provided is temporary, the CP system shall be monitored at all test stations once in a month for healthiness/adequacy of protection of installed TCP system. If any deficiency/interference in protection system is noticed, the same shall be rectified/augmented by providing additional anodes as required. The monitoring report shall be submitted regularly to owner for his review/information.



ANNEXURE – I **TCP MATERIALS DATASHEET**

1.1 MAGNESIUM ANODE

MAGNESIUM ANODE		
Standard	ASTM-B-843	
Composition	Weight Content (Low Potential)	Weight Content (High Potential)
Manganese	0.15 %	0.5 – 1.3%
Aluminum	5.3-6.7 % max.	0.01 % max.
Copper	0.02 % max.	0.02 % max.
Nickel	0.002% max.	0.001% max.
Iron	0.003 % max.	0.03 % max.
Zinc	2.5-3.5 %	-
Silicon	0.1% max.	0.05% max.
Other	0.30 % max. (Total)	0.30 % max. (Total)
Magnesium	Balance	
Anode Circuit Open Potential	1.55 volts (CSE)	1.75 volts (CSE)
Anode Consumption Rate	7.9 Kg/ (A. Yr) max.	7.9 Kg/ (A. Yr) max.
Anode tail cable	1C X 10 mm ² (un-armored)	
Backfill Material	Gypsum – 75% Bentonite – 20% Sodium Sulphate – 5%	
Make	As per approved vendor list	

1.2 ZINC ANODE

ZINC ANODE		
Standard	ASTM-B-418	
Composition	Weight: Type-I (Used for seawater, brackish water or saline electrolyte application)	Weight: Type-II (Used for fresh water, back fill and soil applications)
Aluminum	0.1% to 0.5% max.	0.005 % max.
Cadmium	0.025% to 0.07%	0.003 % max.
Copper	0.005 % max.	0.002 % max.
Iron	0.005 % max.	0.0014 % max.
Lead	0.006 % max.	0.003 % max.
Others	0.01% max.	-
Zinc	Balance	Balance
Anode Open Circuit Potential	(-) 1.1 Volts w.r.t CSE	(-) 1.1 Volts w.r.t CSE
Anode Consumption rate	11.24 Kg/(A. Yr) max.	11.24 Kg/ (A. Yr) max.



ZINC ANODE	
Anode tail cable	1C X 25 mm ² (armored)
Backfill Material	Gypsum –50% Bentonite – 50%
Make	As per approved vendor list

1.3 ZINC RIBBON ANODE

ZINC RIBBON ANODE	
Standard	ASTM-B-418
Dimension	12/14 mm
Length	As required
<u>Composition</u>	<u>Weight: Type-II</u> <u>(Used for fresh water, back fill and soil applications)</u>
Aluminum	0.005 % max.
Cadmium	0.003 % max.
Copper	0.002 % max.
Iron	0.0014 % max.
Lead	0.003 % max.
Others	-
Zinc	Balance
Anode Open Circuit Potential	(-) 1.1 Volts w.r.t CSE
Anode Consumption rate	11.24 Kg/ (A. Yr) max.
Anode tail cable	1C X 25 mm ² (armored)
Backfill Material	Gypsum –50% Bentonite – 50%
Remarks	Trench to be backfilled with chemical backfill
Make	As per approved vendor list

1.4 COPPER CONDUCTOR (AC MITIGATOR)

COPPER CONDUCTOR	
Diameter	38mm
Wire Size	6 AWG (16 mm ²)
Length	As required
Backfill	Special backfill with corrosion inhibitors
Fabric	Integrated woven synthetic acid resistant
Braid	Tough, porous, protective braid enhancing the abrasion and damage resistance of the fabric jacket
Make	As per approved vendor list



1.5 SURGE DIVERTER

SURGE DIVERTER	
Type	Spark gap, explosion proof Ex d IIC T6, Solid State
Lightning Impulse Current (10/350 μ s)	50 kA
Nominal Discharge Current (8/20 μ s)	100 kA
Spark Over AC Voltage (50 Hz)	≤ 1.2 kV
Power Frequency Sparkover Voltage (50 z)	≤ 0.5 kV
Power Frequency Withstand Voltage (50 z)	≤ 250 V
Degree of protection	IP-67
Make	As per approved vendor list

1.6 DC DECOUPLER/POLARIZATION CELL

DC DECOUPLER	
Type	Solid state type
Blocking DC Voltage	- 2 V DC
Leakage Current at -1.2V at 20°C	< 20 μ A
Steady state AC discharge current	45 Arms @ 50 Hz
Power fault current (40 milli sec) 2 cycle @ 50 Hz	5 kA
Power fault current (200 milli sec) 10 cycle @ 50 Hz	3.7 kA
Power fault current (600 milli sec) 30 cycle @ 50 Hz	3.7 kA
Lightning Impulse Current (10/350 μ s)	75 kA
Lightning Impulse Current (8/20 μ s)	100 kA
Max. permissible voltage DC	- 2 V
Degree of protection	IP-68
Make	As per approved vendor list



1.7 CABLES

All the cables shall be annealed high conductivity, tinned, stranded copper conductor, XLPE insulated, 1100V grade, FRLS, PVC sheathed

CABLES	
Anode Tail cable for Magnesium anodes	Conductor Size - 10 Sq mm No of Cores - Single Protection - Un armored
Potential Measurement	Conductor Size - 6 Sq mm No of Cores - Single Protection - Armored
Current Measurement cable	Conductor Size - 10 Sq mm No of Cores - Single Protection - Armored
Bonding, Surge Diverter connection Cable	Conductor Size - 25 Sq mm No of Cores - Single Protection - Armored
Make	As per approved vendor list

1.8 TEST STATION

TEST STATION	
Type	Normal Type / Big Type (to house DC Decoupler)
Dimension	As per manufacturer's detailed drawings
Terminal Plate dimension	As per manufacturer's detailed drawings
Height of the Test station from ground level	1200 mm (min.) Bakelite Sheet with 20% spares.
No. of Terminals	12 Nos. (min.) M-8 (SS)
Test station Material	Mild Steel (MS, 3 mm thick)
Protection Level	IP 55 (Weather Proof), IP - 55 Certificate shall be enclosed with MTC
Cable Entry	Bottom entry through pipe bend
Support Pipe	M.S. Pipe of 100 mm Dia (4"), SCH -40, 90° Elbow, R=5D
Length of Support Pipe	1000 mm.
Base Plate	As per manufacturer's detailed drawings
Thickness of pipe	4.5 mm.
Shutter of the test station	Hinged type with concealed lock (With castle lock key) + Two Nos. of Allen Key lock
Test station for Sacrificial anode	Shall have a shunt (0.10Ohm, 0.5 A, 50 mV) & provision for variable resistance insertion (Rating: 0-0.1 Ohm) at Mg anode locations
Name plate	As per design document (Anodized aluminum name plate, White letter with black back ground) (0.9 thick x 120 x 160mm)
Painting	The sheet steel used for fabrication of test lead point shall be thoroughly cleaned and degreased to remove mill scale, rust, grease and dirt. Fabricated structures shall be pickled and then rinsed to remove any trace of acid. The under surfaces shall be prepared by applying a coat of phosphate paint and a coat of blue/grey zinc chromate primer. The



TEST STATION	
	under surfaces shall be free from all imperfections before undertaking the finished coat. After preparation of the under surface, spray painting with two coats of final paint shall be done. The finished panel is dried in oven in dust free atmosphere. Panel finish shall be free from imperfections like pin holes, orange peels, run off paint etc.
Cable Entry Sealing	With Foam / Solid Sealing
Gas Kit	6 mm – Neoprene
PCC Details	1:5:10
RCC Details	M20
PCC over foundation base Plate	150 mm PCC over foundation
Stencil block letter marking	40 mm marking on Test station by black color, showing arrow of direction of flow, Test Station No., Chainage, "Test station connection scheme type with name of the pipeline", Distance from pipeline in meters
Make	As per approved vendor list

Note: - Variable Power Resistor shall be provided in circuit to limit PSP to -1.5 V (ON).

1.9 PIN BRAZING KIT

PIN BRAZING KIT	
Pin Brazing Pin + Ferrule	Safe track Make or Equivalent
Insulating Resin Material	Epoxy Dobo fill 60 + Hardener 758
Enclosure	Funnel

1.10 THERMIT WELD CONNECTION KIT

THERMIT WELD CONNECTION KIT	
Thermit Cartridge	M/s Erico Europa Make or Equivalent
	CA-15: For 6 to 16 Sq. mm. CA-25: For 25 sq. mm. and above
Insulating Resin Material	Epoxy Dobo fill 60 + Hardener 758
Enclosure	Funnel

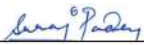


Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION FOR CORROSION SURVEY

VCS – SS – EL - 4017

					
02	05.03.2022	SP	RD	AA	HK
01	16.10.2019	MG	VV	AD	SK
00	05.07.2017	MG	RD	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	05.07.2017	MG	RD	AD	SK	Issued for use as Standard
01	16.10.2019	MG	VV	AD	SK	New revision system updated
02	05.03.2022	SP	RD	AA	HK	New revision system updated

ABBREVIATION

ROU	Right of Use
EHC	Extra High Voltage
HV	High Voltage

CONTENTS

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1.0 SCOPE

- 1.1** The Specification covers the requirements for corrosion survey including measurement of soil resistivity, chemical analysis of soil/water and collection of other cathodic protection related data along ROU of the pipelines.

2.0 REFERENCE DOCUMENTS

- 2.1** Equipment and measurement techniques shall unless otherwise specified, conform to the requirement of latest revisions of following applicable Standards:
- BIS Specifications
 - BS Specifications and codes of practice
 - NACE publications
- 2.2** The work shall be carried out in compliance with all applicable local laws and regulations.
- 2.3** In case of any contradiction between various referred Standards/Specifications/Data Sheet and statutory regulations the following order of priority shall govern:
- Statutory regulations
 - Data Sheets
 - Job Specification
 - This Specification
 - Codes and Standards.

3.0 DEFINITION

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

OWNER / COMPANY	OWNER of the particular Project (Project Specific).
CONSULTANT	The party which is doing engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
BIDDER / SUPPLIER / VENDOR	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.

4.0 GENERAL

- 4.1** This Specification defines the basic guidelines for carrying out the corrosion survey. Contractor shall be responsible for providing necessary data interpretation based on corrosion survey measurements, which is intended to form a basis for design of cathodic protection system for the pipeline.

5.0 SOIL RESISTIVITY SURVEY

- 5.1** Unless otherwise specified the soil resistivity measurements shall be carried out at intervals of approximately 500 m along the ROU. Where soil resistivity is less than 100 ohm.m and two successive readings differ by more than 2:1 then additional soil resistivity readings in between the two locations shall be taken.
- 5.2** To carry out the soil resistivity measurement Wenner's 4 pin method or approved equal shall be used. The depth of resistivity measurement at each location shall be at around 1 m and at the burial depth of the pipeline accounting for the cuttings /fillings or 2 m approximately whichever is higher. At locations where multi-layer soil with large variation in resistivity/ corrosiveness is expected and /or locations specifically advised by Owner or his representative resistivity measurements at additional depth of up to 3 m (approx.) or more shall be taken. In general the resistivity of soil, which shall be surrounding the pipe, shall be measured. Hence the depth of measurement / electrode spacing may vary depending on topography and strata at the area.
- 5.3** At places where ROU has not yet been cleared, measurements shall be made right over the center line of pipeline route surveyed accounting for the cuttings /fillings also.
- 5.4** Observations shall be made enclosing the soils adjoining the trench wherever pipeline trenching has already been done.
- 5.5** The observations shall be made enclosing the soil immediately surrounding the pipeline route where ROU has been cleared but trenching has not been done.
- 5.6** All measurements shall be taken at right angles to the ROU unless otherwise asked by Owner or his representative at site.
- 5.7** At places in ROU where other pipelines are already existing care shall be taken to precisely locate such pipes line and take such precautions that observations are not adversely affected by presence of such pipelines.
- 5.8** Care shall also be taken that the observations are not influenced by presence of other earth currents in the area especially in the vicinity of EHV/HV lines and plants using earth return in their source of power etc.
- 5.9** Wherever possible / advised by Owner or his representative, depth of water table shall be determined by resistivity observations.
- 5.10** All measurements shall be made and recorded in metric units. While recording the data reference to the nearest intersecting point shall be made. To provide visual representation of variations in the resistivity along ROU, values shall be plotted on semi log graph sheets. The resistivity graph shall also indicate the resistivity at additional depths measured at various locations and depth of water table.

6.0 TESTS ON SOIL SAMPLES

- 6.1** Soil/water samples shall be collected along the ROU for analysis. Samples shall be collected on an average at one location for every 10 km along ROU with minimum at two locations. Exact locations shall be decided at site depending on the type of soil, soil

resistivity and in consultation with Owner or his representative. At each location the soil samples shall be collected at 1 m, 2 m depth and at expected depth of pipeline if it is more than 2 in at the location.

- 6.2** The collected soil/water shall be analyzed to determine presence and percentage of corrosive compounds including carbonates, bicarbonates, nitrates, chlorides, oxygen activity, moisture content and pH value.

7.0 ADDITIONAL DATA COLLECTION

- 7.1** The following data shall be collected with a view to generate design data for evaluation of cathodic protection interaction possibilities due to presence of other services in ROU and its vicinity:

- 7.2** Following information regarding foreign service/pipeline in or around the ROU (for existing and those, which are likely to come up during contract execution).

7.2.1 Types of service / pipelines and year of laying.

7.2.2 Diameter and pipeline coating in case of pipeline.

7.2.3 Parallel running / crossing.

7.2.4 Year of laying / commissioning.

7.2.5 Depth of laying.

7.2.6 Type of existing cathodic protection systems (impressed-current / sacrificial).

7.2.7 Location and type (Deep well / surface) of anode ground bed.

7.2.8 Rating of impressed current type of anode ground bed.

7.2.9 Location of existing CP power supply units and their output voltage, current, pipe to soil potential readings.

7.2.10 Location of existing test stations.

7.2.11 Remedial measures existing on foreign service/pipeline to prevent interactions.

7.2.12 Graphical representation of existing structure / pipe to soil potential records.

7.2.13 Possibility of integration/isolation of CP system of the foreign service/pipeline with that of the proposed pipeline, which may involve negotiations with owners of foreign services.

7.2.14 Where, pipeline is likely to "pass close to any existing ground bed (within 100 m approx.), anode-bed potential gradient survey shall be carried out, to verify possible interference with the CP system of the pipeline covered under this project.,

- 7.3** Voltage rating, phases and sheathing details of cables running parallel or crossing the ROU.

-
- 7.4** Existing .and proposed DC/AC power sources and systems using earth return path such as HVDC substations/ earthing stations fabrication yards with electric welding etc. in the vicinity of the entire pipeline route
- 7.5** Crossing and parallel running of electrified and non-electrified traction (along with information regarding, operating voltage, AC/DC type etc.) as well as abandoned tracks near ROU having electrical continuity with the tracks in use.
- 7.6** Crossing or parallel running of any existing or proposed EHV/HV AC/DC overhead power lines along with details of voltage, AC/DC type etc.
- 7.7** Voltage rating, phases, sheathing details of underground power cables, along ROU or in its vicinity.
- 7.8** Any-other relevant information that may be needed in designing and implementing of proper cathodic protection scheme for the proposed pipeline.

8.0 REPORT

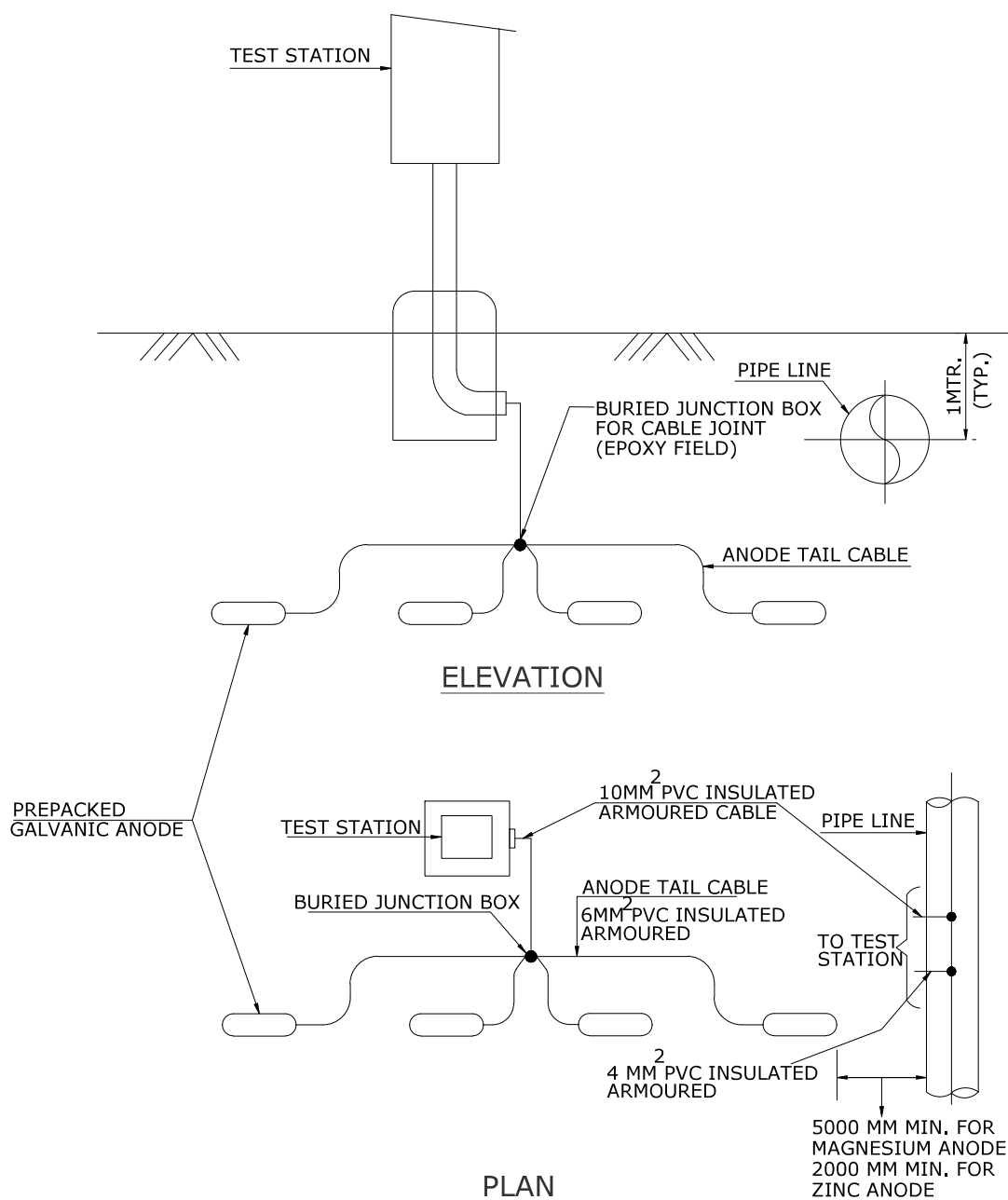
- 8.1** On completion of all the field and laboratory work an interim report incorporating results generated from surveys, additional data collected, results of test carried out, etc., shall be submitted for comments / approval. The report shall also highlight any adverse impact on performance of sacrificial anodes due to the percentage of corrosive compounds including carbonates, bicarbonates, nitrates, chlorides present in the soil and pH value of the soil noticed during the survey. The final report incorporating comments/missing data shall be furnished for records. The report along with various drawings, graphs etc. prepared in connection with the work shall be submitted along with six prints by the Contractor.



1 OF 1

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01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



GALVANIC ANODE INSTALLATION

NOTES:

1. THE PREPACKED GALVANIC ANODE SHALL BE INSTALLED AT A MINIMUM DEPTH, EQUAL TO BOTTOM LEVEL OF THE PIPELINE.
2. THE ANODES ARE SHOWN HORIZONTALLY LAID. ALTERNATIVELY THE ANODES MAY BE VERTICALLY INSTALLED WITH
3. NUMBER OF TERMINALS FOR TEST STATION FOR GALVANIC ANODES FOR PERMANENT CP SYSTEM SHALL BE DECIDED BASED ON NUMBER OF ANODES.

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01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



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VCS QUALITY SERVICES
PRIVATE LIMITED

SHALLOW ANODE GROUND BED (PCP)

STANDARD DRAWING NO.

VCS-STD-EL-4503

SHEET NO.

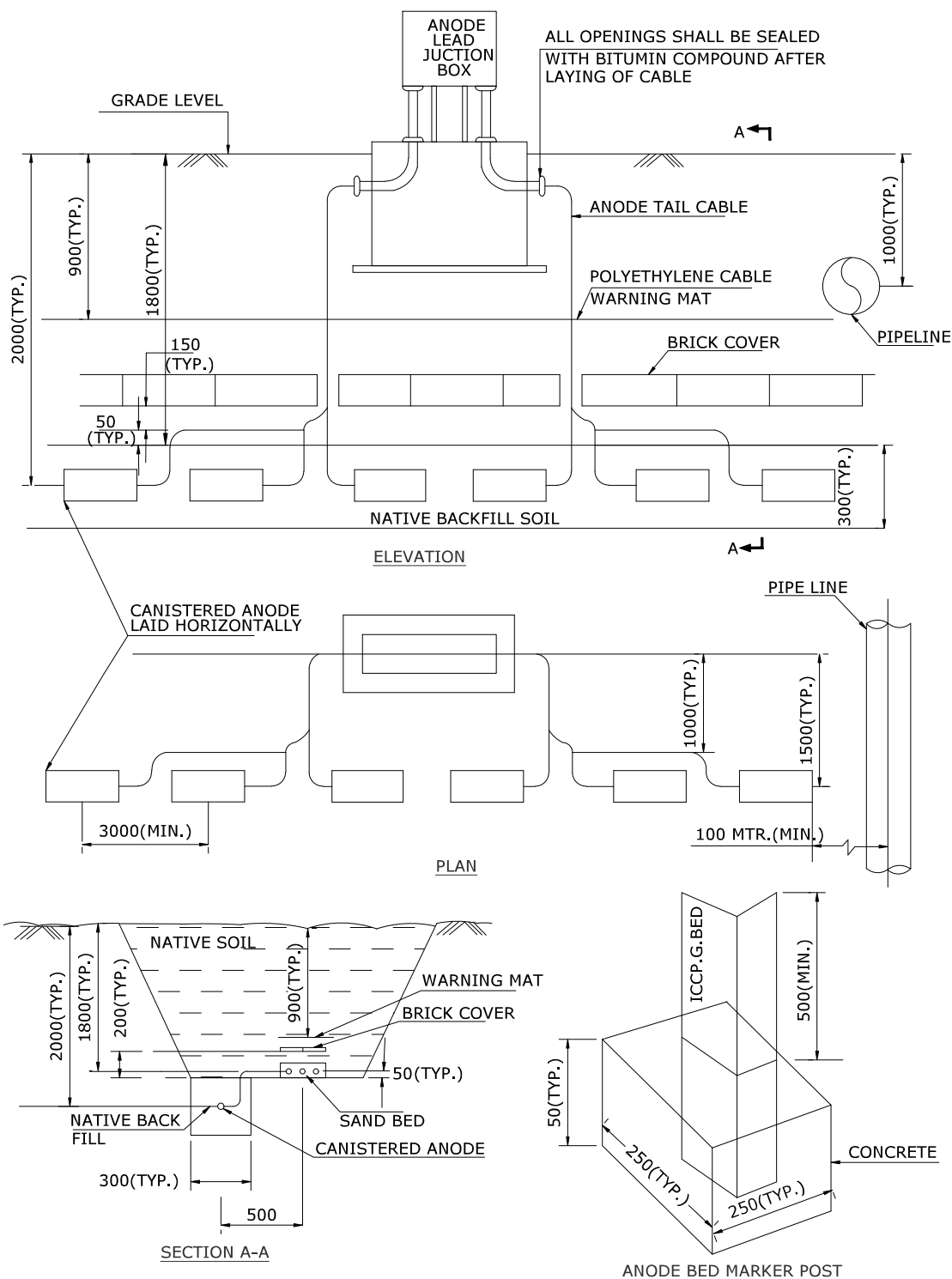
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REV.

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NOTES:

1. THE ANODE GROUND BED SHALL BE LOCATED ELECTRICALLY REMOTE FROM THE PIPELINE WITH MINIMUM 100 MTR. AWAY FROM THE NEAREST POINT ON THE PIPELINE.
2. NO. SPlicing SHALL BE ALLOWED FOR THE CABLES.
3. CONTACTOR SHALL FURNISH THE DIMENSIONED DRAWING SHOWING ACTUAL QUANTITY OF ANODES FOR EACH GROUND BED.
4. ALL UNARMoured CABLES SHALL BE RUN THROUGH PE SLEEVES.
5. ANODE BED MARKER SHALL BE RUN THROUGH PE SLEEVES.
6. NATIVE BACKFILL SOIL SHALL BE FREE OF ROCKS, GARBAGE, PAPERS, PLASTICS ETC.
7. ANODES MAY BE LAID VERTICALLY IN CASE OF VERTICALLY SHALLOW ANODE GROUND BED DESIGN.
8. ALL THE DIMENSIONS ARE IN MM.

Digitally signed by Bivek Kumar
Singh
Date: 2026.03.24 13:16:26 IST

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01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



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THERMITE WELD CONNECTION DETAILS

STANDARD DRAWING NO.

REV.

SIZE

VCS-STD-EL-4504

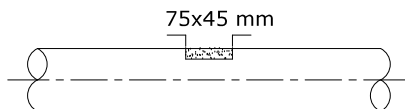
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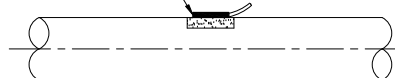
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REMOVABLE PIPE COATING, FILE TO
BRIGHT METAL AND DRY ANY MOISTURE
WITH A CLOTH



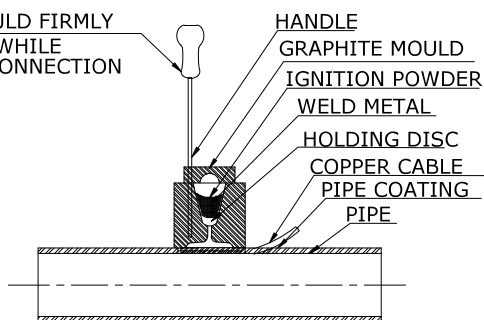
STEP-1

STRIP INSULATION FROM
WIRE EQUAL TO LENGTH
OF MOULD



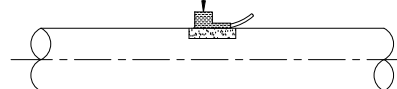
STEP-2

HOLD MOULD FIRMLY
IN PLACE WHILE
MAKING CONNECTION



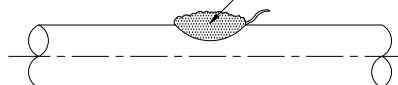
STEP-3

REMOVE SLAG WITH
HAMMER/ WIRE BRUSH



STEP-4

EPOXY ENCAPSULATION
INTERGARD 821(OR EQUIVALENT)



STEP-5

NOTES: GENERAL THERMITE WELDING PROCEDURE

1. REMOVABLE PIPE COATING FILE TO BRIGHT METAL AND DRY ANY MOISTURE WITH A CLOTH.
2. STRIP INSULATION FROM WIRE EQUAL TO LENGTH OF MOULD.
3. INSERT THE CONDUCTOR INTO MOULD.
4. INSERT STEEL DISC IN BOTTOM OF MOULD CAVITY INSIDE MOULD _ DUMP THE METAL INTO MOULD BEING CAREFUL NOT TO UPSET THE STEEL DISC. TAP THE BOTTOM OF THE TUBE TO LOOSEN ALL THE IGNITION POWDER AND SPREAD IT EVENLY OVER THE WELD METAL. PLACE A SMALL MOUNT OF STARTING POWDER ON THE TOP EDGE OF THE MOULD UNDER COVER OPENING FOR EASY IGNITION.
5. CLOSE COVER AND IGNITE WITH THE FLINT GUN MOVE GUN AWAY QUICKLY TO PREVENT FOULING . IF FLINT GUN SHOULD BECOME FOULED , SOAK IT IN HOUSEHOLD AMMONIA.
6. AFTER IGNITION, HOLD THE MOULD IN PLACE FOR 5 SECONDS TO ALLOW THE WELD TO SOLIDIFY, AFTER THE WELD HAS COOLED, REMOVE THE SLAG WITH A CHIPPING HAMMER OR WIRE BRUSH.
7. ENCAPSULATE THE CONNECTION AND ENTIRE PREPARED SURFACE WITH TWO PART EPOXY COMPOUND.
8. REMOVE ALL SLAG'S FROM THE WELDER BEFORE MAKING THE NEXT WELD CLEAN THE COVER EVERY 6 TO 10 WELDS.
9. WET OR DAMP MOULDS WILL PRODUCE POROUS WELDS. MOULDS MUST BE DRIED OUT BEFORE ATTEMPTING TO WELD.
10. CONNECTIONS ARE TO BE PLACED A MINIMUM OF 100mm APART, UNSUCCESSFUL WELDS ARE ABANDONED AND MOVED TO ANOTHER PREPARED SURFACE NOT LESS THAN 100mm AWAY.

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Singh
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02	05.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
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REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



Energising Quality

VCS QUALITY SERVICES
PRIVATE LIMITED

TYPICAL CONSTRUCTION DETAILS
OF HIGH SILICON CAST
IRON ANODE

STANDARD DRAWING NO.

VCS-STD-EL-4505

SHEET NO.

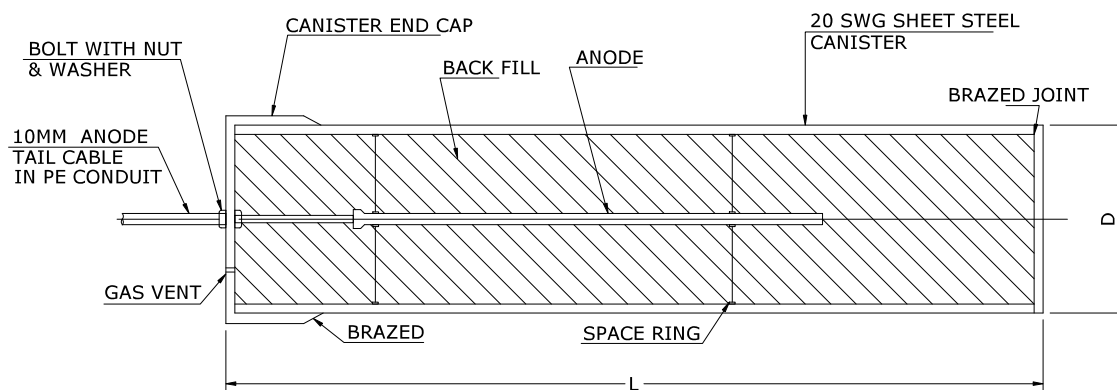
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REV.

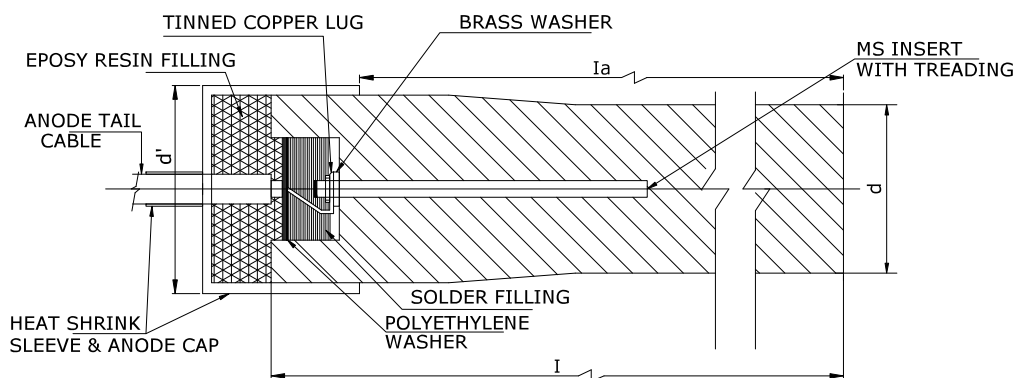
02

SIZE

A4



PREPACKED CANISTERED ANODE



ANODE DETAILS

CHEMICAL COMPOSITION OF ANODE (% WEIGHT):-

CARBON -----: 0.7%-1.1%
MANGANESE -----: 1.5% max.
SILICON -----: 14.2%-14.75%
CHROMIUM -----: 3.25%-5%
MOLYBDENUM -----: 0.2%max.
COPPER -----: 0.5% max
IRON -----: REMAINDER

NOTES:

1. ANODE FOR SURFACE AND DEEP GROUND BED APPLICATION SHALL BE IDENTICAL EXCEPT FOR BACK FILL PREPACKING.
2. SHEET STEEL ANODE CANISTERS SHALL BE FILLED WITH METALLURGICAL GRADE COKE BREEZE.
3. FLUID PETROLEUM COKE BREEZE BACKFILL SHALL BE PROVIDED IN THE WELL, SURROUNDING ANODES IN DEEP WELL GROUND BEDS.
4. ANODE TAIL CABLE SHALL BE 10 Sq.mm HIGH CONDUCTIVITY, STRANDED COPPER CONDUCTOR, 650V GRADE, PE INSULATED, PVC SHEATHED & UNARMoured.
5. ALL THE DIMENSIONS, NET WEIGHT & GROSS WEIGHT OF THE ANODE SHALL BE FURNISHED BY CONTACTOR.
6. THE ACTIVE LENGTH 'Ia' OF ANODE SHALL BE CONSIDERED FOR CALCULATING THE SIZE / WEIGHT.

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ZINC RIBBON ANODE FOR CASED
CROSSINGS WITH COATED/PAINTED
CASING

STANDARD DRAWING NO.

VCS-STD-EL-4506

SHEET NO.

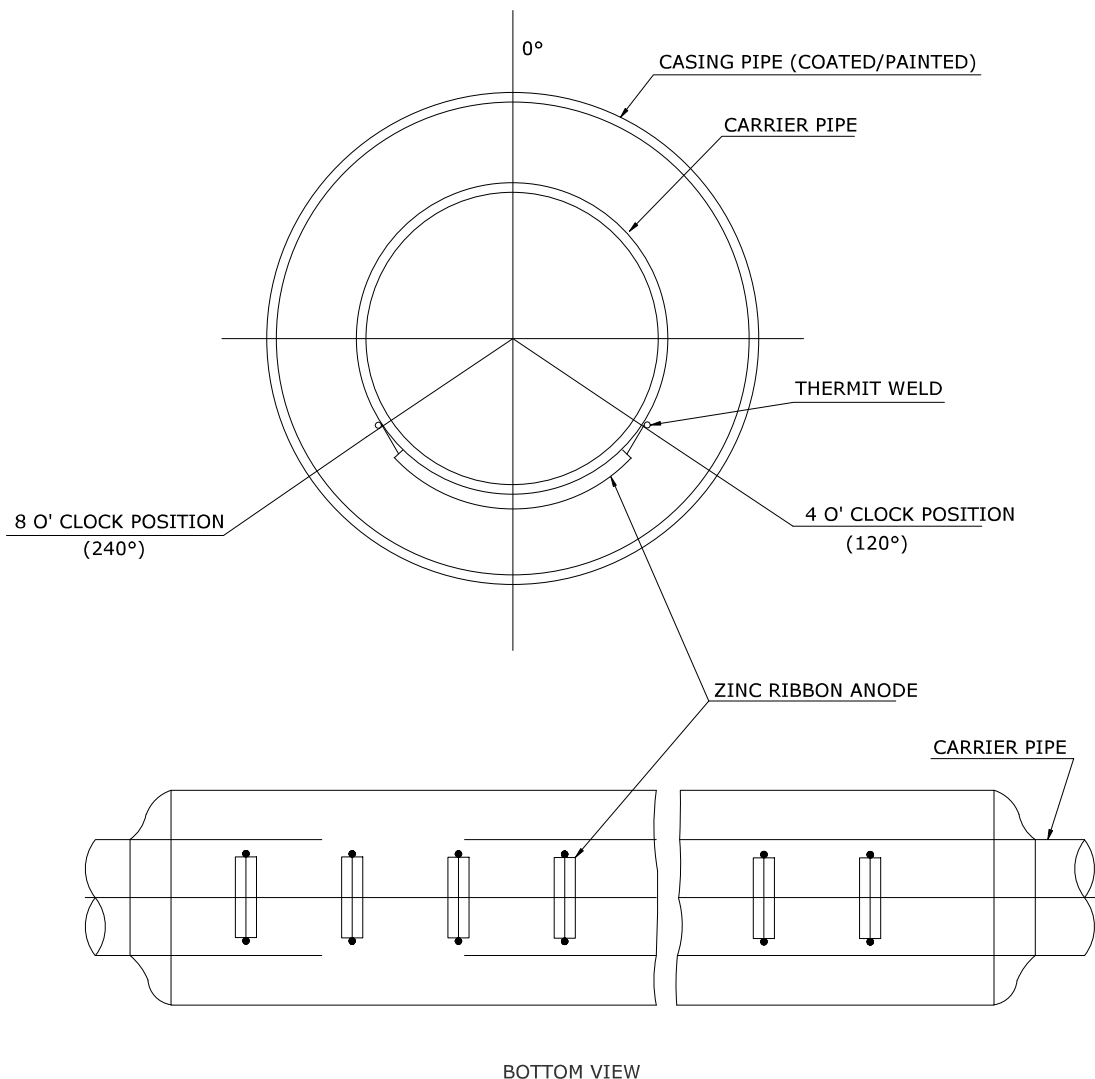
1 OF 1

REV.

02

SIZE

A4



BOTTOM VIEW

CHEMICAL COMPOSITION OF ANODE (% WEIGHT):-

A1 ----- : 0.005% max.
Cd ----- : 0.003% max.
Cu ----- : 0.002% max.
Fe ----- : 0.0014% max.
Pb ----- : 0.003% max.
Zn ----- : REMAINDER

NOTES:

1. STEEL CORE TO BE THERMIT WELDED DIRECTLY TO CARRIER PIPE WITHIN CASINGS AT 4 & 8 'O' CLOCK POSITIONS FOR CARRIER PIPE OF LESS THAN 4 INCH DIA. ANODES MAY BE PROVIDED ALONG THE LENGTH OF THE CARRIER PIPE LINE AT THE BOTTOM LEVEL.
2. SIZE OF ANODE & SPACING BETWEEN ANODES SHALL BE DECIDED BASED ON DESIGN CRITERIA. HOWEVER MINIMUM ONE NUMBER ANODE SHALL BE PROVIDED BETWEEN TWO PIPE SPACERS/CENTRALISERS PROVIDED BETWEEN CARRIER AND CASING PIPES.
3. PIPE SPACERS/CENTRALISERS ARE NOT SHOWN.
4. ANODE COMPOSITION, DIMENSION, NET & GROSS WEIGHT PER UNIT LENGTH SHALL BE FURNISHED BY THE CONTACTOR.
5. CASING PIPE WHERE COATED AGAINST CORROSION OF EXTERNAL SURFACE SHALL BE PROTECTED BY GALVANIC ANODES INSTALLED AT BOTH THE ENDS OF THE CASING PIPE.

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VCS QUALITY SERVICES
PRIVATE LIMITED

PIPELINE GROUNDING THROUGH
POLARIZATION CELL AND
GALVANIC ANODE

STANDARD DRAWING NO.

VCS-STD-EL-4507

SHEET NO.

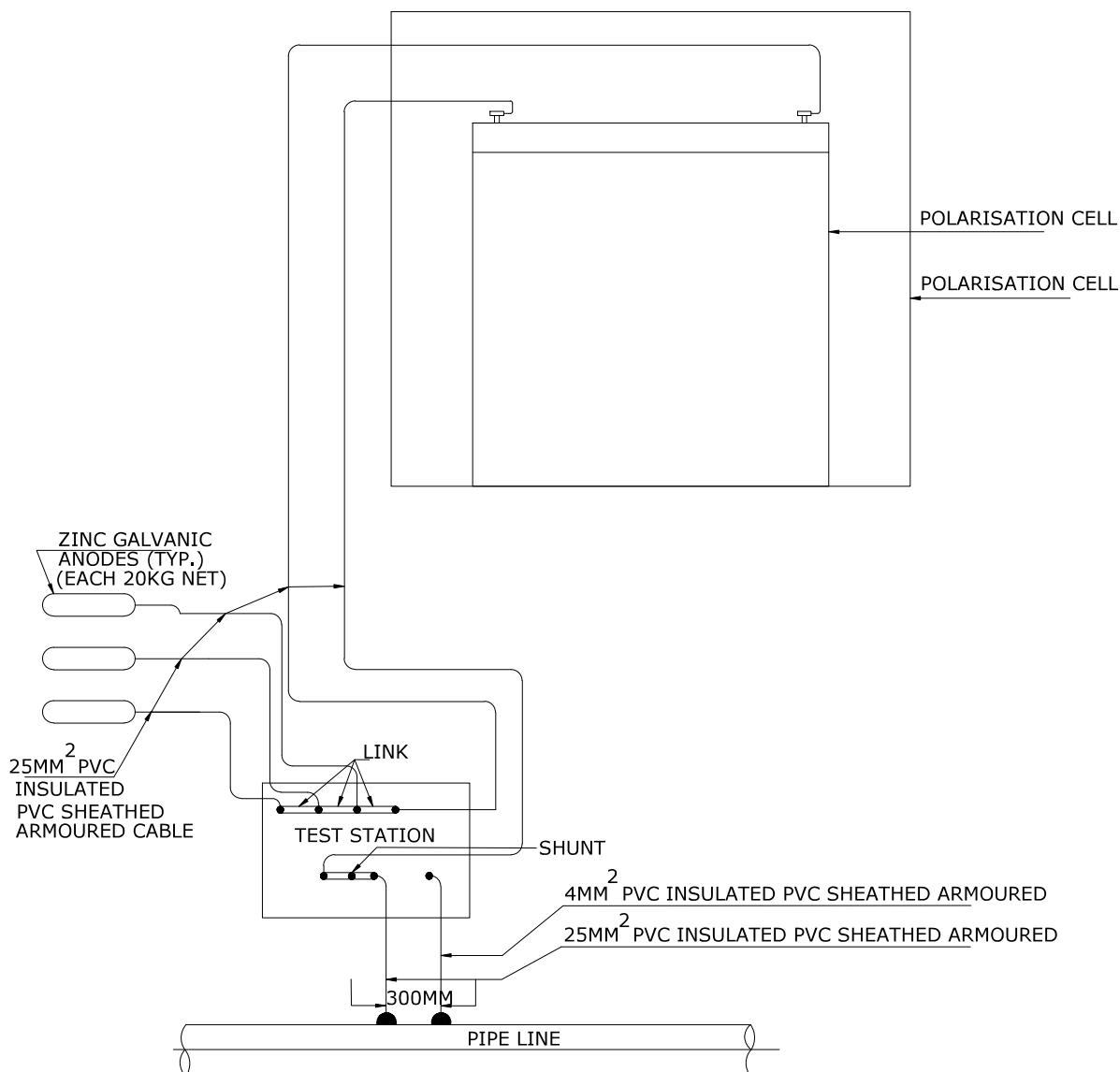
1 OF 1

REV.

02

SIZE

A4



NOTES:

1. THE POLARISATION CELL, ANODES AND ASSOCIATED CABLES, CABLE JOINT ETC. SHALL BE MINIMUM BE RATED FOR THE EXPECTED FAULT CURRENT AT THE LOCATION OF THE INSTALLATION & SIZED FOR DESIGN LIFE OF PERMANENT C.P SYSTEM.
2. THE POLARISATION CELL SHALL BE HOUSED IN A VANDALLISM PROOF HOUSING.
3. CELL SHALL HAVE GOOD VENTILATION TO ATMOSPHERE & SHALL BE PROTECTED AGANIST DIRECT SUN LIGHT & RAIN / WATER.
4. ANODE TAIL CABLES OF EACH ANODE SHALL BE TERMINATED INDIVIDUALLY IN TESTSTATION.
5. CONTACTOR SHALL FURNISH DRAWING WITH ACTUAL DIMENSIONS & RATINGS.
6. EASY ACCESS TO POLARISATION CELL SHALL BE AS PER STANDARD 7-51-0601 (PREPACKED ZINC ANODE).

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VCS QUALITY SERVICES
PRIVATE LIMITED

ZINC GROUNDING CELL
TWO PLATE TYPE

STANDARD DRAWING NO.

REV.

SIZE

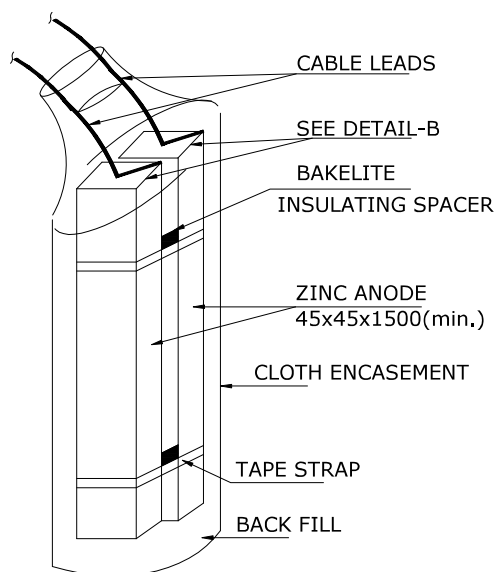
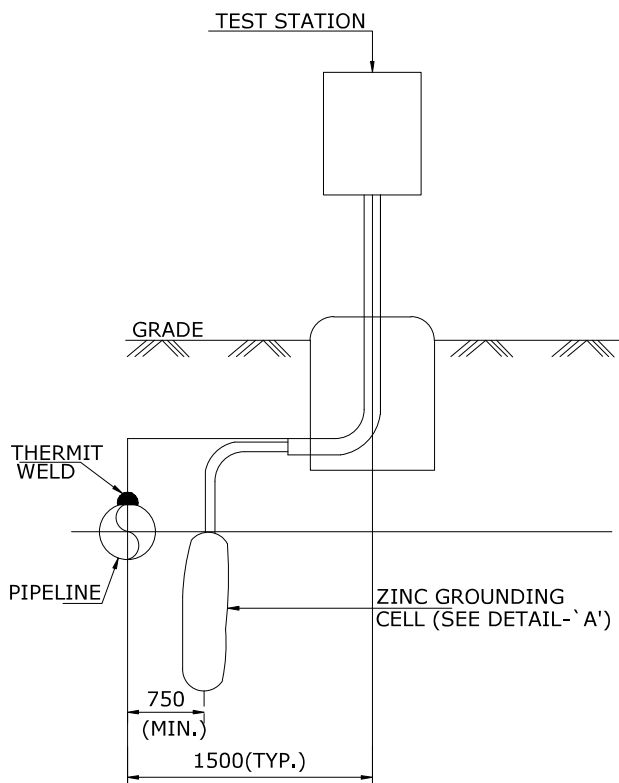
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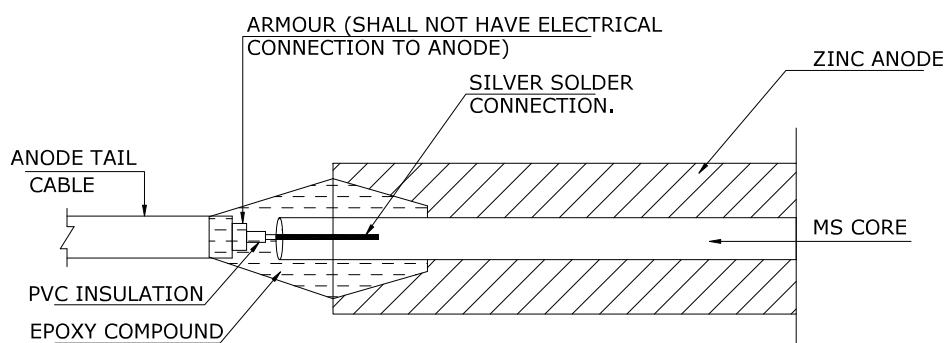
A4

SHEET NO.

1 OF 1



DETAIL-A



DETAIL-B

NOTES:

1. CONTACTOR SHALL FURNISH ANODE COMPOSITION, NET WEIGHT, GROSS WEIGHT AND ALL THE DIMENSIONS OF THE GROUNDING CELL.
2. ZINC GROUNDING CELLS SHALL BE INSTALLED VERTICALLY SUCH THAT THE TOP OF THE CELL IS APPROXIMATELY AT THE SAME ELEVATION AS PIPE CENTRE LINE.
3. NET WEIGHT OF ZINC FOR EACH PLATE OF THE GROUNDING CELL SHALL BE MINIMUM 20KG.
4. ALL CABLE LEADS FOR ZINC GROUNDING CELL SHALL BE KEPT AS SHORT & DIRECT AS POSSIBLE.
5. GROUNDING CELL CABLE LEAD SHALL BE 25 Sqmm HIGH CONDUCTIVITY, STRANDED, COPPER CONDUCTOR 650V GRADE, PVC INSULTED, ARMOURED & PVC SHEATHED.
6. CABLE JOINT TO ANODE CORE SHALL BE SUITABLE TO DISCHARGE MINIMUM 10 KA FAULT CURRENT.
7. ALL DIMENSIONS ARE IN MM.

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VCS QUALITY SERVICES
PRIVATE LIMITED

PERMANENT COPPER-COPPER SULPHATE
REFERENCE CELL AND
INSTALLATION DETAILS

STANDARD DRAWING NO.

VCS-STD-EL-4509

SHEET NO.

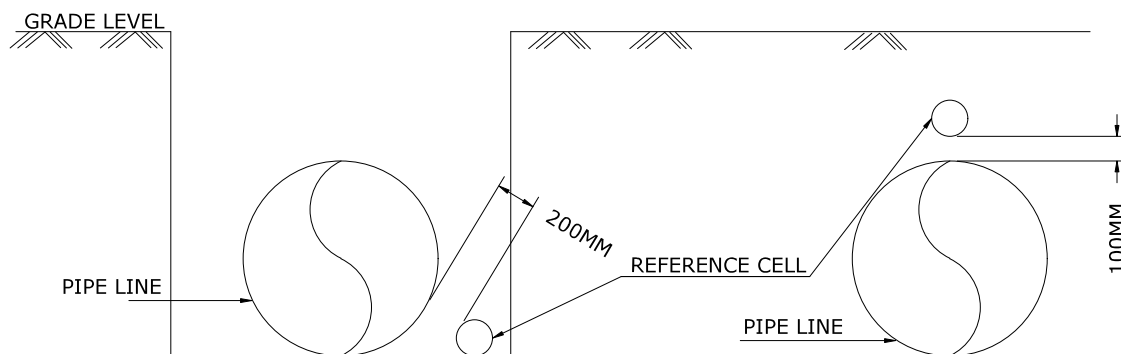
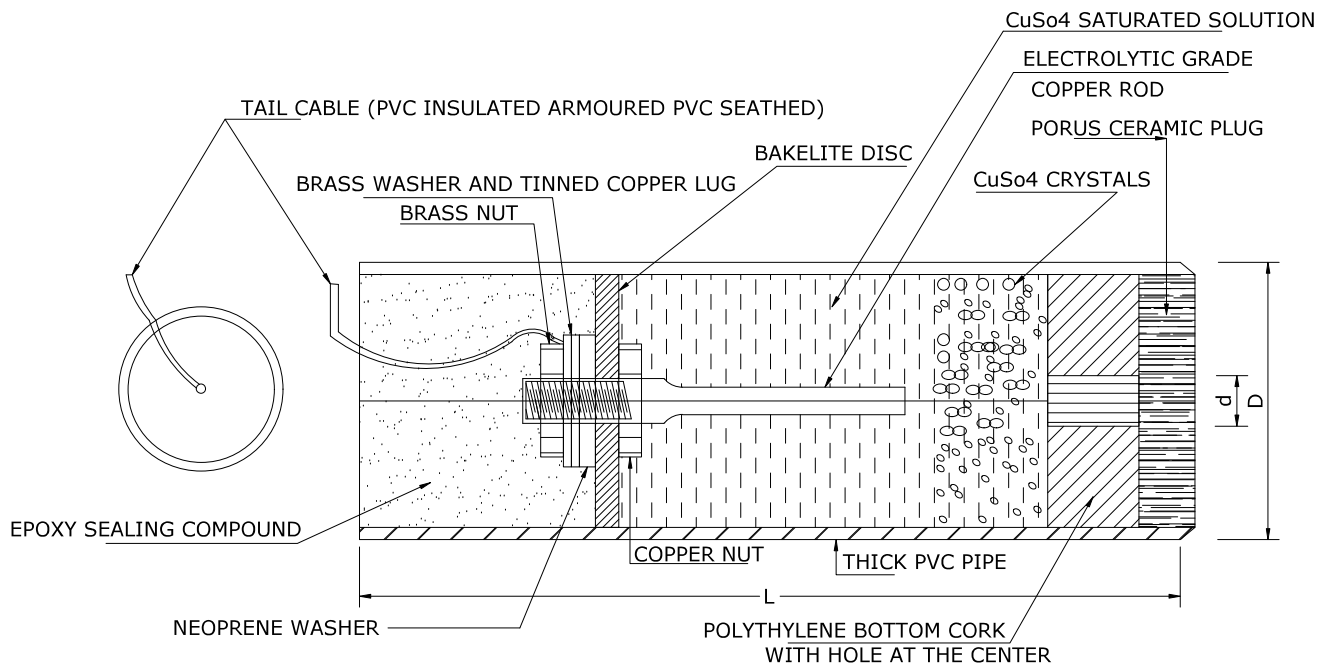
1 OF 1

REV.

02

SIZE

A4



REFERENCE CELL INSTALLATION

NOTES:

1. REFERENCE CELL SHALL BE BACK FILLED WITH CARBONACEOUS BACK FILL MATERIAL SPECIFIED.
2. FOR NEW PIPELINES REFERENCE ELECTRODE SHALL BE INSTALLED APPROXIMATELY AT THE BOTTOM LEVEL OF THE PIPE LINE, 200MM AWAY FROM SURFACE OF THE PIPELINE.
3. REFERENCE ELECTRODES MAY BE INSTALLED AT THE TOP OF THE PIPELINE, APPROXIMATELY 100MM ABOVE THE PIPELINE WHERE THE PIPELINE HAS ALREADY BEEN LAID.
4. REFERENCE CELL CABLE SHALL BE ROUTED ALONG THE BOTTOM LEVEL OF THE PIPELINE, AND 250MM APPROX. AWAY FROM THE SURFACE OF THE PIPE.
5. BACKFILLED REFERENCE ELECTRODES SHALL BE SOAKED IN 20 LTRS. OF CLEAN FRESH WATER FOR 24 HOURS IMMEDIATELY PRIOR TO INSTALLATION.
6. CONTACTOR SHALL FURNISH REFERENCE CELL DRAWING WITH ALL DIMENSIONS.

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PREPACKED MAGNESIUM ANODE

STANDARD DRAWING NO.

REV.

SIZE

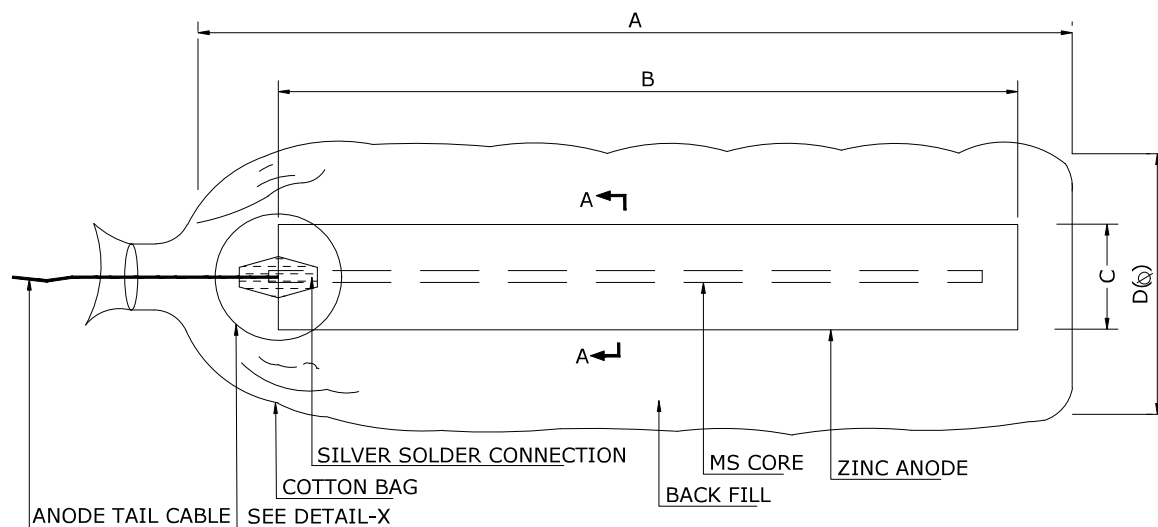
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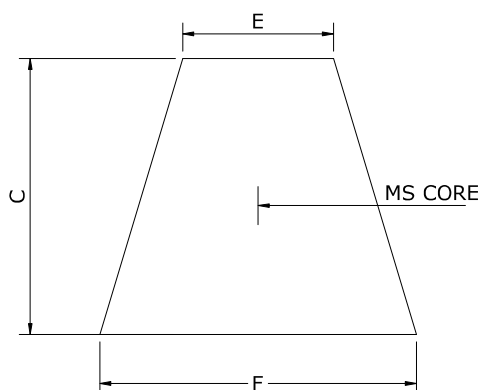
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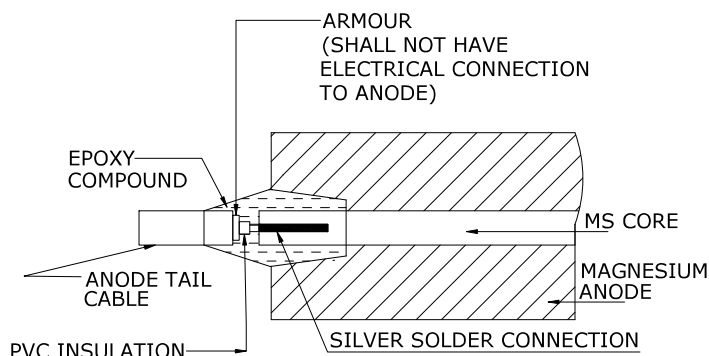
1 OF 1



ELEVATION



SECTION-AA



DETAIL-X

NOTES:

1. ANODE COMPOSTION, NET WEIGHT, GROSS WEIGHT AND DIMENSIONS SHALL BE FURNISHED BY CONTACTOR.
2. ANODE TAIL CABLE SHALL BE HIGH CONDUCTIVITY, STRANDED, COPPER CONDUCTOR, 650V GRADE, PVC INSULATED, PVC SHEATHED & ARMOURED.

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VCS QUALITY SERVICES
PRIVATE LIMITED

PREPACKED ZINC ANODE

STANDARD DRAWING NO.

REV.

SIZE

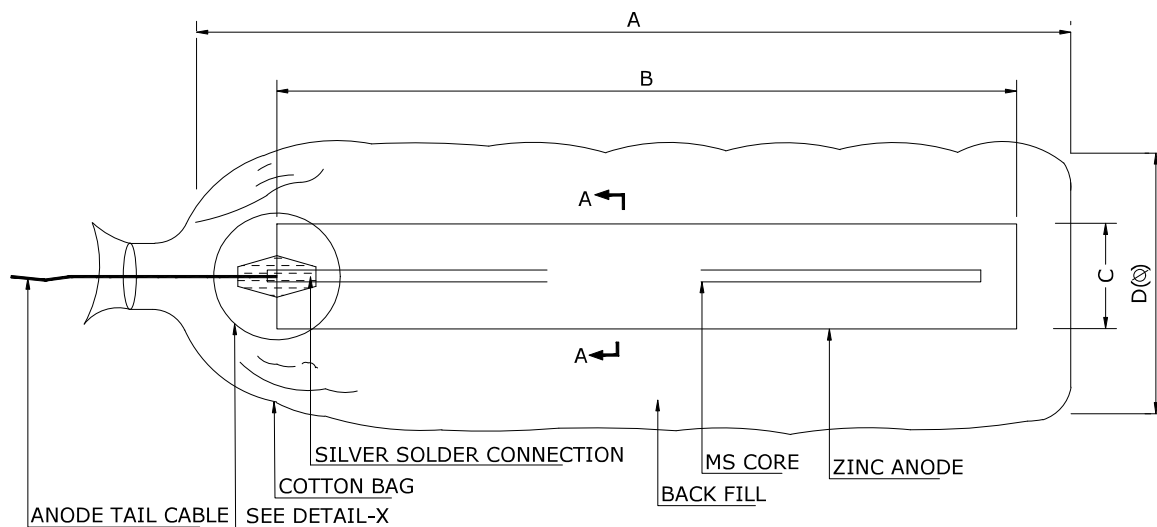
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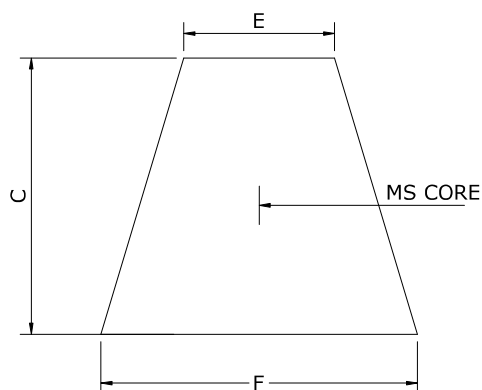
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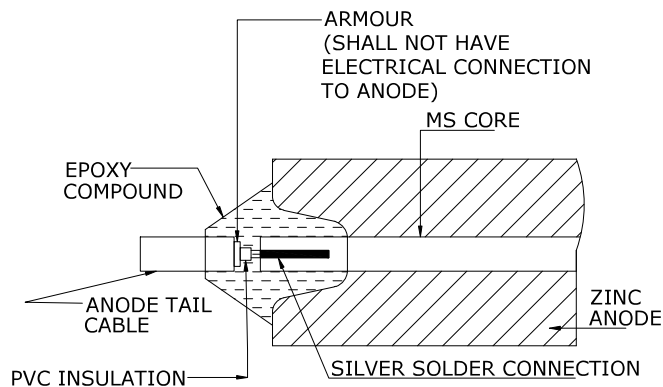
1 OF 1



ELEVATION



SECTION-AA



DETAIL-X

NOTES:

1. ANODE COMPOSTION, NET WEIGHT, GROSS WEIGHT AND DIMENSIONS (A,B,C,D,E & F) SHALL BE FURNISHED BY CONTACTOR.
2. ANODE TAIL CABLE SHALL BE HIGH CONDUCTIVITY, STRANDED, COPPER CONDUCTOR, 650V GRADE, PVC INSULATED, PVC SHEATHED & ARMoured.
3. ANODE TYPE-I SHALL BE USED FOR SEA WATER, BRACKISH WATER OR SALINE ELECTROLYTE AND ANODE-II SHALL BE USED FOR WATER, BACK FILLS & SOIL APPLICATION.

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Singh
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Energising Quality

VCS QUALITY SERVICES
PRIVATE LIMITED

CATHODIC PROTECTION SYSTEM
TEST POST INSTALLATION AT
ROAD CROSSING (RX)

STANDARD DRAWING NO.

VCS-STD-EL-4512

SHEET NO.

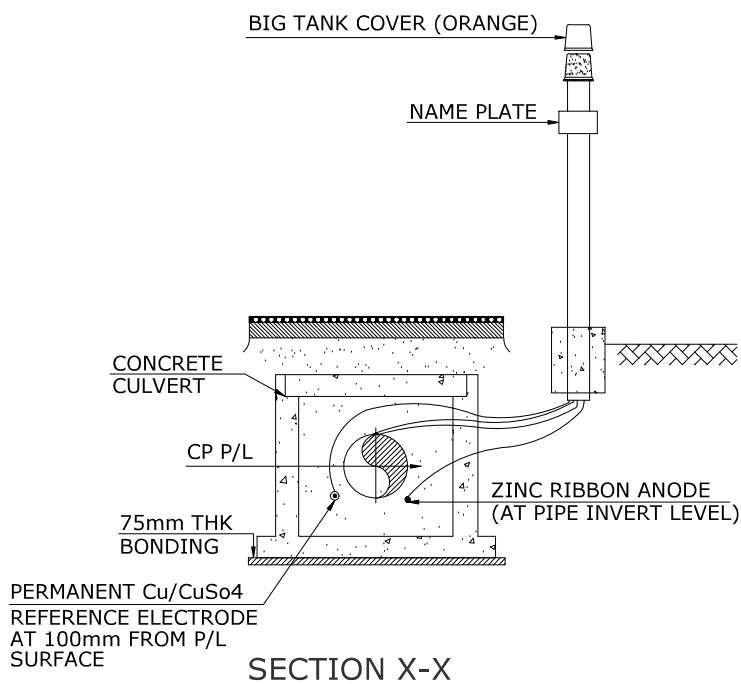
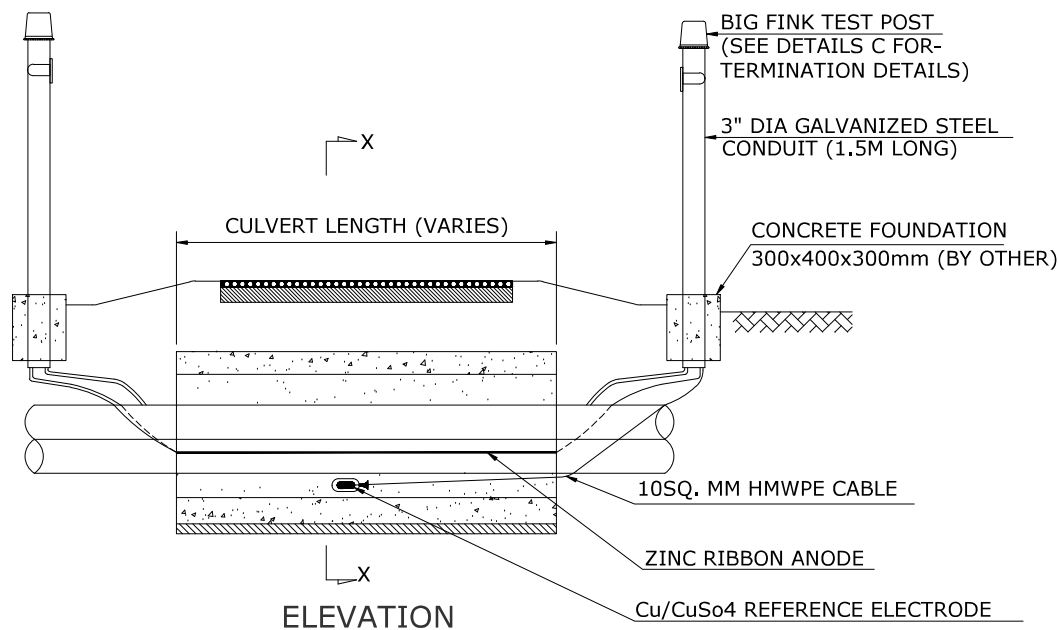
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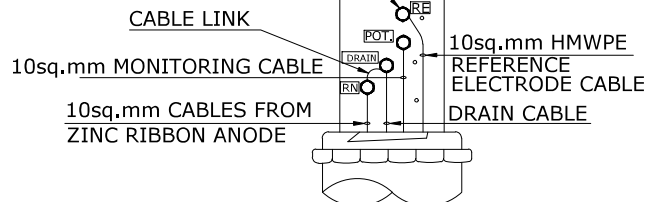
02

SIZE

A4



NICKEL PLATED BRASS NUT
AND SCREW FOR TERMINAL
LEAD CONNECTION



TEST POST INSTALLATION DETAILS AT ROAD CROSSING WITH CONCRETE CULVERT

NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. ANODE RIBBONS SHALL BE INSTALLED AT ROAD CROSSING WHERE THE PIPE IS CASED IN CONCRETE CULVERT.
3. EACH TEST POST SHALL BE HAVE ONE MONITORING AND ONE DRAIN CABLE CONNECTED TO THE PIPE PIPE STRUCTURE.

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VCS QUALITY SERVICES
PRIVATE LIMITED

CATHODIC PROTECTION SYSTEM HIGH
TENSION LINE
CROSSING JUNCTION BOX
(HTB) INSTALLATION DETAILS

STANDARD DRAWING NO.

VCS-STD-EL-4513

SHEET NO.

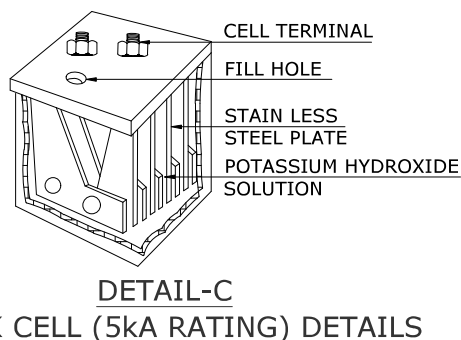
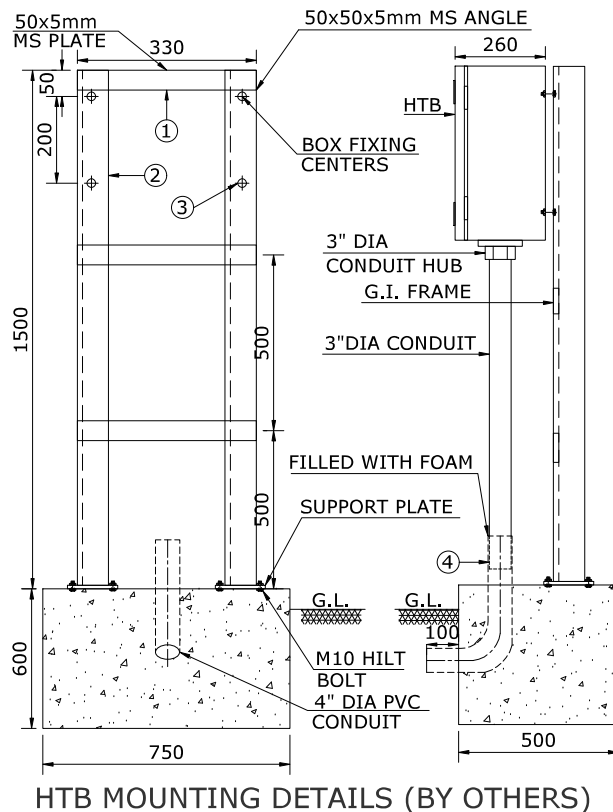
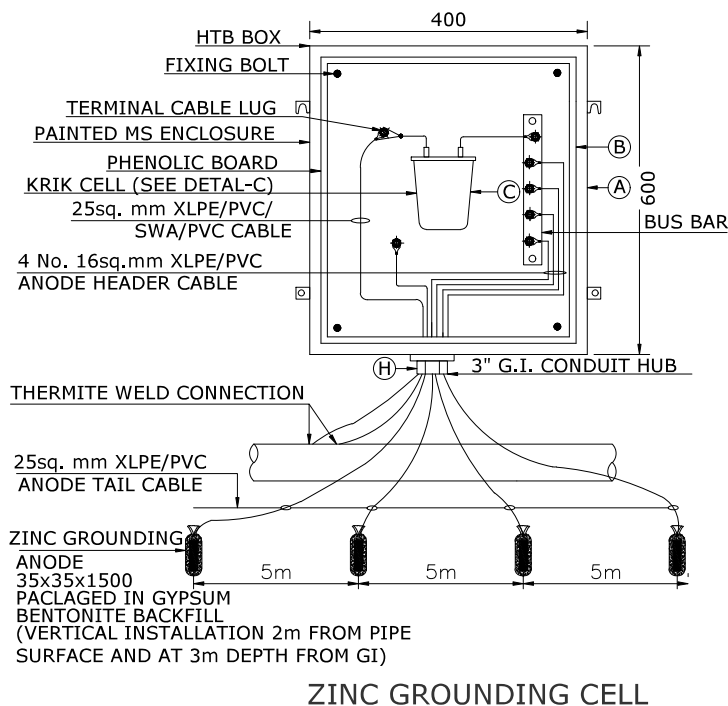
1 OF 1

REV.

02

SIZE

A4



MATERIALS SCHEDULE		
ITEM NO.	DESCRIPTION	QTY.
A.	PAINTED STEEL ENCLOSURE LOCKABLE TYPE RATED FOR IP 55 PROTECTION MIN. 1.6mm THICK.	1 No.
B.	PHENOLIC BOARD-6mm THICK	1 No.
C.	TINNED CUPPER BUS BAR 25x5mm PLATE	1 No.
D.	SHUNT 10A, 100mV	2 No.
E.	VARIABLE RESISTOR 1.29 OHM 60 WATTS.	2 No.
F.	BRASS TERMINAL C/W WASHER, LOCK WASHER & NUTS	AS REQ.
G.	CRIMPED CABLE LUG	AS REQ.
H.	2" DIA G.I. CONDUIT HUB	1 No.

MOUNTING FRAME MATERIAL SCHEDULE (BY OTHERS)

ITEM NO.	DESCRIPTION	UNIT	QTY.
1.	MS FLAT SIZE 50x5mm, LENGTH TO SUIT	NO	3
2.	MS ANGLES SIZE 50x50x5mm, OVERALL LENGTH 1500mm	NO	2
3.	FRAME AND BOX FIXING HOLES, 11mm DIAMETER AND STAINLESS STEEL SET SCREWS, NUTS AND WASHERS	NO	4
4.	CONDUIT LENGTH TO SUIT.	NO	1
5.	2" DIA PVC CONDUIT LENGTH TO SUIT.	NO	1

NOTES:

- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
- THE ZINC GROUNDING ANODE INSTALLATION CAN BE DONE ON ANY ONE SIDE OF THE OVERHEAD POWER LINE CROSSING TO SUIT THE DRILLING AUGERING MACHINE ACCESSIBILITY AT SITE.

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Singh
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VCS QUALITY SERVICES
PRIVATE LIMITED

TEST STATION CONNECTION
SCHEMES

STANDARD DRAWING NO.

VCS-STD-EL-4514

SHEET NO.

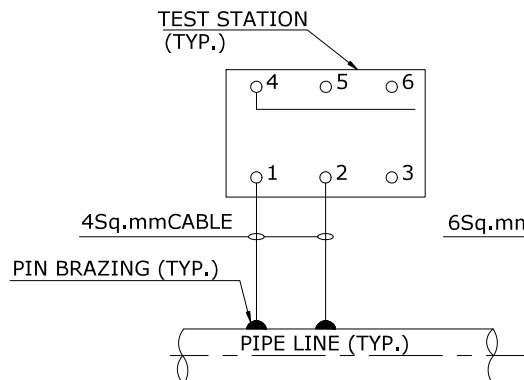
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REV.

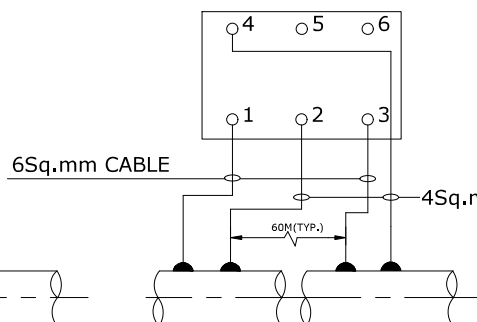
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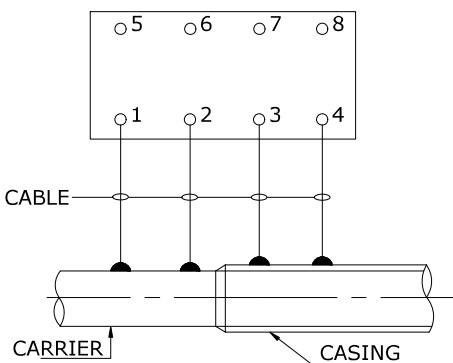
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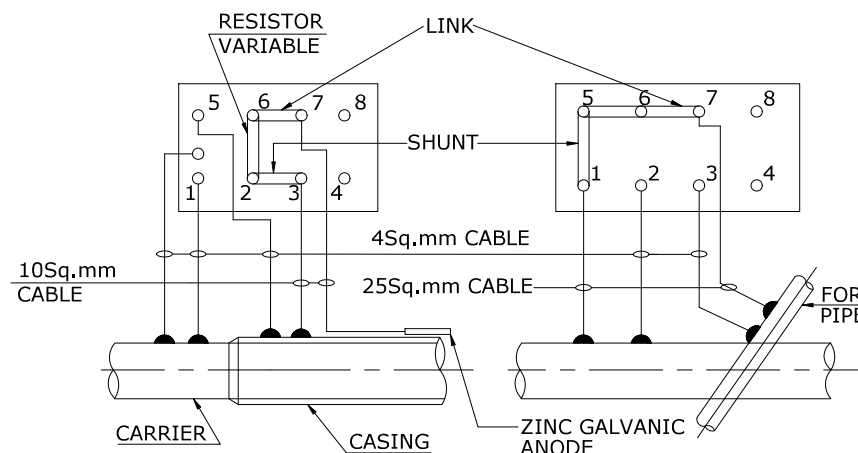
POTENTIAL MEASUREMENT
CONNECTION SCHEME-A



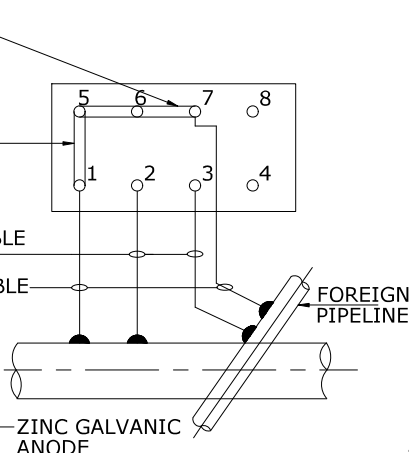
CURRENT MEASUREMENT
CONNECTION SCHEME-B



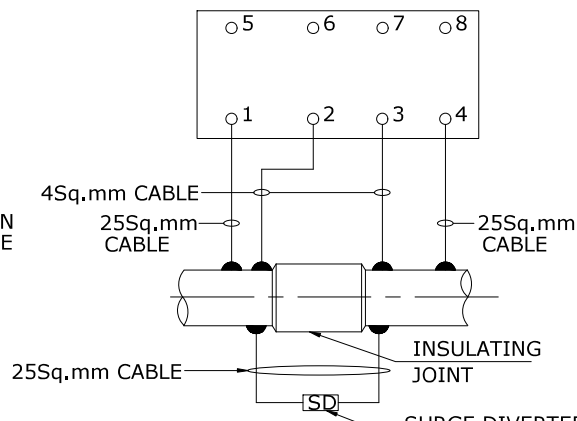
CASED CROSSING WITH
UNCOATED/UNPAINTED CASIN
CONNECTION SCHEME-C



CASED CROSSING WITH
COATED/PAINTED CASING
(CONNECTION SCHEME-D)



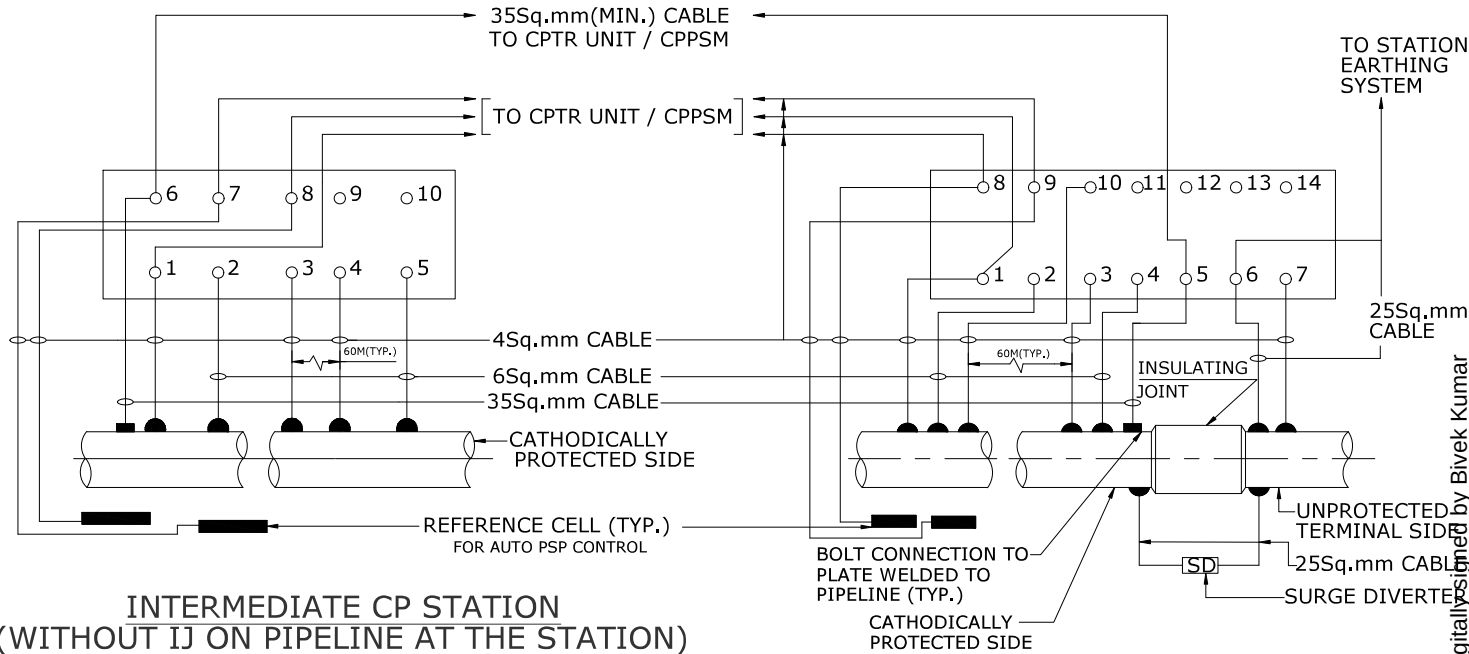
FOREIGN PIPELINE CROSSING
(CONNECTION SCHEME-E)



INSULATING JOINT CONNECTION
(CONNECTION SCHEME-F)

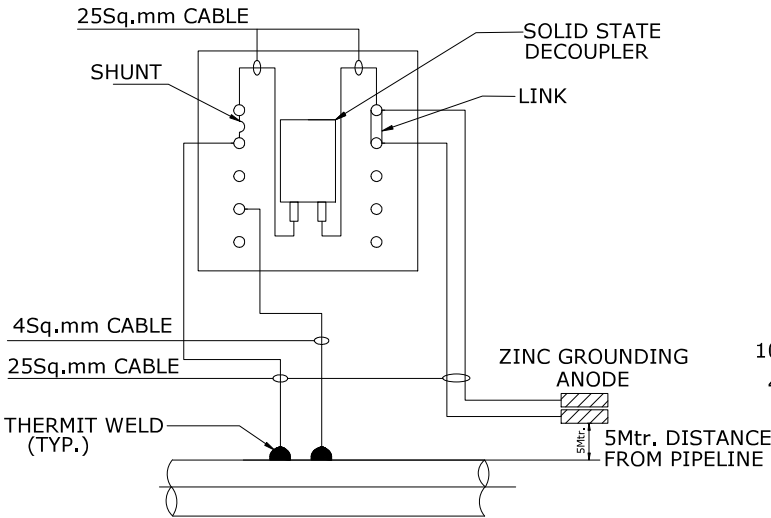
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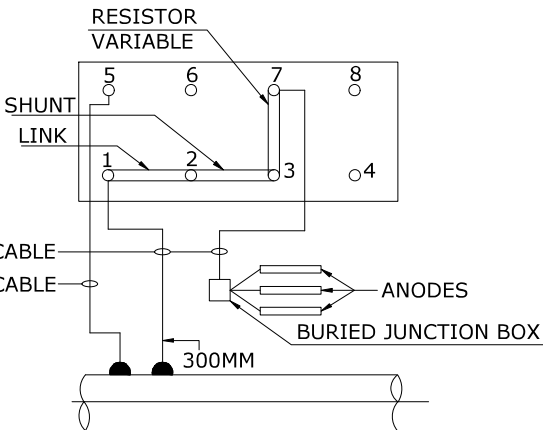


INTERMEDIATE CP STATION
(WITHOUT IJ ON PIPELINE AT THE STATION)
IMPRESSED CURRENT DRAINAGE POINT
(CONNECTION SCHEME-G)

TERMINAL STATION IMPRESSED
CURRENT DRAINAGE POINT
(CONNECTION SCHEME-H)



PIPELINE GROUNDING THROUGH
POLARIZATION CELL AND GALVANIC ANODE
(CONNECTION SCHEME-M)



TCP GALVANIC ANODE INSTALLATION
(CONNECTION SCHEME-L)

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Energising Quality

VCS QUALITY SERVICES
PRIVATE LIMITED

TEST STATION CONNECTION
SCHEMES

STANDARD DRAWING NO.

VCS-STD-EL-4514

SHEET NO.

3 OF 3

REV.

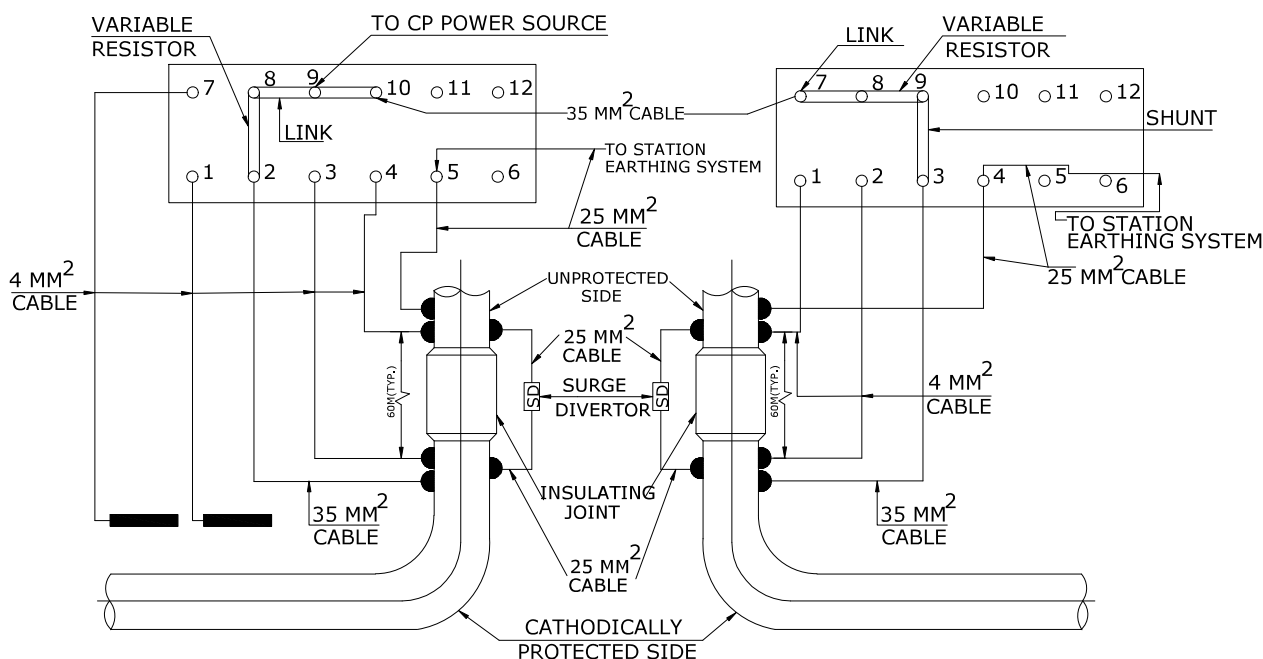
02

SIZE

A4

TEST STATION I-1

TEST STATION I-2



INTERMEDIATE PIGGING STATION IMPRESSED CURRENT DRAINAGE POINT CONNECTION SCHEME -I

NOTES:

1. NUMBER OF TERMINALS FOR TEST STATION OF DIFFERENT CONNECTION SCHEME SHALL BE AS SHOWN ON THE RESPECTIVE SCHEME DRAWING, TEST STATION FOR ANY OTHER SCHEME DRAWING, TEST STATION FOR ANY OTHER SCHEME SHALL PREFERABLY BE SIMILAR TO ANY OF THE ABOVE TYPES.
2. ELECTRICAL CONNECTIONS SHALL BE CLEANED TO BRIGHT SURFACE & TIGHTENED WITH NON-OXIDE GREASE APPLIED ON MECHANICALLY MATED SURFACE.
3. NUMBER OF TERMINALS FOR TEST STATION FOR GALVANIC ANODES FOR PERMANENT CP SYSTEM SHALL BE DECIDED BASED ON NUMBER OF ANODES.

Digitally signed by Bivek Kumar
Singh
Date: 2026.03.24 13:16:26 IST

02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



1 OF 1

Digitally signed by Bivek Kumar Singh
Date: 2026.03.24 13:16:26 IST

02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
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REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



Energising Quality

VCS QUALITY SERVICES
PRIVATE LIMITED

CATHODIC PROTECTION SYSTEM
EQUIPOTENTIAL BOND BOX (EBB) DETAILS
FOR RMETP

STANDARD DRAWING NO.

VCS-STD-EL-4516

SHEET NO.

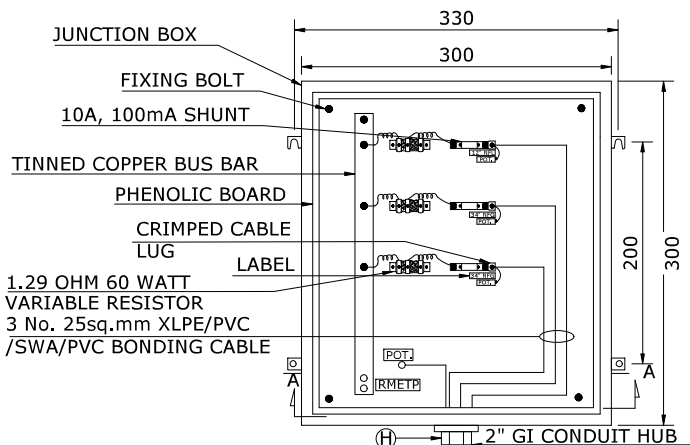
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REV.

02

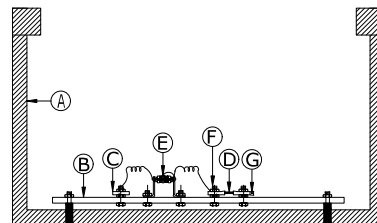
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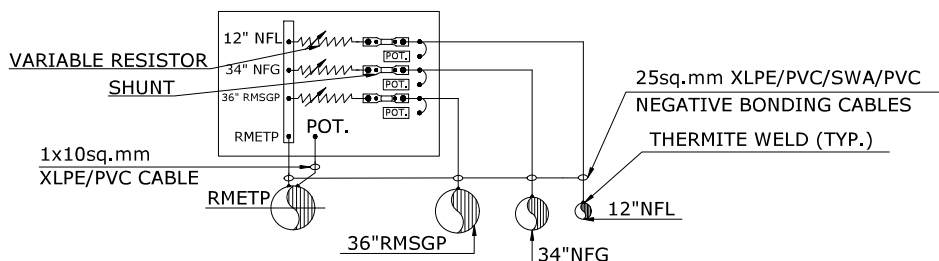


EQUIPOTENTIAL BOND BOX

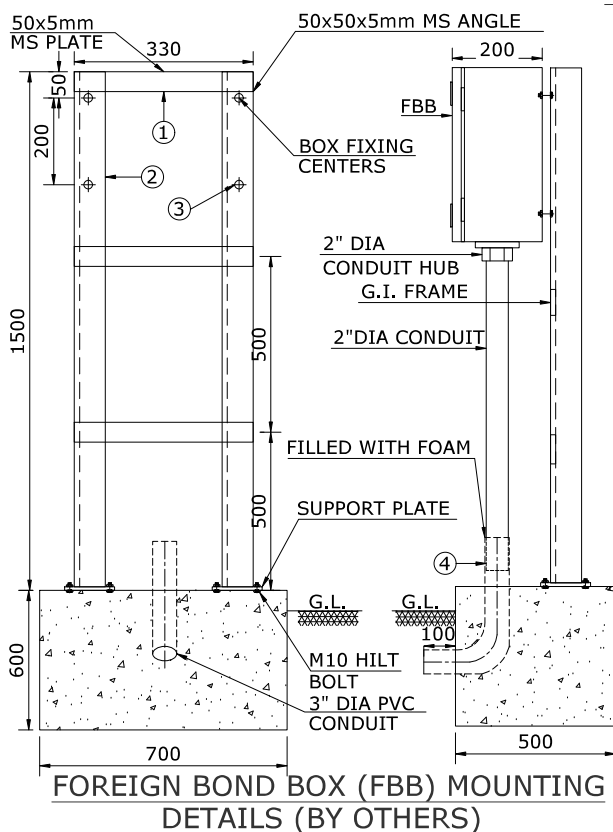
DETAIL-1
NAME PLATE DETAILS



SECTION A-A



TERMINATION DETAILS



FOREIGN BOND BOX (FBB) MOUNTING
DETAILS (BY OTHERS)

MATERIALS SCHEDULE

ITEM NO.	DESCRIPTION	QTY.
A.	PAINTED STEEL ENCLOSURE LOCKABLE TYPE RATED FOR IP 55 PROTECTION MIN. 1.6mm THICK.	1 No.
B.	PHENOLIC BOARD-6mm THICK	1 No.
C.	TINNED CUPPER BUS BAR 25x5mm PLATE	1 No.
D.	SHUNT 10A, 100mV	3 No.
E.	VARIABLE RESISTOR 1.29 OHM 60 WATTS.	3 No.
F.	BRASS TERMINAL C/W WASHER, LOCK WASHER & NUTS	AS REQ.
G.	CRIMPED CABLE LUG	AS REQ.
H.	2" DIA G.I. CONDUIT HUB	1 No.

MOUNTING FRAME MATERIAL SCHEDULE (BY OTHERS)

ITEM NO.	DESCRIPTION	UNIT	QTY.
1.	MS FLAT SIZE 50x5mm, LENGTH TO SUIT	NO	3
2.	MS ANGLES SIZE 50x50x5mm, OVERALL LENGTH 1500mm	NO	2
3.	FRAME AND BOX FIXING HOLES, 11mm DIAMETER AND STAINLESS STEEL SET SCREWS, NUTS AND WASHERS	NO	4
4.	3: PVC CONDUIT LENGTH TO SUIT.	NO	1
5.	2" G.I. CONDUIT LENGTH TO SUIT.	NO	1

NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.

02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	19.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



Energising Quality

VCS QUALITY SERVICES
PRIVATE LIMITED

CATHODIC PROTECTION SYSTEM FOREIGN
BOND BOX (FBB)
DETAILS (2CIRCUITS)

STANDARD DRAWING NO.

VCS-STD-EL-4517

SHEET NO.

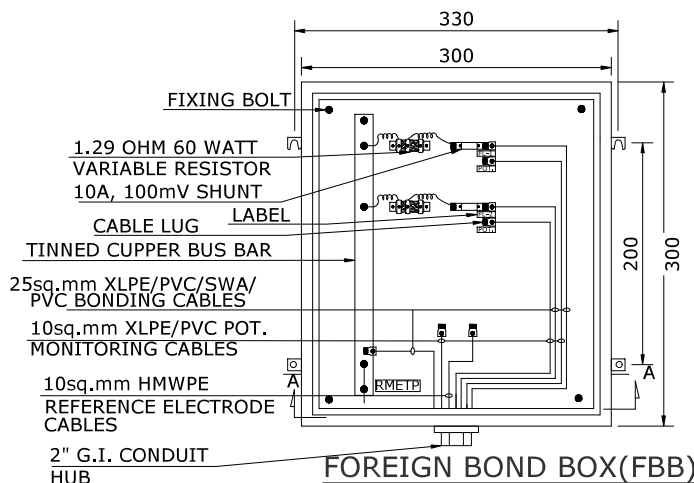
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REV.

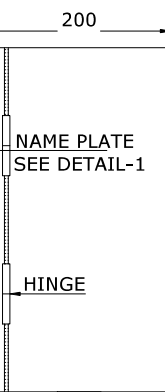
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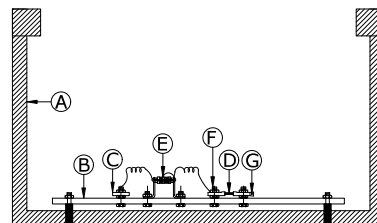


FOREIGN BOND BOX(FBB)

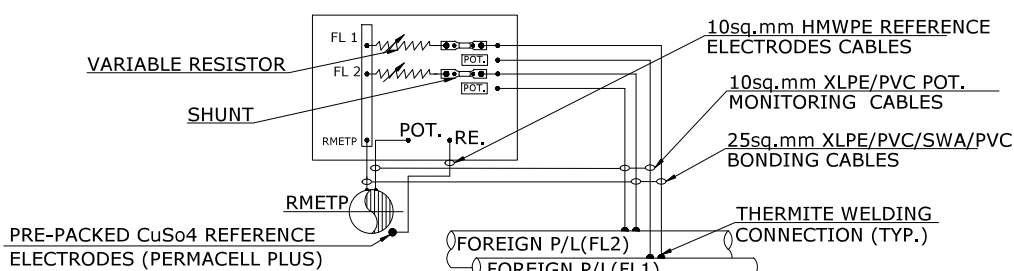


SIDE VIEW

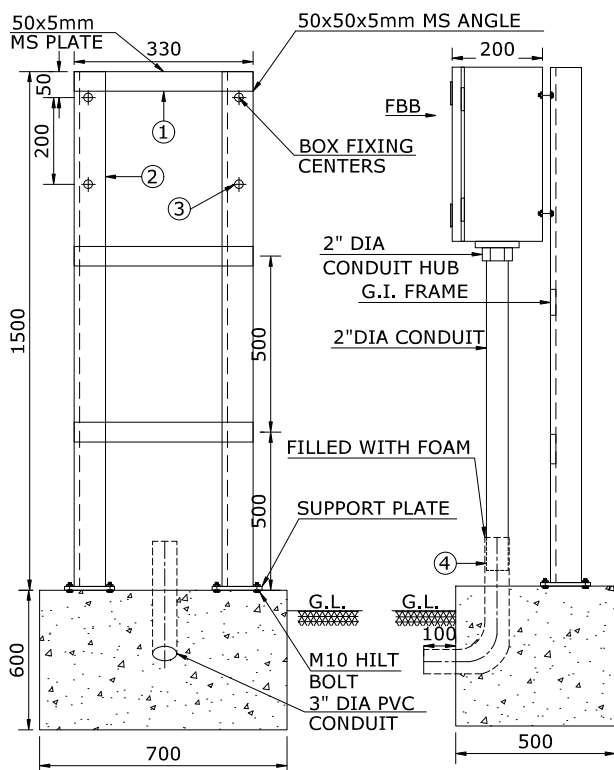
DETAIL-1
NAME PLATE DETAILS



SECTION A-A



TERMINATION DETAILS



FOREIGN BOND BOX (FBB) MOUNTING
DETAILS (BY OTHERS)

MATERIALS SCHEDULE

ITEM NO.	DESCRIPTION	QTY.
A.	PAINTED STEEL ENCLOSURE LOCKABLE TYPE RATED FOR IP 55 PROTECTION MIN. 1.6mm THICK.	1 No.
B.	PHENOLIC BOARD-6mm THICK	1 No.
C.	TINNED CUPPER BUS BAR 25x5mm PLATE	1 No.
D.	SHUNT 10A, 100mV	2 No.
E.	VARIABLE RESISTOR 1.29 OHM 60 WATTS.	2 No.
F.	BRASS TERMINAL C/W WASHER, LOCK WASHER & NUTS	AS REQ.
G.	CRIMPED CABLE LUG	AS REQ.
H.	2" DIA G.I. CONDUIT HUB	1 No.

MOUNTING FRAME MATERIAL SCHEDULE (BY OTHERS)

ITEM NO.	DESCRIPTION	UNIT	QTY.
1.	MS FLAT SIZE 50x5mm, LENGTH TO SUIT	NO	3
2.	MS ANGLES SIZE 50x50x5mm, OVERALL LENGTH 1500mm	NO	2
3.	FRAME AND BOX FIXING HOLES, 11mm DIAMETER AND STAINLESS STEEL SET SCREWS, NUTS AND WASHERS	NO	4
4.	CONDUIT LENGTH TO SUIT.	NO	1
5.	2" DIA PVC CONDUIT LENGTH TO SUIT.	NO	1

NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.

02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	19.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
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REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



Energising Quality

VCS QUALITY SERVICES
PRIVATE LIMITED

NEGATIVE DISTRIBUTION BOND
BOX (NDBB) DETAILS

STANDARD DRAWING NO.

VCS-STD-EL-4518

SHEET NO.

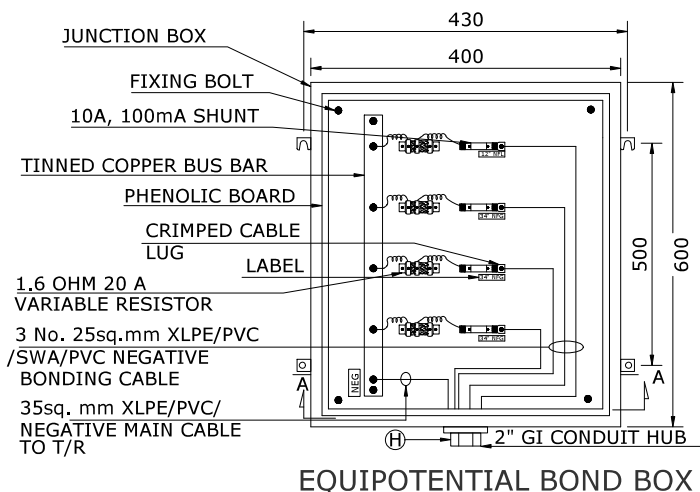
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REV.

02

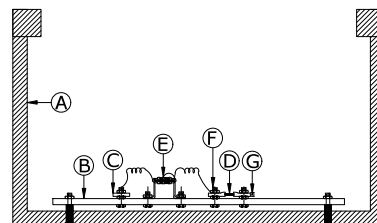
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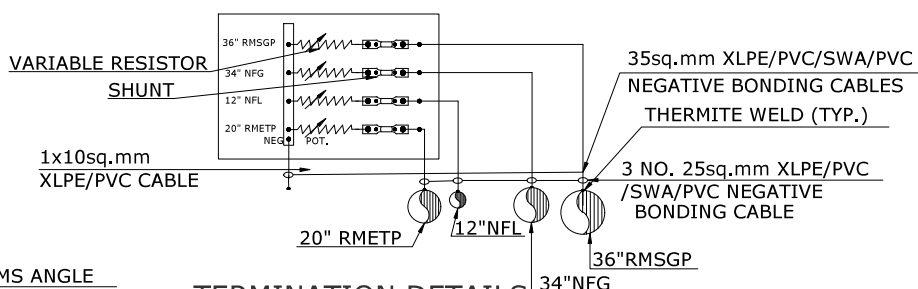


EQUIPOTENTIAL BOND BOX

DETAIL-1
NAME PLATE DETAILS



SECTION A-A



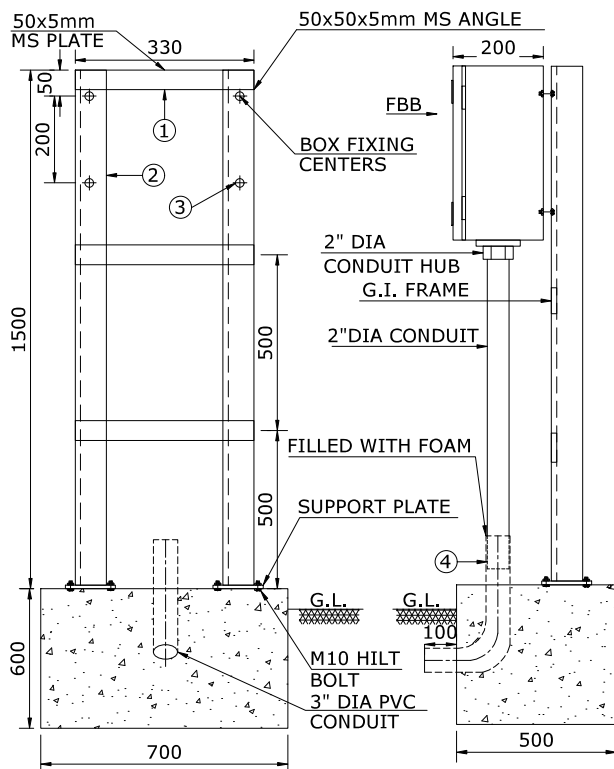
TERMINATION DETAILS

MATERIALS SCHEDULE

ITEM NO.	DESCRIPTION	QTY.
A.	PAINTED STEEL ENCLOSURE LOCKABLE TYPE RATED FOR IP 55 PROTECTION MIN. 1.6mm THICK.	1 No.
B.	PHENOLIC BOARD-6mm THICK	1 No.
C.	TINNED COPPER BUS BAR 25x5mm PLATE	1 No.
D.	SHUNT 10A, 100mV	4 No.
E.	VARIABLE RESISTOR 1.29 OHM 60 WATTS.	4 No.
F.	BRASS TERMINAL C/W WASHER, LOCK WASHER & NUTS	AS REQ.
G.	CRIMPED CABLE LUG	AS REQ.
H.	2" DIA G.I. CONDUIT HUB	1 No.

MOUNTING FRAME MATERIAL SCHEDULE (BY OTHERS)

ITEM NO.	DESCRIPTION	UNIT	QTY.
1.	MS FLAT SIZE 50x5mm, LENGTH TO SUIT	NO	3
2.	MS ANGLES SIZE 50x50x5mm, OVERALL LENGTH 1500mm	NO	2
3.	FRAME AND BOX FIXING HOLES, 11mm DIAMETER AND STAINLESS STEEL SET SCREWS, NUTS AND WASHERS	NO	4
4.	3" PVC CONDUIT LENGTH TO SUIT.	NO	1
5.	2" G.I. CONDUIT LENGTH TO SUIT.	NO	1



NEGATIVE DISTRIBUTION BOND BOX
MOUNTING DETAILS (BY OTHERS)

NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.

02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY

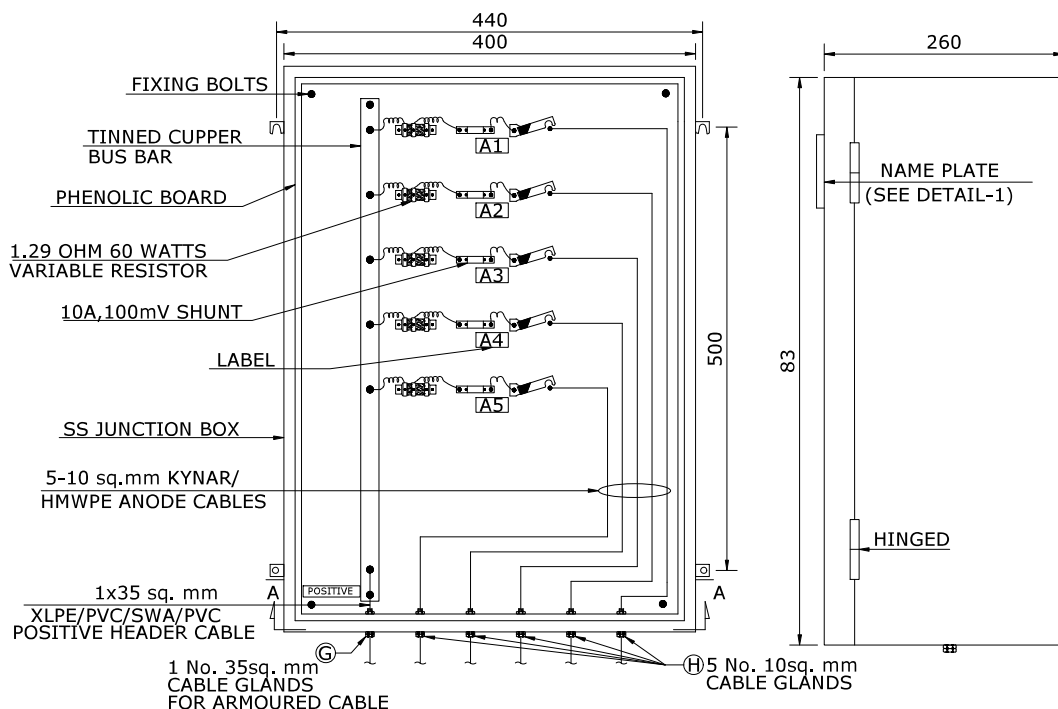


CATHODIC PROTECTION SYSTEM ANODE JUNCTION BOX(AJB) DETAILS

REV. | SIZE

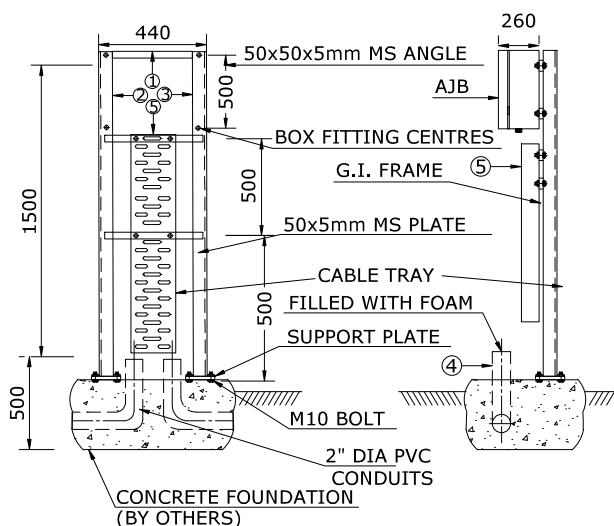
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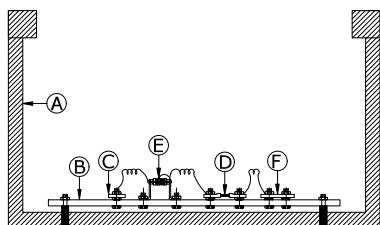


DETAIL-1
NAME PLATE DETAILS

ANODE JUNCTION BOX



ANODE JUNCTION BOX (AJB) MOUNTING DETAILS (BY OTHERS)



SECTION A-A

NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.

MATERIALS SCHEDULE

ITEM NO.	DESCRIPTION	QTY.
A.	PAINTED STEEL ENCLOSURE LOCKABLE TYPE RATED FOR IP 55 PROTECTION MIN. 3mm THICK.	1 No.
B.	PHENOLIC BOARD-6mm THICK	1 No.
C.	TINNED CUPPER BUS BAR 25x5mm PLATE	1 No.
D.	SHUNT 10A, 100mV	5 No.
E.	VARIABLE RESISTOR 1.29 OHM 60 WATTS.	5 No.
F.	BRASS TERMINAL C/W WASHER, LOCK WASHER & NUTS	AS REQ.
G.	BRASS CABLE GLAND (35 sq. mm)	1 No.
H.	BRASS CABLE GLAND (10 sq. mm)	5 No.
I.	COPPER CABLE LINK	5 No.

MOUNTING FRAME MATERIAL SCHEDULE (BY OTHERS)

ITEM NO.	DESCRIPTION	UNIT	QTY.
1.	MS FLAT SIZE 50x5mm, LENGTH TO SUIT	NO	3
2.	MS ANGLES SIZE 50x50x5mm, OVERALL LENGTH 1500mm	NO	2
3.	FRAME AND BOX FIXING HOLES, 11mm DIAMETER AND STAINLESS STEEL SET SCREWS, NUTS AND WASHERS	NO	4
4.	2" DIA PVC CONDUIT LENGTH TO SUIT.	NO	2
5.	CABLE TRAY LENGTH TO SUIT (APPROX. 800mm)	NO	1

02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	19.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED Digitally signed by Birek Kuma Singh	AUTHORIZED BY



Energising Quality

VCS QUALITY SERVICES
PRIVATE LIMITED

DEEP WELL GROUNDING INSTALLATION
DETAILS

STANDARD DRAWING NO.

VCS-STD-EL-4520

SHEET NO.

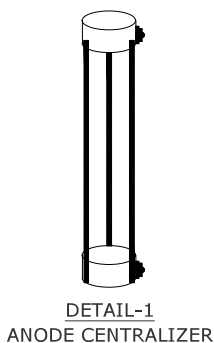
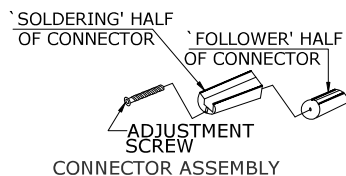
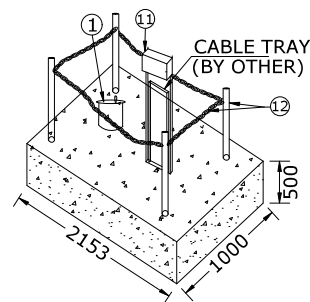
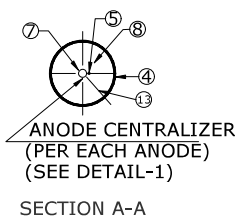
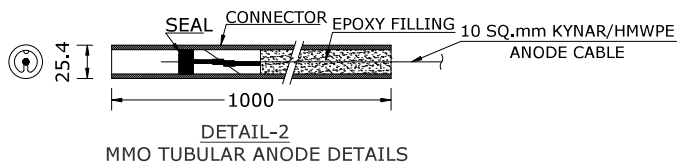
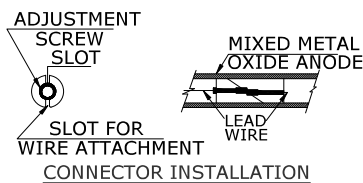
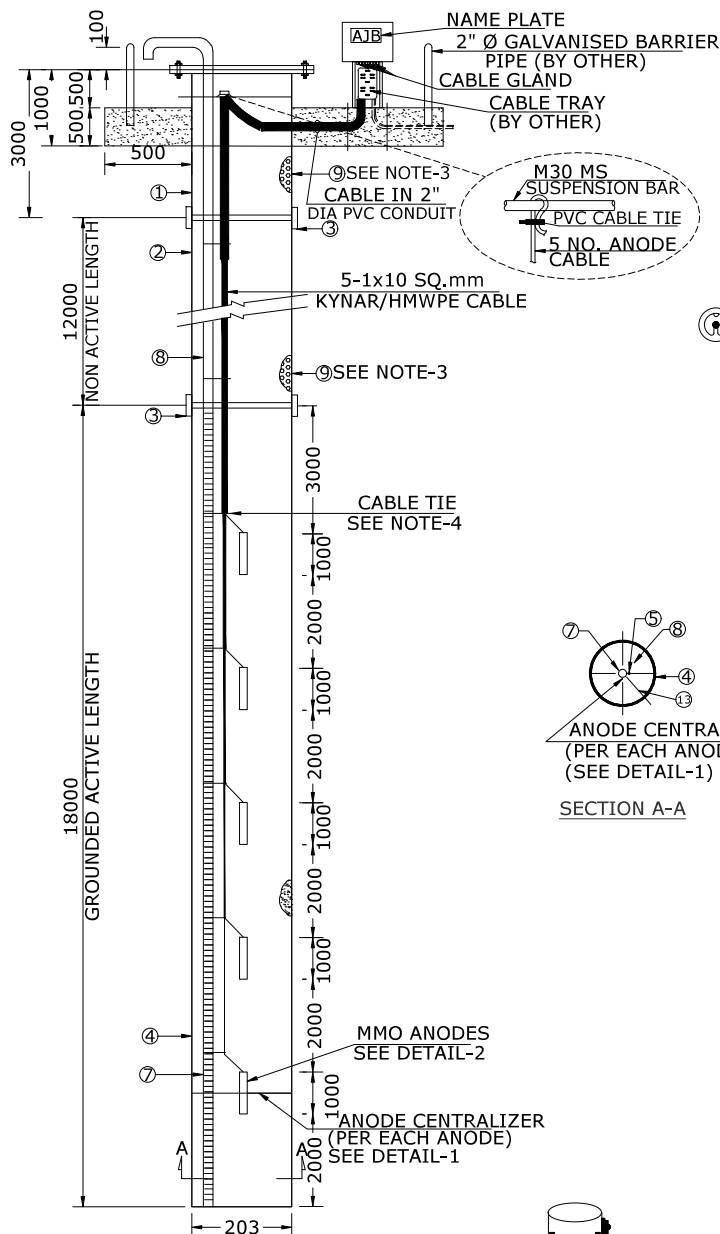
1 OF 1

REV.

02

SIZE

A4



NOTES:

- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
- ACTIVE LENGTH (16mm) SHALL BE FIELD WITH CALCINED PETROLEUM COKE BREEZE.
- ONCE THE COKE BREEZE COLUMN BECOMES HARD, INACTIVE LENGTH TO BE FIELD WITH CLEAN SHINGLE 12mm DIA (BY OTHER)
- CABLES TO BE TIED TO THE VENT PIPE USING PVC CABLE TIE.
- CABLES TO BE TIED TO THE SUSPENSION ROC USING PVC CABLE TIES.

MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QTY.
1.	HEAD WORKS INCLUDING BLIND FLANGE VENT AND CABLE ROPE HANGER	1M
2.	PVC CASING, 203 MM Ø	6M
3.	STEEL THREADED COLLAR	2 No.
4.	STEEL CASING 203mm DIA WITH END SEALED (BY OTHER)	18M
5.	MIXED METAL OXIDE TUBULAR ANODES WITH 16 SQ. mm KYNAR/HMWPE CABLE	5 No.
6.	CALCULATED PETROLEUM COKE BREEZE	800KG
7.	PERFORATED PVC VENT PIPE (25mm Ø)	16M
8.	UNPERFORATED PVC VENT PIPE (25mm Ø)	16M
9.	CLEAN SHINGLE 12mm Ø (BY OTHER)	AS REQ.
10.	M30 M.S. SUSPENSION BAR	1 No.
11.	ANODE JUNCTION BOX (450x450x260)	1 No.
12.	CRASH GUARD (BY OTHER)	AS REQ.
13.	ANODE CENTRALIZER	5 No.

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Energising Quality

VCS QUALITY SERVICES
PRIVATE LIMITED

TYPICAL DRAWING FOR OVERHEAD
POWER LINE FOR PIPE LINES

STANDARD DRAWING NO.

VCS-STD-EL-4521

SHEET NO.

1 OF 1

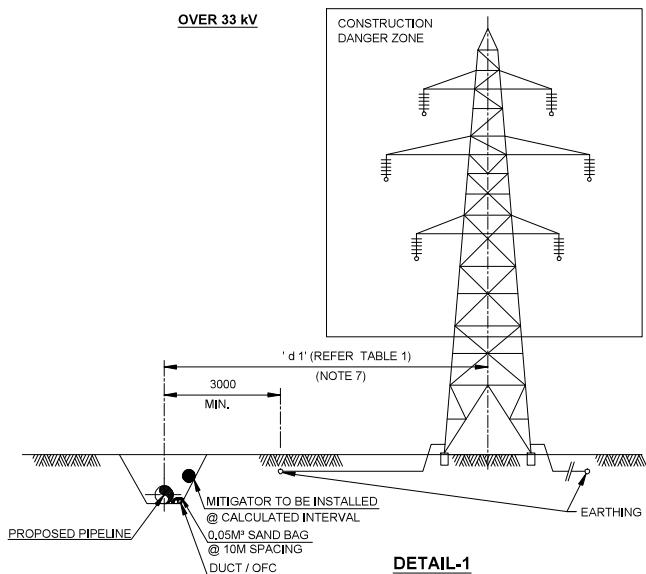
REV. SIZE

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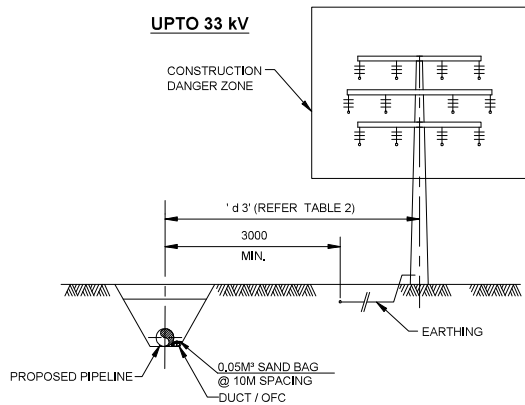
PARALLELISM TO HIGH VOLTAGE TRANSMISSION LINES

OVER 33 kV



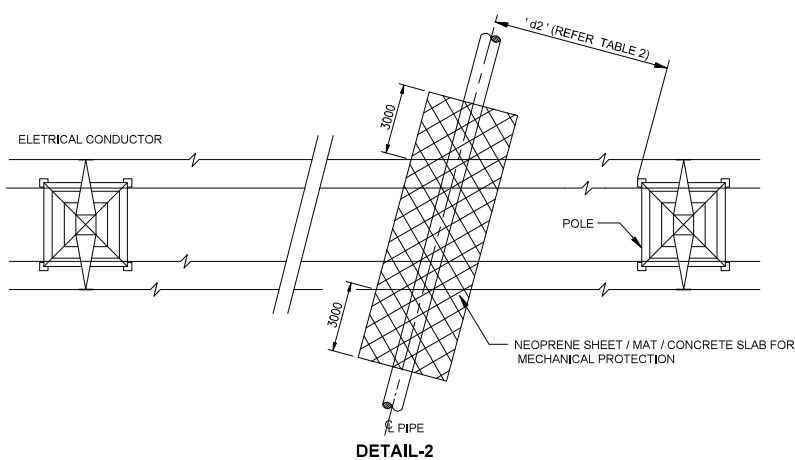
DETAIL-1

UPTO 33 kV

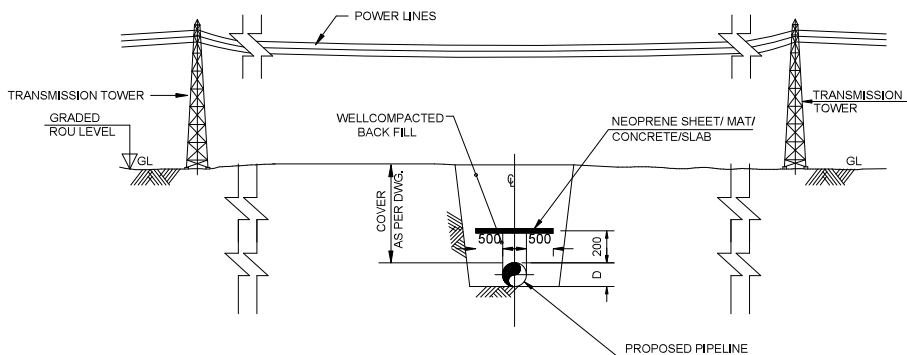


DETAIL-3

CROSSING OF HIGH VOLTAGE TRANSMISSION LINES



DETAIL-2



DETAIL-4

NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. IN CASE THE MINIMUM DISTANCE IS NOT MET, THE LOCAL ELECTRICAL COMPANY HAS TO BE CONTACTED FOR APPROVAL.
3. CONSIDERATION SHOULD BE GIVEN TO LIGHTNING FAULT, CURRENT PROTECTION OF PIPELINE & SAFETY OF PERSONNEL.
4. IN CASE OF CROSSING OF HIGH VOLTAGE TRANSMISSION LINES, MIN. DISTANCE SHALL BE MAINTAINED AS PER TABLE-1.
5. SUITABLE MEASURE SHALL BE TAKEN FOR THE PROTECTION OF THE LINE AS PER TABLE-2.
6. CONCRETE SLAB/ NEOPRENE / MAT SHALL BE PROVIDED FOR OHL CROSSINGS FOR 11 KV AND ABOVE AS PER REQUIREMENTS.
7. AS PER NOTE-4 MIN. DISTANCE IS NOT FEASIBLE THEN PLEASE REFER THE DETAILS-A

TABLE 1

IF THE OHL IS RUNNING PARALLEL TO THE PIPE LINE MORE THEN 100mtrs. MAINTAIN THE MINIMUM DISTANCE FROM CENTERLINE OF PIPELINE TO POWER TRANSMISSION STRUCTURES / LINE

Right of Way Clearance (As per Standard)	
KV	Min. ROW
66 KV	18 Meter
132 KV	27 Meter
220 KV	35 Meter
400KV	52 Meter (Single Circuit)
400 KV	48 Meter (Double Circuit)

TABLE 2

Minimum Clearance Between Power Lines to other metal / human safety distance at Nominal System Voltage of line.

KV	METER
11 KV	2,44 Meter
33 KV	2,44 Meter
66 KV	2,44 Meter
132KV	3,05 Meter
220KV	4,58 Meter
400KV	6,10 Meter

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REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY

 Energising Quality	CONTRACTOR		QUALITY ASSURANCE PLAN FOR TCP WORKS			CLIENT:	M/S HOGPL																																																																																																													
	ORDER NO. & DATE					PROJECT	CITY GAS DISTRIBUTION PROJECT																																																																																																													
	SUB-CONTRACTOR					PACKAGE NAME	TCP SYSTEM																																																																																																													
	ORDER NO. & DATE																																																																																																																			
INSTRUCTIONS FOR FILLING UP : 1. QAP shall be submitted for each of the equipment separately with breakup of assembly/sub-assembly & part/component or for group of equipment having same specification. 2. Use numerical codes as indicated for extent of inspection & tests and submission of test certificates & documents. Additional codes & description for extent of inspection & tests may be added as applicable for the plant and equipment 3. Separate identification number with quantity for equipment shall be indicated wherever equipment having same specifications belonging to different facilities are grouped together. 4. Weight in tonnes (T) must be indicated under column 5 for each item. Estimated weights may be indicated wherever actual weights are not available.			CODES FOR EXTENT OF INSPECTION, TESTS, TEST CERTIFICATES & DOCUMENTS: <table border="0"> <tr> <td>Code</td> <td>Description</td> <td>Code</td> <td>Description</td> <td>Code</td> <td>Description</td> <td>DOCUMENTS:</td> </tr> <tr> <td>1.</td> <td>Visual</td> <td>12.</td> <td>Routine test as per relevant IS other standard</td> <td>23.</td> <td>Short time rating</td> <td>D1. Approved GA drawings</td> </tr> <tr> <td>2.</td> <td>Dimensional</td> <td>13.</td> <td>Type test as per relevant IS/ other standard</td> <td>24.</td> <td>Operational & functional check</td> <td>D2. Approved single line/ schematic diagram</td> </tr> <tr> <td>3.</td> <td>Fitment & Alignment</td> <td></td> <td></td> <td>25.</td> <td>Over Speed Test</td> <td>D3. Approved</td> </tr> <tr> <td>4.</td> <td>Physical Test (Sample)</td> <td></td> <td></td> <td>26.</td> <td>Flame Proof Test</td> <td>data sheet</td> </tr> <tr> <td>5.</td> <td>Chemical Test (Sample)</td> <td>14.</td> <td>Impulse Test</td> <td>27.</td> <td>Clearance and creepage Distance</td> <td>D4. Approved bill of materials</td> </tr> <tr> <td></td> <td>(Review of test report only)</td> <td>15.</td> <td>Partial Discharge Test</td> <td>28.</td> <td>Acceptance Test</td> <td>D5. Unpriced P.O. copy</td> </tr> <tr> <td>6.</td> <td>Ultrasonic Test</td> <td>16.</td> <td>Heat run risc test\tempr.</td> <td>29.</td> <td>Material test</td> <td>D6. 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EQUIPMENT DATA							INSPECTION AND TESTS						Test Certificates & documents to be submitted to VCS	Acceptance Criteria Standards /IS/ BS/ASME/ Norms and Documents	REMARKS / SAMPLING PLAN																																																																																																					
Sl. No	Description (With equipment heading, place of use, and Breif Specifications)	Identification No.	Quantity		Manufacturer's Name and Address	Expected schedule of Final Inspection	Raw Material and in process stage			Final Inspection/Test by																																																																																																										
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1	CP Cables (1Cx6Sqmm, 1Cx10 Sqmm, 1Cx25Sqmm & 1Cx35Sqmm)		Meters				1,2,28	-	-	1,2,28	1,2,28	R	D1, D2, D3, D4, D5, D6, 20, 13	I.S., Approved Data Sheet & Specifications																																																																																																						
2.	Test Stations (Big & Small Type)		Nos.				1,2,3,4,22, 29	-	-	1,2,3,4, 22,33	1,2,3,4, 22,33	R	D1, D2, D3, D4, D5, D6, 20, 13	I.S., Approved Data Sheet & Specifications																																																																																																						
3.	Sacrificial Mg & Zn Anodes		Nos.				1,2,5	-	-	1,2,4, 5, 30, 32*	1,2,4, 5, 30, 32*	R	D1, D2, D3, D4, D5, D6, 20, 13	I.S., Approved Data Sheet & Specifications	* on 1% of total nos. of anodes																																																																																																					
4.	Spark Gap Arrestor (100 kA)		Nos.				-	-	-	-	-	R	Manufacturer test certificates & Compliance Report	Approved Data Sheet & Specifications																																																																																																						
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5.	Polarisation Cell (Solid State)		Nos.				-	-	-	-	-	R	Manufacturer test certificates & Compliance Report	Approved Data Sheet & Specifications	
6.	External ER Probe		Set				1,2,3,5,13,29		-	1,2,3,5,13*,17*,21*,24,29	1,2,3,5,13*,17*,21*,24,29	R	D1, D3, D4, D5, D6, 20,12,13	Approved Data Sheet & Specifications	*on one no. of each type
7.	CTSU (Computerised Test Station Unit) & CTSU Reader		Nos.				1,2,3	-	-	1,2,3,22,24,33	1,2,3,22,24,33	R	D1, D3, D4, D5, D6, 20,12,13	Approved Data Sheet & Specifications	
8.	Permanent Reference Cell		Nos.				-	-	-	-	-	R	Manufacturer test certificates & Compliance Report	Approved Data Sheet & Specifications	
9.	Mg/Zinc Ribbon Anode		Mtr				-	-	-	1,2,30,34	1,2,30,34	R	D1, D3, D4, D5, D6, 20,12,13	Approved Data Sheet & Specifications	
For Manufacturer (Stamp & Signature)				For CONTR (Stamp & Signature)			For V C S (Stamp & Signature)								
												Q.A.P. NO. VCS/QAP/TCP/001			REV. 0
												SHEET 2 OF 2			



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

15	30.09.2025	Issued as Standard	Ramveer Singh	Safdar Ali	Rachna Shukla
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. (Formly 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. Ahmedngr, 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)

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)
- x. Hawa Engineers Limited, Ahmedabad
- y. G M Engineering PVT LTD (Non API)

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

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.

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.

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)

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

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. Siirtec 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 makeLincon
- c. D & H SECHERON ELECTRODE PVT. LTD

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. Eurofiltrec
- 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. Venus Pumps & Engineering Works

26.3 RRL Hose

- a. Jayshree
- b. Newage

26.4 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	Rock wool (india) Ltd. Minwool Rock Fibres Ltd.,



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	(Under deck insulation)	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 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



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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.
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



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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
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.



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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



ENERGISING QUALITY

LIST OF RECOMMENDED VENDORS FOR BOUGHT OUT ITEMS

DOC NO: VCS-00-00-VL-0001
Rev No : 15

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. Caldynes 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. NAKABOHITEC, 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

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

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

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

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

**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.

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.

2.0 MDPE FITTINGS & MDPE VALVES

- c. Aliaxis,
- d. George Fischer,
- e. Al-Aziz,
- f. Kimplas,
- g. Banides,
- h. Agru,
- i. Friatech,
- j. 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

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)